

Bowl Feeder BF10 / BF15



Translation of operating and installation instructions

Copyright by Afag GmbH

This operation instruction applies to:

Type			Order number	
			BF10	BF15
Bowl feeder	right 12°	230 V / 50 Hz	50042183	50042190
		115 V / 60 Hz	50042179	50042186
Bowl feeder	left 12°	230 V / 50 Hz	50028522	50029786
		115 V / 60 Hz	50042180	50042187

Version of Documentation: BA_BF10-15_R05.1_EN.docx

Release: R05.1

Date: 07/01/2021

Following US patents are registered or announced:

- Vibrating spiral conveyor (U.S. Patent No.7,143,891)
- Drive unit for a vibrating spiral conveyor (U.S. Patent No.7,299,913)

Table of contents:

1	Safety instructions	4
1.1	<i>Notes on symbols and instructions</i>	4
1.2	<i>Basic safety information</i>	5
1.3	<i>Appropriate use</i>	5
2	Description of the device	6
2.1	<i>General</i>	6
2.2	<i>Function description</i>	6
2.3	<i>Definition of the feed direction</i>	7
2.4	<i>Technical data</i>	8
3	Assembly instructions	10
3.1	<i>Transport</i>	10
3.2	<i>Installing the unit</i>	10
3.3	<i>Fixing the bowl</i>	11
3.4	<i>Power supply</i>	12
4	Operating instructions	13
4.1	<i>Standard operation</i>	13
4.2	<i>Settings for the specific device</i>	13
5	Maintenance instructions	16
5.1	<i>Replacing the leaf springs</i>	16
5.2	<i>Adjusting the magnet gap</i>	17
5.3	<i>Wear and spare parts</i>	18
6	Accessories	19
6.1	<i>Adjusting tools</i>	19
6.2	<i>Controller</i>	19
6.3	<i>Address for orders</i>	20
7	Disposal	20



1 Safety instructions



1.1 Notes on symbols and instructions


Symbols: Assembly and commissioning must be carried out by qualified personnel only and according to these operating instructions.

Please observe the meaning of the following symbols and notes. They are grouped into risk levels and classified according to ISO 3864-2.

 DANGER	
	<p>Indicates an immediate threatening danger.</p> <p>Non-compliance with this information can result in death or serious personal injuries (invalidity).</p>

 WARNING	
	<p>Indicates a possible dangerous situation.</p> <p>Non-compliance with this information can result in death or serious personal injuries (invalidity).</p>

 CAUTION	
	<p>Indicates a possibly dangerous situation.</p> <p>Non-compliance with this information can result in damage to property or light to medium personal injuries.</p>

NOTE	
	<p>Indicates general notes, useful operator tips and operating recommendations which don't affect safety and health of the personnel.</p>



1.2 Basic safety information

These operating instructions provide the information operators require to use the BF bowl feeder safely. These operating instructions, and in particular the safety information, must be observed by anyone working on and with the BF. The applicable on-site accident prevention rules and regulations must also be observed.


These operating instructions must always be kept ready to hand where the BF is operated.

1.3 Appropriate use

Afag BF bowl feeders are designed only for storing, transporting, separating and sorting workpieces of varying dimensions, shapes and material variants. Appropriate use also includes observation of all Notes in these operating instructions.

 WARNING	
	<p>The BF may not be used:</p> <ul style="list-style-type: none"> a) in damply and wet area b) in temperature lower than 10°C or higher than 45°C c) in areas where readily flammable media are present d) in areas where readily explosive media are present e) in heavy polluted or dust- laden area f) in aggressive area (e.g. saliferous atmosphere)

None modification or reconstruction are allowed. The operations described in chapter 3.3 Fixing the bowl and in chapter 4.2 Settings for the specific device are excluded from this arrangement.

NOTE	
	<p>Any other use is inappropriate and will result in the warranty becoming null and void.</p>

See also our General Terms of Business.

2 Description of the device

2.1 General

The BF bowl feeder is used in conjunction with a bowl for storing, transporting, separating and sorting bulk goods. The transport motion is generated by vibration. The parts are moved in the transport direction by micro-jumps.

The mass and the moment of inertia of the bowl used should not exceed the values and tolerances specified in section 2.4 Technical data as otherwise the goods will not be transported as well as possible.

The BF is designed in such a way that if the tolerance ranges for the mass moment of inertia and mass specified in section 2.4 Technical data are observed, no mechanical tuning is required.

If these tolerances are exceeded, mechanical tuning by fitting or removing leaf springs will be necessary. Please note, however, that in this case perfect transport will no longer be guaranteed. In addition the vibration force compensation system will be adversely affected in this case, which means that more vibrations will be guided into the sub-structure and this may affect the area around the machine.

NOTE

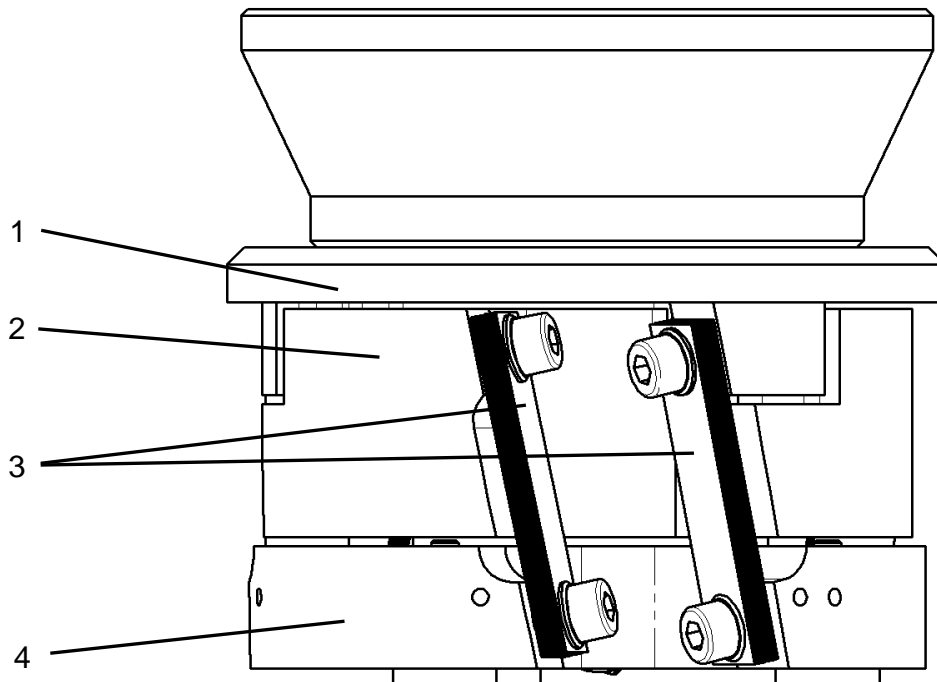


BF feeders are to be operated in conjunction with an Afag control unit. This is the only combination that will guarantee perfect transport characteristics.

2.2 Function description

Afag BF bowl feeders use a vibration force compensation system based on the counter-vibration principle. In this case a utility weight (1) vibrates exactly opposite to a counterweight (2). The utility weight is essentially formed by the mounting plate, the bowl and the magnetic anchor, the counterweight is formed by the counter ring and the vibration magnet. The utility and counter weights are secured to a base ring (4) by leaf spring assemblies (3). If the mass moments of inertia and mass specified in section 2.3 are not exceeded when the utility and counterweights vibrate, exactly equal reaction forces are generated, which are then transferred to the base ring (4) through the of leaf spring assemblies (3). As a result of this opposite vibration of the utility weight and counter weight, these reaction forces almost totally cancel each other on the base ring (4).

Figure 1: BF without casing



2.3 Definition of the feed direction

The feed directions for the BF are defined as follows:

Left-hand (L), in anti-clockwise direction

Right-hand (R), in clockwise direction

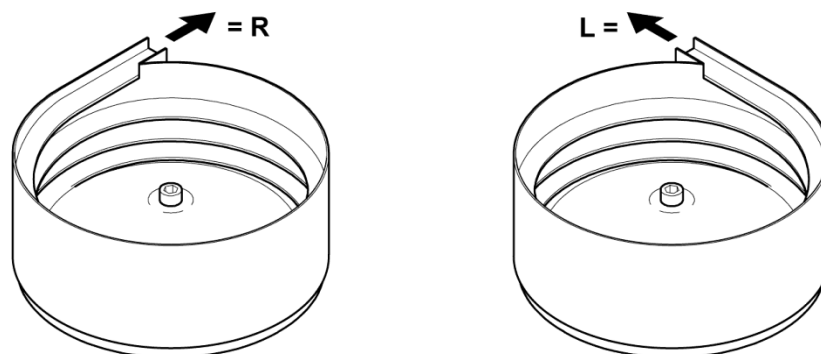


Figure 2

2.4 Technical data

Figure 3: Dimension sheet for BF10 - 15

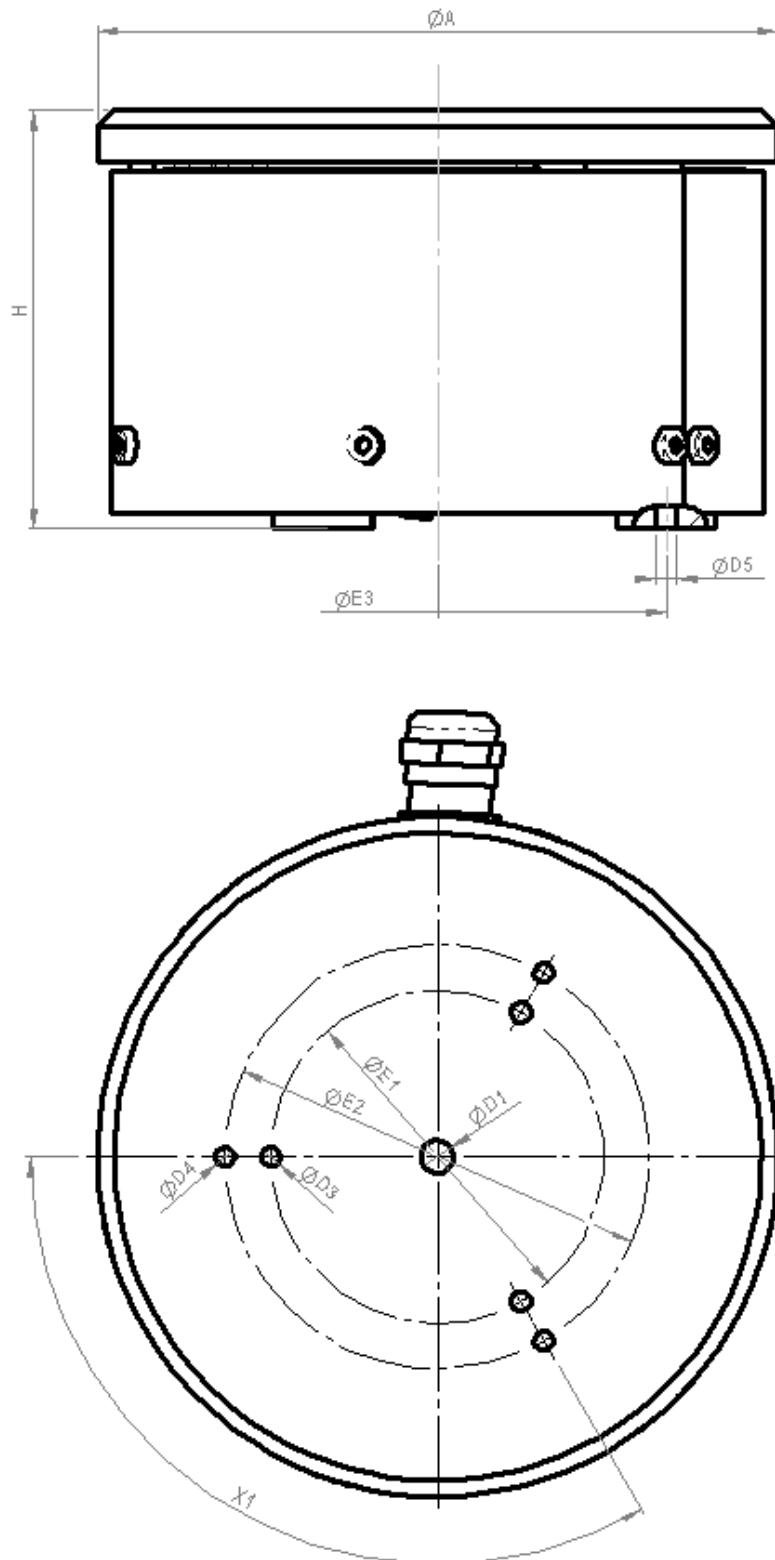






Table 1: Technical data

Type		Units	BF 10	BF 15
Dimension	A	[mm]	104	130
	D1	-	M6	M6
	D3	[mm]	3H7	3H7
	D4	[mm]	3H7	4H7
	D5	-	3 x M4	3 x M4
	E1	[mm]	51	87
	E2	[mm]	65	-
	E3	[mm]	70	104
	H	[mm]	64	90
	X1	[°]	120	120
Max. mass moment of inertia		[kg*dm ²]	0,03 ±10%	0,25 ±10%
Max. bowl weight		[kg]	0,160 ±30%	0,550 ±30%
Weight		[kg]	2,2	4,5
Rating		[VA]	11	27,5
Protection type		IP	54	
Vibration force compensation		-	yes	
Electric version		[V / Hz]	230 / 50 or 115 / 60	
Vibration frequency		[1/min]	6000 / 7200	
Direction of rotation		-	right / left	
Leaf spring angle		[°]	12	
Environmental conditions for operation: Temperature range		[°C]	+10 to +45	
Noise emission: Continuous noise pressure level (without transported material)		[dB]	<70	
Measuring height/measuring distance		[m]	1,6 / 1	
Measurement direction with respect to the noise source		[°]	90	
Measurement method		-	A evaluation	

3 Assembly instructions

3.1 Transport

 WARNING	
	<p>Improper use of transport means (industrial trucks, cranes, technical aids, sling gear etc.) may lead to bruises and other injuries.</p> <p>Required behaviour:</p> <ul style="list-style-type: none"> - Observe and follow the transport and maintenance instructions - Proper use of transport means

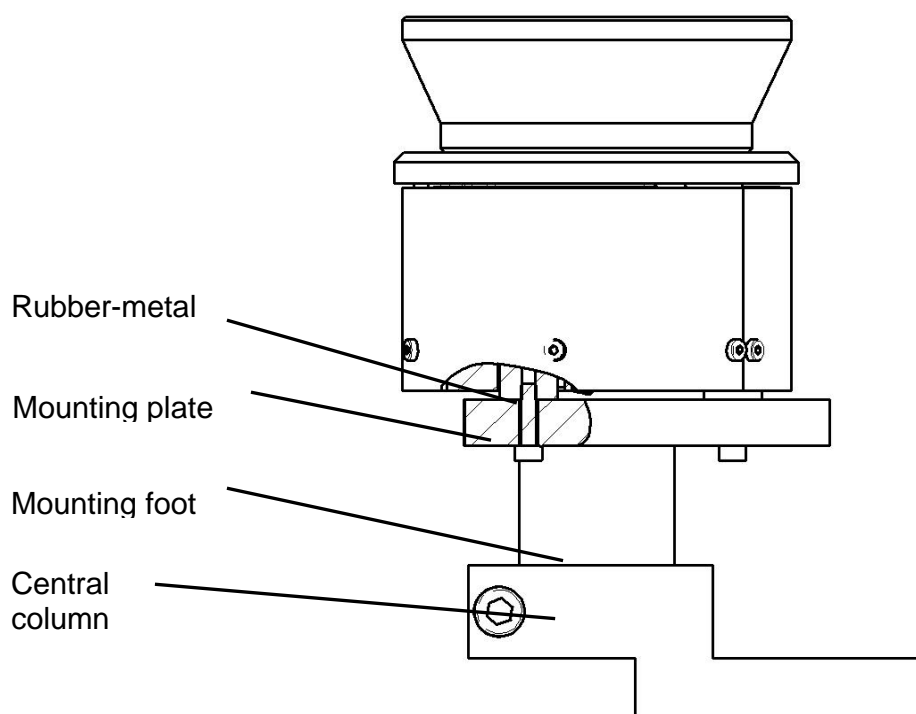
 CAUTION	
	<p>Only handle the bowl feeder by its base ring during transport. Neither the bowl nor the control elements may be used to lift the feeder.</p>

3.2 Installing the unit

Each BF has 3 rubber-metal buffers so that the bowl feeder can be fastened to the substructure (see Figure 4). See section 2.3, Table 1, for the mounting hole dimensions.

Ideally the devices must be mounted on a plate that can be height-adjusted and rotated around a central column. Suitable substructure components are available from Afag.

Figure 4: Drive unit mounting



Another possibility is to mount the device straight on to a base plate.

Suitable Afag standard parts are available for complete station assemblies using Afag linear feeders.

3.3 Fixing the bowl

The bowl is secured to the mounting plate provided for it on the BF bowl feeder using a central mounting screw. The mounting screw must be tightened using the torque specified in Table 2 in order to generate the required frictional locking.

There are adjusting holes on the mounting plate so that the bowl can be positioned precisely on the BF drive unit. This means that there is no need to repeat the alignment of the interface on the bowl discharge when the bowl is changed or if a bowl that has been removed for cleaning or repair is refitted.

Feeder bowls that are mounted differently (at the edges, for example) require special adapter plates.

To ensure perfect operation of the equipment, do not exceed the maximum mass moment of inertia and feeder bowl weights. They are dependent on the design of the feeder bowls.

Figure 5: Bowl mounting

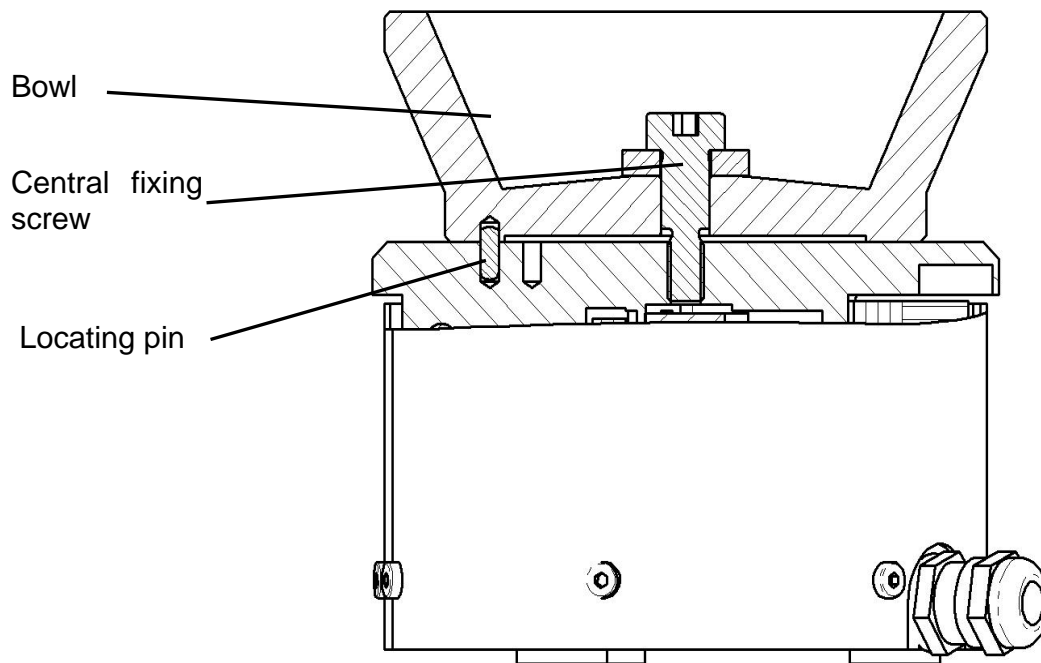




Table 2: Tightening torques for the bowl mounting

Model	BF10	BF15
Tightening torque [Nm]	8	8

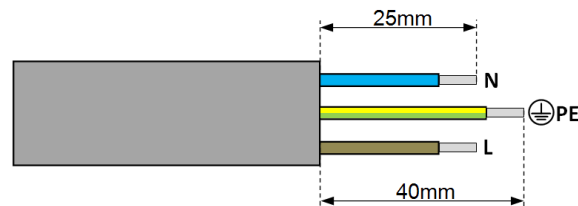
3.4 Power supply

 WARNING	
	<ul style="list-style-type: none"> ▪ Any work performed on the electrical supply may only be performed by trained, authorised, qualified personnel! ▪ The power supply must be protected by an FI switch (provided by the customer). ▪ The bowl feeder may only be operated with the power supply specified on the name plate.

The control device IRG1-S is used for the activation of the bowl feeder. The MSG801 or MSG802 can also be used. Please note that an additional CEE connector plug is required for the MSG controllers (article no. 11006982)

Installation of the plug is only to be carried out by technically qualified personnel.

Figure 6: End of the wire for additional plug





4 Operating instructions

4.1 Standard operation

No further settings are required for standard operation once the control is switched on. An uninterrupted operation only requires the re-filling of the bowl.

 CAUTION	
	<p>The bulk material must be filled into the middle of the conveyor bowl. Otherwise the orientation system might be damaged or the required capacity might not be achieved as falling parts can get jammed in the orientation system.</p>

 CAUTION	
	<p>Under certain circumstances an inadmissible noise level may occur (e.g. when opening the cover of the noise protection hood for filling in parts).</p> <p>Required behaviour:</p> <p>Wear ear protection when working at critical sound levels</p>

4.2 Settings for the specific device

The BF is a spring and mass vibration system that operates on the basis of its resonance properties. All basic devices are set by the manufacturer to the mass moment of inertia and weight values specified in section 2.3. If you comply with these values and tolerances, there will be no need to adjust the BF.

However, if you fail to comply with these values, the inherent frequency of the BF will have to be adjusted accordingly. Once the assembled feeder bowl has been mounted, the inherent frequency of the drive unit must be tuned to the feeder bowl. The bowl feeder must always be adjusted '**sub-critically**', in other words, the **inherent frequency** must be approximately 5% **above** the **exciter frequency**. For a 100 Hz feeder this translates to an inherent frequency of around 104 Hz (6000 vibrations per minute), for a 120 Hz feeder to one of around 126 Hz (7200 vibrations per minute).

The fully set-up feeder bowl must be bolted to the basic device to allow the drive unit to be tuned. Proceed as follows to tune the drive unit to the specific application:

1. Unscrew the cover from the BF and mount the feeder bowl on to the drive unit.
2. Place a part into the feeder bowl and use the control unit to set a low transport speed.
3. Slowly loosen the lower mounting screw at one of the three spring assemblies on the bowl side and watch the transport speed of the part inside the bowl.
4. If the transport speed increases initially at first and then decreases again as the screw is loosened further, the drive unit is correctly tuned and the inherent frequency is slightly above the exciter frequency.

5. If the transport speed only increases when the screw is loosened and does not decrease again even when the screw is fully loosened, the drive unit is too rigidly tuned. In this case, remove a leaf spring and retune the frequency. You must remove as many leaf springs as necessary until the properties described in point 4) are achieved. If you have to remove several leaf springs, they must be removed as evenly as possible from the three spring assemblies on the bowl side.
6. If the transport speed decreases immediately while the screw is being loosened, the drive unit is tuned too softly. In this case, fit a leaf spring and retune the frequency. You must add as many leaf springs as necessary until the properties described in point 4) are achieved. If you have to add several leaf springs, they must be added as evenly as possible to the three spring assemblies on the bowl side. The fitted leaf springs must be clean and dry.

Only one spring assembly must be dismantled at a time. To tighten the screw after tuning the bowl feeder, apply the appropriate installation tool (see section 6.1, Table 7: Adjusting tools) in order to prevent the bowl feeder from twisting. The spring assemblies connected to the counter weight must not be loosened.

After you have adjusted the natural frequency, the magnet gap must be checked. This can easily become maladjusted whilst you are fitting or removing springs. If this is the case the magnet gap must be reset as described in section 5.2 Adjusting the magnet gap.

4.3 Torques

Tightening torques M_{Sp} in Nm for shank screws with metric ISO control threads and head supports according to DIN 912 or DIN 931:

Screw	Tightening torques M_{Sp} in Nm		
	Strength class 8.8	Strength class 10.9	Strength class 12.9
M4	2,8	4,1	4,8
M5	5,5	8,1	9,5
M6	9,5	14,0	16,5
(M7)	15,5	23,0	27,0
M8	23,0	34,0	40,0
M10	46,0	68,0	79,0
M12	79,0	117,0	135,0
M14	125,0	185,0	215,0
M16	195,0	280,0	330,0
M18	280,0	390,0	460,0
M20	390,0	560,0	650,0
M22	530,0	750,0	880,0
M24	670,0	960,0	1120,0
M27	1000,0	1400,0	1650,0
M30	1350,0	1900,0	2250,0

by: Dubbel (18th edition), page G175

5 Maintenance instructions

A type BF bowl feeder essentially requires no servicing. The leaf springs, however, may oxidize in certain conditions of use, thus affecting the vibration behavior in the long run. In these cases the leaf springs must be removed and cleaned or be changed. In rare cases the leaf springs must be completely replaced.

5.1 Replacing the leaf springs

Only one spring assembly may be dismantled at a time when removing the leaf springs. Before undoing the screws the centering brackets (Table 7: Adjusting tools) must be secured to the drive unit (see Figure 7). These secure the counterweight and mounting plate and thus prevent these parts sagging or moving.

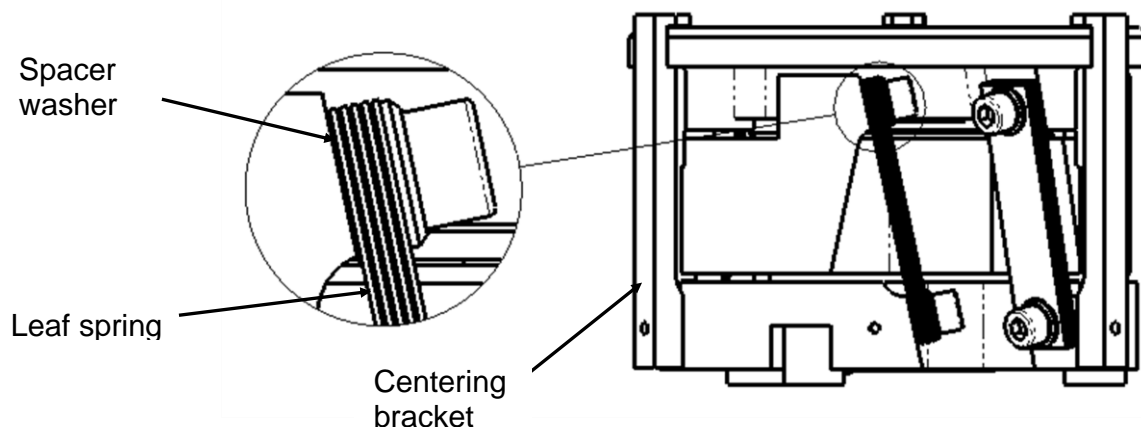
CAUTION



The leaf springs must not be oiled or greased as this would make the springs sticky and in turn adversely affect the vibration response.

The number of leaf springs in a spring assembly and the structure of the spring assembly installed must be identical to the original spring assembly. Only then will the device function correctly.

Figure 7: Spring assembly and centring bracket



The screws must be tightened using the torque shown in Table 3. During tightening the screws the spacer washers may not be turned.

Table 3: Tightening torques for spring installation

Typ	BF10	BF15
Tightening torque [Nm]	9,5	16

5.2 Adjusting the magnet gap

To adjust the magnet gap between the oscillating magnet, the casing must be removed and the securing screws (see Figure 8) of the magnetic anchor undone. Then the appropriate spacer gauge (Table 7: Adjusting tools) must be slid into the opening provided on the counterweight between the magnet and the magnetic anchor. Then apply 24 VDC to the drive unit which will cause the magnet and the anchor to pick up. The required magnet gap will be set by the inserted spacer gauge. Now the securing screws must be tightened using the appropriate torque (Table 4: Magnet gap and tightening torque). When the magnetic anchor has been secured, switch off the 24 VDC voltage and remove the spacer gauge from the opening in the drive unit. As you do this, ensure that the spacer gauge can be removed easily but do not have too much play since otherwise the magnet gap is too large. In this case the magnet gap adjustment process must be repeated.

Figure 8: Adjusting the magnet gap with spacer gauge

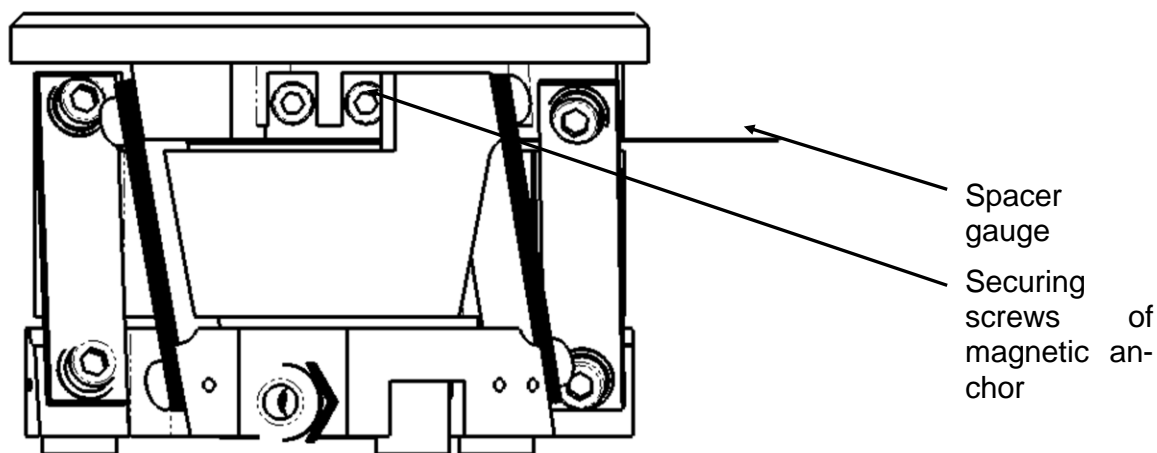


Table 4: Magnet gap and tightening torque

Type	BF10	BF15
Air gap [mm]	0,3	0,3
Tightening torque [Nm]	2,8	5,5

5.3 Wear and spare parts

Table 5: Wear parts

Order number		Order number
BF10	Leaf spring	15148633
	Spacer	15170196
	Rubber buffer	50041323
BF15	Leaf spring	50080191
	Spacer	15085780
	Rubber buffer	50041323

Table 6: Spare parts

Designation	Order number
Magnet for BF10 – 230V/50Hz	15083534
Magnet for BF10 – 115V/60Hz	15073802
Magnet for BF15 – 230V/50Hz	50175696
Magnet for BF15 – 115V/60Hz	50175700

6 Accessories

6.1 Adjusting tools

Table 7: *Adjusting tools*

Designation	Type of drive	Order number
Centering bracket	BF10	50076927
	BF15	50076954
Spacer gauge	BF10 / BF15	50185534

6.2 Controller

The BF is connected to the 230V/50Hz AC system via an IRG or MSG controller and can be rated for other mains voltages and frequencies, e.g. 115V/60Hz. They operate in full-wave mode at double mains frequency, i.e. at 50Hz AC, with a vibration frequency of 100 Hz.

Vibration displacement and thus the transport speeds are infinitely adjustable due to magnet current and thus magnetic force variability.

Soft-starting, all IRG and MSG types can be mounted in various different ways and offer extra controls for photoelectric barriers, initiator elements, or extern 24VDC signal. For a detailed description of the controllers refer full-range catalogue from Afag GmbH.

Third-party controllers can also be used as long as they meet the technical requirements.

Tabelle 8: *Controllers for BF*

Type	Power supply	Order number	Comments
IRG1-S	230V/50Hz	50360105	Control with no timer function
	115V/60Hz	50360106	External target value preset
MSG801	230V/50Hz – 115V/60Hz	50391818	With timer function, valve and inter- face outputs, sensor feed
MSG802	230V/50Hz – 115V/60Hz	50391819	With sensor feed

6.3 Address for orders

Germany:

Afag GmbH

Wernher-von-Braun-Straße 1

D – 92224 Amberg

Tel.: ++49 (0) 96 21 / 65 0 27-0

Fax: ++49 (0) 96 21 / 65 0 27-490

Sales

sales@afag.com

www.afag.com

Switzerland:

Afag Automation AG

Luzernstrasse 32

CH – 6144 Zell

Tel.: ++41 (0) 62 / 959 86 86

Fax: ++41 (0) 62 / 959 87 87

7 Disposal

BF feeders that are no longer in use should not be disposed of as complete units but dismantled into separate materials and recycled. Non-recyclable components must be disposed of correctly.