MM-404A

Installation, Operation and Maintenance Instructions

MODEL FF METAL SEPARATOR

ERIEZ MAGNETICS HEADQUARTERS: 2200 ASBURY ROAD, ERIE, PA 16506-1440 U.S.A.
WORLD AUTHORITY IN ADVANCED TECHNOLOGY FOR MAGNETIC, VIBRATORY and INSPECTION APPLICATIONS

Table of Contents

Eriez Model FF Metal Separator

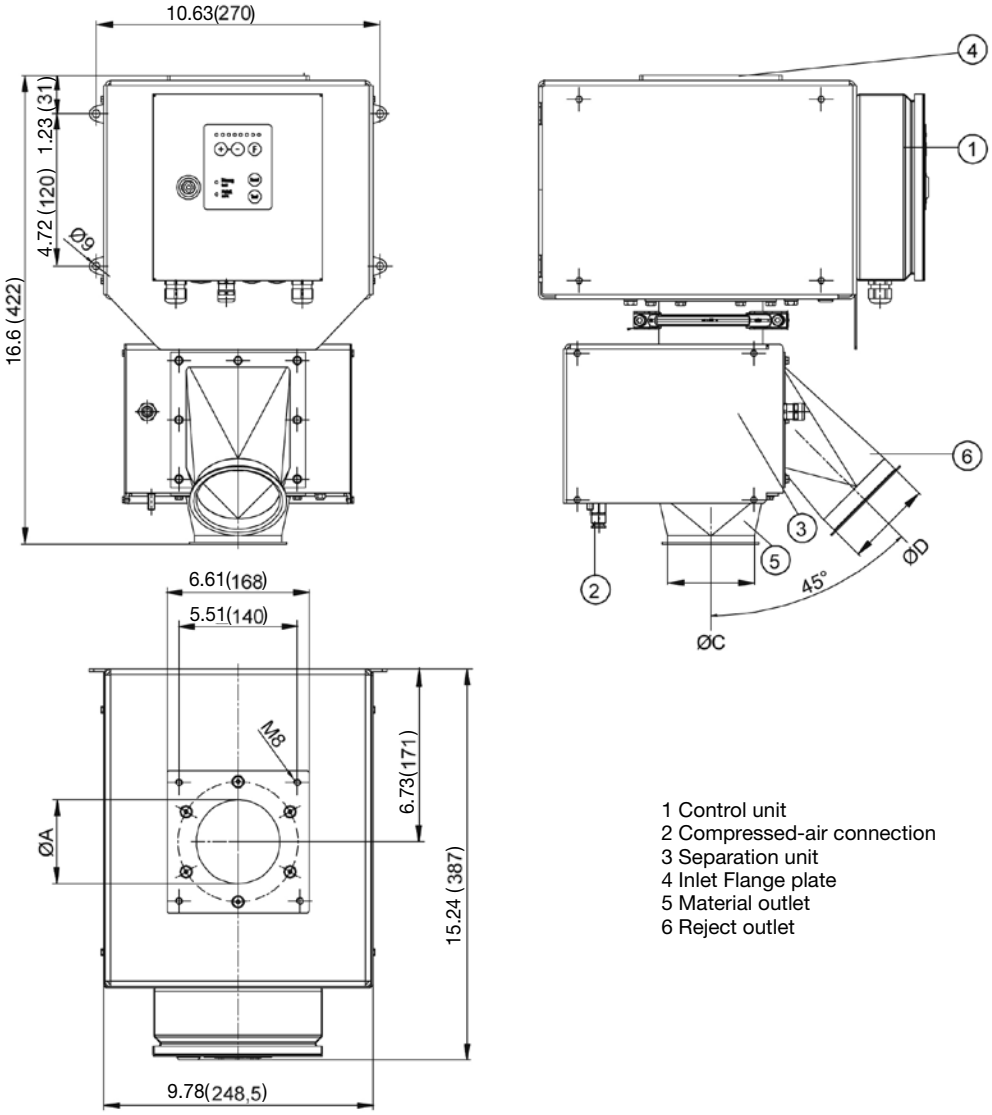
Table of Contents (cont.)

FF-30, 50, & 70 METAL SEPARATOR

TECHNICAL DATA SHEET

MDDS-404-1

DIMENSIONS



1 Control unit
2 Compressed-air connection
3 Separation unit
4 Inlet Flange plate
5 Material outlet
6 Reject outlet

TECHNICAL DATA

Model number	FF-30	FF-50	FF-70
Nominal ØB Jacob system connector	3.07(78)	3.07(78)	3.07(78)
Nominal ØC Jacob system connector	3.07(78)	3.07(78)	3.07(78)
Effective ID of inlet pipe ØD	1.07(27.2)	1.73(44.0)	2.67(67.8)
Maximum sensitivity [1] Ø Ferrous ball	0.4 mm	0.5 mm	0.7 mm
Maximum throughput [2]	14 ft^3/hr	71 ft^3/hr	177 ft^3/hr
Weight (lbs/kg)	57.3/26	57.3/26	57.3/26

All dimensions in inches (mm)

[1] The specified sensitivity (sphere Ø in mm) is related to the center of the aperture of the detector, which is the least sensitive area. The achievable sensitivity within a product depends on its product effect (conductivity caused by moisture, carbon content, metal oxides etc.), the product temperature and environmental influences. The detectability of metal particles is also determined by their nature, shape and position.

[2] The throughput volume is dependent on the flow characteristics and density of the bulk material as well as the installation location of the metal separator.

Subject to change without notice!

FF-30, 50, & 70 METAL SEPARATOR

TECHNICAL DATA SHEET

MDDS-404-1

CONDITIONS OF USE

Use:	For inspecting free-falling bulk materials in the plastics industry, but also in other industries with similar applications.
Bulk material characteristics:	Dry, free-flowing, short fibers, any possible product effect must be able to be tuned out, particle size <.315 in.(8 mm)
Drop height of bulk material:	Max 19.69 in. (500 mm). above equipment top edge
Material flow:	No back draft of material
Bulk material temperature:	Maximum 176° F. (+ 80° C)
Ambient temperature:	14° F to 122° F (-10° C to +50° C)

STANDARD DESIGN

System Description:	Compact unit with integrated metal detector, rotating diverter unit (mounted using Jacob's quick-release fasteners), integral control unit; good and reject material outlets with Jacob's connectors for good and reject material
Operation:	• Membrane keypad with 3 keys as well as Reset and Test buttons • Access protection • LED lights for operation, metal alarm and fault
Electronics housing:	Sheet steel, varnished, aluminium gray (RAL 9007)
Upper enclosure (coil):	Sheet steel, varnished, aluminium gray (RAL 9007)
Lower enclosure (mechanics):	Stainless steel AISI 304/1.4301, bead blasted
Parts in contact with product:	Stainless steel AISI 304/1.4301, PE-EL, Teflon, POM
Scanning pipe:	PE-EL, static dissipating polyethylene
Operating voltage:	100-240 VAC (±10%), 50/60 Hz
Current consumption:	Approx. 160 mA/115 V, approx. 80 mA/230 V
Mains cable:	5.9 ft. (1.8m) with plug
Compressed air connection:	73-116psi. (5-8 bar); .24in.(6 mm)/.31in.(8 mm) hose connection
Ingress protection:	NEMA 3S (IP 54) (cover and on site weather protection is necessary)
Compressed air consumption:	0.4 l / switch operation
Reject travel time & duration	Adjustable from 0.05 to 29 sec
Scanning sensitivity:	Selectable with 8 adjustments
Self-monitoring system:	Detection coil and outputs
Max. conveying pipe pressure:	Maximum 7.25psi (0.5 bar)

SPECIAL OPTIONS / ACCESSORIES

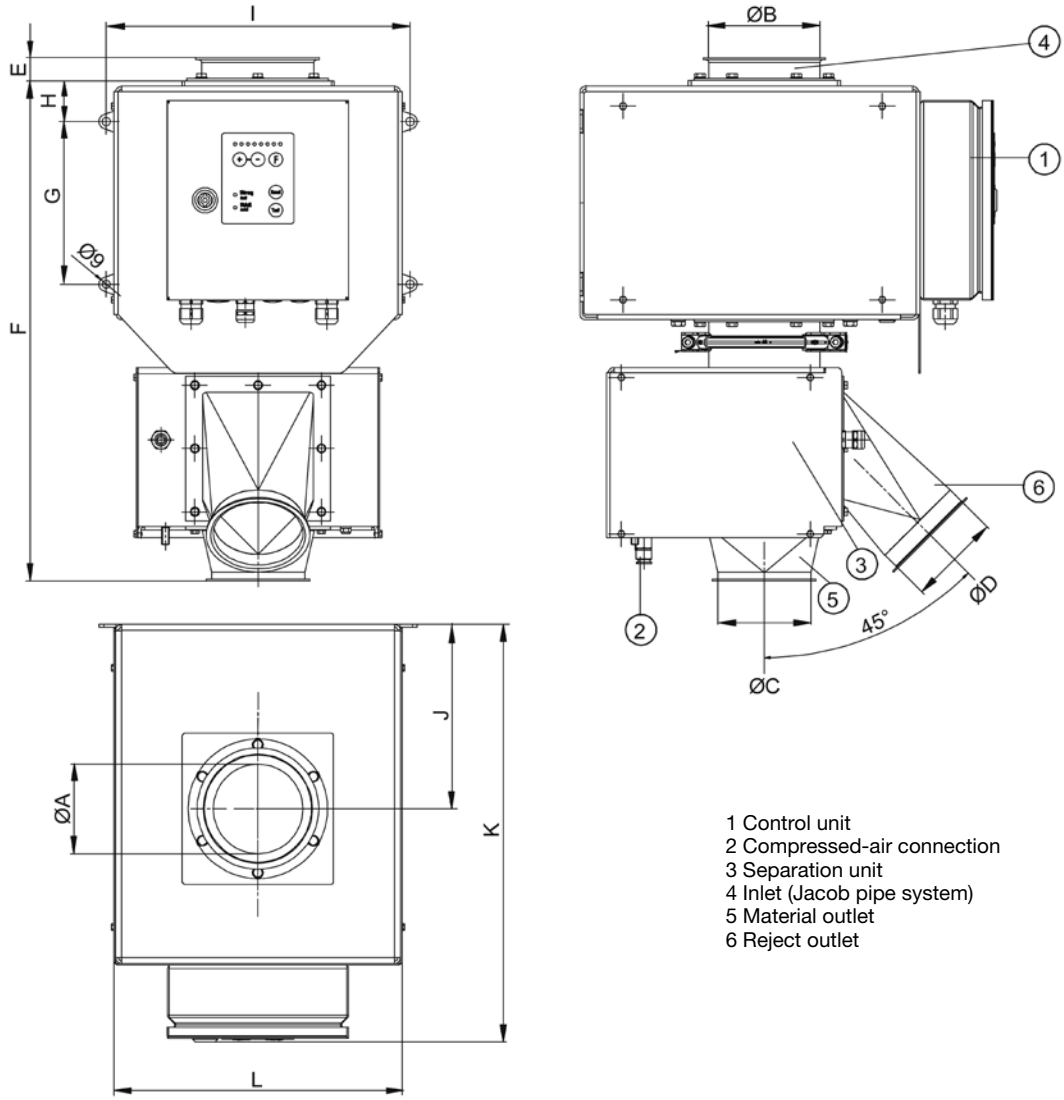
- •Visual Alarm
  - Fault indication
  - Fault and metal indication
- Audible Alarm
  - Fault indication
  - Fault and metal indication
- Visual and Audible Alarm
  - Fault indication
  - Fault and metal indication
- Control unit can be operated remotely up to 49.2 ft. (15 m)
- Counter (number of detections)
- Feed hopper
- Low-wear scanning pipe
- Food grade scanning pipe
- Filter control valve
- Push button for manual rejection
- Monitor system for diverter
- Compressed-air monitor
- Heat resistant version up to 284° F (140° C) material temperature
- Test samples
- Increased free fall height up to 39.37''(1m)
- Special varnishes
- Special supply voltages
- High abrasive materials
- ATEX explosion-proof version
- Pipe transition pieces with flanges
- Particle size >.315 in. (8mm)
- UL/CSA certificate

MODEL FF-100, 120 & 150 METAL SEPARATOR

TECHNICAL DATA SHEET

MDDS-404-2

DIMENSIONS



1 Control unit
2 Compressed-air connection
3 Separation unit
4 Inlet (Jacob pipe system)
5 Material outlet
6 Reject outlet

TECHNICAL DATA

Model number	FF-100	FF-120	FF-150
Nominal ØA Jacob system connector	3.9(99)	4.69(119)	5.87(149)
Nominal ØB Jacob system connector	3.9(99)	4.69(119)	5.87(149)
Nominal ØC Jacob system connector	3.9(99)	3.9(99)	5.87(149)
Effective ID of inlet pipe ØD	3.9(99)	4.69(119)	5.87(149)
Maximum sensitivity [1] ØFerrous ball	0.9 mm	1.0 mm	1.5 mm
Maximum throughput [2]	424ft³/hr	565 ft³/hr	883 ft³/hr
Weight lbs.(kg.)	68.3 lbs(31kg)	68.3 lbs(31kg)	88.1 lbs(40kg)

Model Number	E	F	G	H	I	J	K	L
FF-100	1.1(28)	21.8(553)	7.1(180)	1.8(45)	13.2(336)	8.0(204)	18.2(462)	12.5(318.5)
FF-120	1.1(28)	21.8(553)	7.1(180)	1.8(45)	13.2(336)	8.0(204)	18.2(462)	12.5(318.5)
FF-150	1.4(36)	25.6(649)	8.5(215)	1.8(45)	15.7(400)	7.5(190)	18.2(462)	14.7(373.5)

All dimensions in inches(mm)

[1] The specified sensitivity (sphere Ø in mm) is related to the center of the detector's aperture, which is the least sensitive area. The achievable sensitivity within a product depends on its product effect (conductivity caused by moisture, carbon content, metal oxides, etc.), the product temperature and environmental influences. The detectability of metal particles is also determined by their nature, shape and position.

[2] The throughput volume is dependent on the flow characteristics and density of the bulk material as well as the installation location of the metal separator.

MODEL FF-100, 120 & 150 METAL SEPARATOR

TECHNICAL DATA SHEET

MDDS-404-2

CONDITIONS OF USE

Use:	For inspecting free-falling bulk materials in the plastics industry, but also in other industries with similar applications.
Bulk material characteristics:	Dry, free-flowing, short fibers, any possible product effect must be able to be tuned out, particle size <.315 in.(8 mm).
Drop height of bulk material:	Max 19.69 in.(500 mm). above equipment top edge
Material flow:	No back draft of material
Bulk material temperature:	Maximum 176° F. (+80° C)
Ambient temperature:	14° F to 122° F(-10° C to +50° C)

STANDARD DESIGN

System Description:	Metal Separator with detection coil and reject valve (mounted using Jacob's quick release fasteners), integral control unit; good and reject material outlets with Jacob's connectors
Operation:	• Membrane keypad with 3 keys as well as Reset and Test buttons • Access protection • LED lights for operation, metal alarm and fault
Electronics housing:	Sheet steel, varnished, aluminium gray (RAL 9007)
Detection unit:	Sheet steel, varnished, aluminium gray (RAL 9007)
Separation unit:	Stainless steel AISI 304/1.4301, bead blasted
Parts in contact with product:	Stainless steel AISI 304/1.4301, PE-EL, Teflon, POM
Scanning pipe:	PE-EL, static dissipating polyethyline
Operating voltage:	100-240 VAC (±10%), 50/60 Hz
Current consumption:	Approx. 160 mA/115 V, approx. 80 mA/230 V
Mains cable:	5.9 ft. (1.8 m) with plug
Compressed air connection:	73 to 116psi. (5-8 bar); .24in.(6mm), .31in.(8mm) mm hose connection
Ingress protection:	NEMA 3S (IP 54) (cover and on site weather protection is necessary)
Compressed air consumption:	0.5 l / switch operation
Reject travel time and duration:	Adjustable from 0.05 to 29 sec
Scanning sensitivity:	Selectable with 8 adjustments
Self-monitoring system:	Detection coil and outputs
Max. conveying pipe pressure:	Maximum 7.25psi (0.5 bar)

SPECIAL OPTIONS / ACCESSORIES

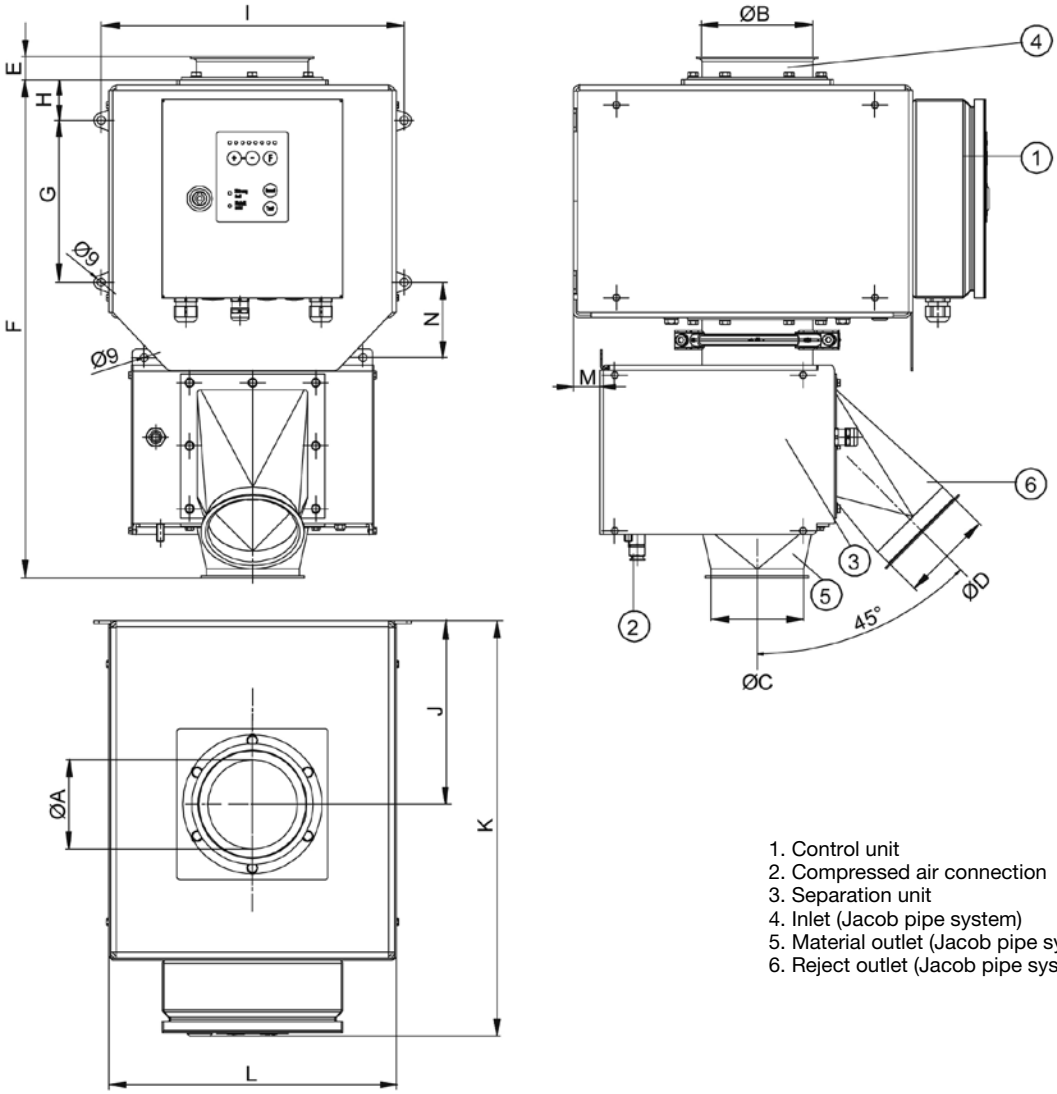
- Visual alarm
  - Fault indication
  - Fault and metal indication
- Audible alarm
  - Fault indication
  - Fault and metal indication
- Combination alarm (visual and audible alarm)
  - Fault indication
  - Fault and metal indication
- Counter (number of detections)
- Low-wear scanning pipe
- Food grade scanning pipe
- Cable set for remote control unit: 9.84ft.(3 m), 19.69ft.(6 m), 33ft.(10 m) & 49.2ft.(15 m)
- Filter control valve
- Push button for manual rejection
- Monitor system for diverter
- Compressed-air monitor
- Heat resistant version up to 284° F (140° C) material temperature
- Test samples
- UL/CSA certificate
- Increased free fall height up to 39.37''(1m)
- Special varnishes
- Special supply voltages
- High abrasive materials
- ATEX explosion-proof version
- Pipe transition pieces with flanges
- Particle size >.315 in. (8mm)

MODEL FF-200 & 250 METAL SEPARATOR

TECHNICAL DATA SHEET

MDDS-404-3

DIMENSIONS



1. Control unit
2. Compressed air connection
3. Separation unit
4. Inlet (Jacob pipe system)
5. Material outlet (Jacob pipe system)
6. Reject outlet (Jacob pipe system)

TECHNICAL DATA

Model number	FF-200	FF-250
Maximum sensitivity [1] Ø Ferrous ball	1.70	2.35
Maximum throughput [2]	1554(ft³ l/h)	2437(ft³ l/h)
Inlet flange plate, ID of inlet pipe A	7.4(188)	9.2(234)
Inlet nominal width B	7.8(199)	9.8(249)
Material outlet, nominal width C	7.8(199)	7.8(199)
Reject outlet, nominal width D	7.8(199)	7.8(199)
Weight (lbs/kg)	126(57)	139(63)

Model Number	E	F	G	H	I	J	K	L	M	N
FF 200	1.5(37)	36.7(931)	9.5(240)	1.8(45)	19.1(485)	9.8(250)	23.1(587)	18.1(458.5)	1.9(50)	4.8(122)
FF 250	1.7(48)	41.7(1059)	12.2(310)	1.9(50)	22.2(565)	10.2(260)	25.1(637)	21.2(538.5)	2.4(60)	5.3(135)

All dimensions inches(mm)

[1] The specified sensitivity (sphere Ø in mm) is related to the center of the detector's aperture, which is the least sensitive area. The achievable sensitivity within a product depends on its product effect (conductivity caused by moisture, carbon content, metal oxides, etc.), the product temperature and environmental influences. The detectability of metal particles is also determined by their nature, shape and position.

[2] The throughput volume is dependent on the flow characteristics and density of the bulk material as well as the installation location of the metal separator.

MODEL FF-200 & 250 METAL SEPARATOR

TECHNICAL DATA SHEET

MDDS-404-3

CONDITIONS OF USE

Use:	For inspecting freefalling bulk materials in the plastics industry, but also in other industries with similar applications.
Bulk material characteristics:	Dry, free-flowing, short fibers, any possible product effect must be able to be tuned out, particle size <.315 in.(8 mm).
Drop height of bulk material:	Max 19.69 in (500 mm). above equipment top edge
Material flow:	No back draft of material
Bulk material temperature:	Maximum 176° F. (+80° C)
Ambient temperature:	14° F to 122° F(-10° C to +50° C)

STANDARD DESIGN

System Description:	Metal Separator with detection coil and reject valve (mounted using Jacob's quick release fasteners), integral control unit; good and reject material outlets with Jacob's connectors
Operation:	• Membrane keypad with 3 keys as well as Reset and Test buttons • Access protection • LED lights for operation, metal alarm and fault
Electronics housing:	Sheet steel, varnished, aluminium gray (RAL 9007)
Detection unit:	Sheet steel, varnished, aluminium gray (RAL 9007)
Separation unit:	Stainless steel AISI 304/1.4301, bead blasted
Parts in contact with product:	Stainless steel AISI 304/1.4301, PE-EL, Teflon, POM
Scanning pipe:	PE-EL, static dissipating polyethylene
Operating voltage:	100-240 VAC (±10%), 50/60 Hz
Current consumption:	Approx. 160 mA/115 V, approx. 80 mA/230 V
Mains cable:	5.9 ft. (1.8 m) with plug
Compressed air connection:	73 to 116psi. (5-8 bar); .24in.(6mm), .31in.(8mm) hose connection
Ingress protection:	NEMA 3S (IP 54) (cover and on site weather protection is necessary)
Compressed air consumption:	0.5 l / switch operation
Reject travel time and duration:	Adjustable from 0.05 to 29 sec
Scanning sensitivity:	Selectable with 8 adjustments
Self-monitoring system:	Detection coil and outputs
Max. conveying pipe pressure:	Maximum 7.25psi (0.5 bar)

SPECIAL OPTIONS / ACCESSORIES

- Visual alarm
  - Fault indication
  - Fault and metal indication
- Audible alarm
  - Fault indication
  - Fault and metal indication
- Combination alarm (visual and audible alarm)
  - Fault indication
  - Fault and metal indication
- Counter (number of detections)
- Low-wear scanning pipe
- Food grade scanning pipe
- Pipe transition pieces with flanges
- Cable set for remote control unit: 9.84ft.(3 m), 19.69ft.(6 m), 33ft.(10 m) & 49.2ft.(15 m)
- Filter control valve
- Push button for manual rejection
- Monitor system for diverter
- Compressed-air monitor
- Special supply voltages
- Special varnishes
- High abrasive materials
- Heat resistant version up to 284° F (140° C) product temperature
- Test samples
- UL/CSA certificate
- Increased free fall height to 39.37" (1m)
- Particle size 2.315" (8mm)
- ATEX explosion-proof version

General Information

Introduction

The texts and illustrations in this instruction manual are for the exclusive purpose of explaining how to operate and handle the metal separator. Please check that this is the correct manual for your equipment. The manufacturer accepts no responsibility for damage resulting from the use or misuse of this equipment. All appropriate safety rules and regulations for the use of this equipment must be adhered to. If you have any questions with regard to the installation and operation of this equipment, please do not hesitate to contact us.

This instruction manual must not be copied, saved on computer or otherwise reproduced without prior permission of the manufacturer. Nor should any extract of this instruction manual be similarly reproduced.

Symbols Used


Important Notes


Danger Notes


Safety Notes


Danger!

Risk of hand injury due to pneumatic reject flap.

Legal Compliance

This equipment complies with machine guideline 98/37/EWG

Fields of Application

- Product liability
- ISO 9000
- TQM (Total Quality Management)
- Protection of machines and operators

Important Functional Notes

The metal separator is designed and built to provide optimum detection and separation of metal contaminants.

However, it is important to be aware of the circumstances in which metal detection may be compromised when conveying and processing bulk materials.

• Accumulation of metal particles in a batch of bulk material. This may occur with ground or shredded material if a larger piece has been ground.

• Turbulence in the reject unit and reject flap reaction time. If there is an accumulation of metal particles the flap cannot react to the control signals without delay. Occurs when recycled or reground material is processed, even when blended with virgin material.

• Material back draught with gravity feed type metal separators using a reject flap separation system (wrong type of equipment).

• Pipe conveying with high fill ratio.

Depends on the bulk material, particularly for gravity and vacuum/pressure systems.

• Recommended conveying speed exceeded.

For these reasons, no general guarantee can be given that the unit will operate with 100% accuracy.

For bulk materials containing a high proportion of metal contaminants, it is recommended that two separators are connected one after the other (for gravity systems) and additional permanent magnets are installed in freefall pipes or hoppers (for pipeline systems).

For preliminary cleaning, special separators are available for vacuum and pressure pipes.

Design and Method of Operation

Control Elements / Complete Device

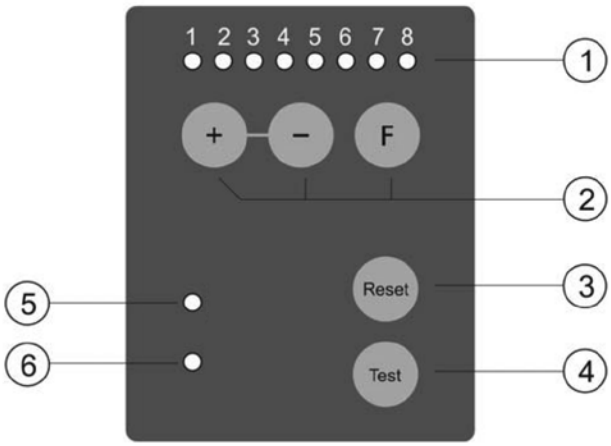
1 Inlet
2 Control Unit
3 Diverter unit (rotating)
4 Reject outlet
5 Outlet for good material

Example shown: Model FF Metal Separator

Functional and Control Elements / Control Unit

Control unit

Used mainly in the plastics industry, equipped with 8 product memories.



1	LED display:	8 digits	For machine operation and metal signal display
2	Operator keys	+ , - , F	For operation and machine setting
3	Function key	Reset	Reset to restore the unit after metal or fault signal
4	Function key	Test	Test function for metal detector
5	Red light	Fault	Flashes when fault detected
6	Yellow light	Metal	Illuminates when metal detected

Design and Method of Operation (cont.)

Functional Principle

Design:

Metal separator consists of a detection coil and a rotating reject mechanism. Both components are connected via a controller board.

Technical Description:

The detector head generates a high-frequency electromagnetic field.

Metal particles conveyed through the coil disrupt this field. Control electronics evaluate the disruption and send an electronic signal to the reject mechanism. The material to be inspected is gravity fed through the machine.

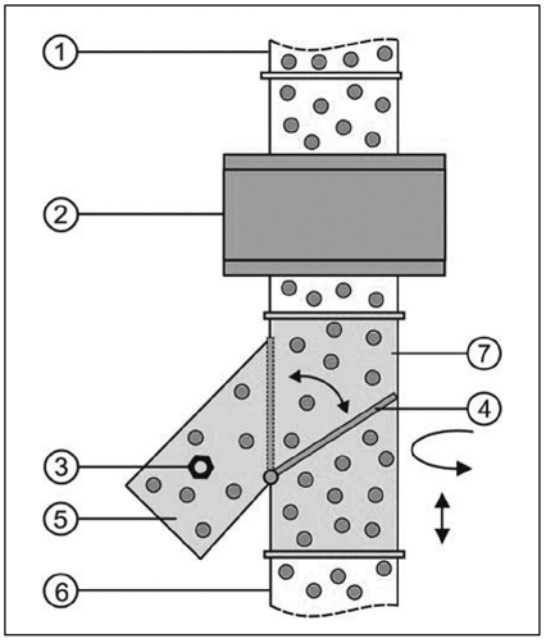
If no detection occurs, the material passes through the diverter flap into the good material outlet. If metal is detected, the electronics control a magnetic valve and pneumatic cylinder so that the flap moves into the reject position. The metal contaminant is then diverted with a small amount of material through the reject outlet.

Material loss be calculated as follows:

Throughput (kg/sec) x reject duration

Example:

Throughput: 300 kg/h = 83 g/s
Eject duration / Reject time: 0.2 sec
Reject quantity = 83g/s x 0.2 sec = 17g



1 Inlet
2 Detection coil
3 Metal contaminant
4 Diverter flap
5 Reject outlet
6 Outlet for good material
7 Diverter unit (rotating)

Note: The flap is shown in reject position.

Technical Data

Noise Levels

Sound pressure level measurements (in acc. with DIN 45 635)

Peak value of sound pressure level at distance of 3.25 ft. (1m) from machine surface and 5.25 ft. (1.60m) across the floor, LpA, 1m, max.

Result:

Idling < 70 dB

Activated < 90 dB

We reserve the right to change the contents due to product innovation or technical improvement.

Safety

Our equipment conforms to all official technical safety regulations. However, as a manufacturer we believe it is our duty to make you aware of the following information. Please also refer to the chapter on safety in the operating manual of the control unit.

Intended Use

The equipment is designed for installation in closed pipes or funnels, in which material is free-falling. Free fall height must not exceed 19.69 in. (500mm). No chemically aggressive bulk material should be fed through the equipment. Inlets and outlets should be connected to funnels, hoppers, pipes etc. to avoid hand injuries during operation. Ensure that the operation area is free from steam, plasticizers or other materials that may damage the PVC cable sheathing. If there is a high proportion of metal contaminants or the bulk materials being inspected are abrasive, it is likely that any surfaces in contact with the product will show signs of wear and tear (e.g. separation slide, pneumatic cylinder etc.). In this case it is important that surfaces in contact with the product (e.g. scanning pipe, adaptors, reject device, drive unit etc.) are checked at regular weekly or monthly intervals. Worn parts must be replaced to ensure the machine functions properly. Please note that any preventative measures which may have been taken at the time of construction will merely delay the onset of wear and tear but will not eliminate it completely.

Safety Signs

The safety sign shown on the left must be displayed on the reject system cover. Covering this area prevents access to any dangerous areas. Please observe instructions on page 16 when removing the cover to carry out maintenance and repair work.

Dangers Arising from Non-Compliance with Safety Notices

Hand injuries caused by the pneumatic reject flap are likely in cases of non-compliance with the safety notices.

Safety Information for Operation and Maintenance

The metal separator must be maintained in perfect working order and used for the purpose for which it was designed. Ensure that during operation all covers remain closed. The frame of the equipment must be earthed. Safety signage must not be removed and must be maintained in good condition. Apertures of more than 7.87 in. (200mm) must be connected to an inlet pipe of 19.69 in. (0.5m) and outlet pipes of 35.4 in. (0.9m) (or other preventative measures must be taken) to prevent anyone reaching inside. The instruction manual must remain complete and in good, readable condition. Only qualified personnel should operate, maintain and repair the equipment. Disconnect mains and compressed air supply prior to undertaking any electrical or pneumatic work.

Notes on Residual Risks

Compressed air tanks may still be pressurized even after being disconnected from the compressed air supply. Empty them if necessary.

Consequences of Unauthorized Modification

Unauthorized modification or repair will invalidate all manufacturer declarations and guarantees.

Improper Use

The is not designed for use other than that stipulated on page 15. All operations must be within the specifications detailed in the technical data. Improper use also includes operating the equipment with excessive mechanical, static or dynamic loads (e.g. heavy machine parts or strong vibration). The inspection of aggressive materials such as those containing alkalis, acids and solvents is not permitted, nor is the equipment to be used in an environment where there is risk of explosion.

Installation

Mechanical Installation

It is important to pay attention to the following items:

• Free fall height of the fed product should not exceed the given value in the technical data sheet.

• Solid and vibration-free mounting, including the feeding hopper and blender on top of the inlet plate.

• Avoid electromagnetic interference in the area surrounding the detector, (e.g. caused by electrical motors, frequency converters etc.).

• Ensure there are no moving or vibrating metal parts in the immediate vicinity of the metal separator.

• Indoors mounting and operation.

• Prevent electrostatic charging by earthing frame.

• Apertures of more than 7.87 in. (200mm) must be connected to an inlet pipe of 19.69 in. (0.5m) and outlet pipes of 35.4 in. (0.9m) (or other preventative measures must be taken) to prevent anyone reaching inside.

Note: We recommend installing a sealable opening in the pipe in front of the detector. This opening will enable samples for performance tests to be introduced.

Installation of Power and Air Supply

• Ensure the metal separator framework is earthed.

• Connect compressed air supply.

• Check the cable connection to the pneumatic valve and detector head.

• Check operating pressure at 87 PSI (6 bar), adjust if necessary.

• For service unit settings, see attached manual.

Warning: Effective and reliable separation is guaranteed only if operating pressure is above 75 PSI (5 bar).

For electrical power connection see attached manual for the metal detector.

Setting Operating Parameters

Warning: Close control unit cover and metal separator cover. Once the unit has been installed correctly, and mains supply (115/230 VAC; 50/60 Hz) and compressed air supply 73-116 PSI (5-8 bar) have been connected, check reject mechanism function by using the test button. Activate conveying and adjust the metal detector to eliminate false alarms. Convey appropriate test materials through the machine (e.g. plastic ball containing correct size metal contaminant.) See note above and check reject process. If necessary, adjust reject duration.

Maintenance

⚠ If there is a high proportion of metal contaminants or the bulk materials being inspected are abrasive, it is likely that any surfaces in contact with the product will show signs of wear and tear (e.g. separation slide, pneumatic cylinder etc.). In this case, it is important that surfaces in contact with the product (e.g. scanning pipe, adaptors, reject device, drive unit etc.) are checked at regular weekly or monthly intervals. Worn parts must be replaced to ensure the machine functions properly.

General Notes

• Before cleaning or carrying out any maintenance work, switch off the mains power supply and disconnect the compressed air supply.

• Do not use aggressive cleaning agents.

• Check brush seals.

• When carrying out repairs, clean dirty parts and drain off condensate at compressed air supply.

Separation Unit

First remove the cover of the separation mechanism. The pneumatic components are now accessible and can be checked, cleaned or replaced. When cleaning the reject mechanism, take out the entire unit. Loosen the Jacob's clamps, pneumatic and electrical connections, remove the reject and clean it. If the reject flap needs to be taken out, first disconnect the reject material outlet connection flange from the reject unit. The cylinder is separated from the lever taking out the bolts. Take out the flap on the reject material outlet by removing the central screws from the butterfly valve stem and the axes from the bearing blocks. Damaged or worn brushes on the diverter slide are easy to replace. To reassemble, follow these instructions in reverse order.

Performance Check

Check the reject mechanism by pressing the test button at least every 2 weeks. Switching operation can also be carried out by:

• Switching off power supply

• Introducing test piece into the conveying pipe in front of the metal detector.

• Manually operating the pneumatic valve

Cleaning

• Do not use chemical cleaning materials

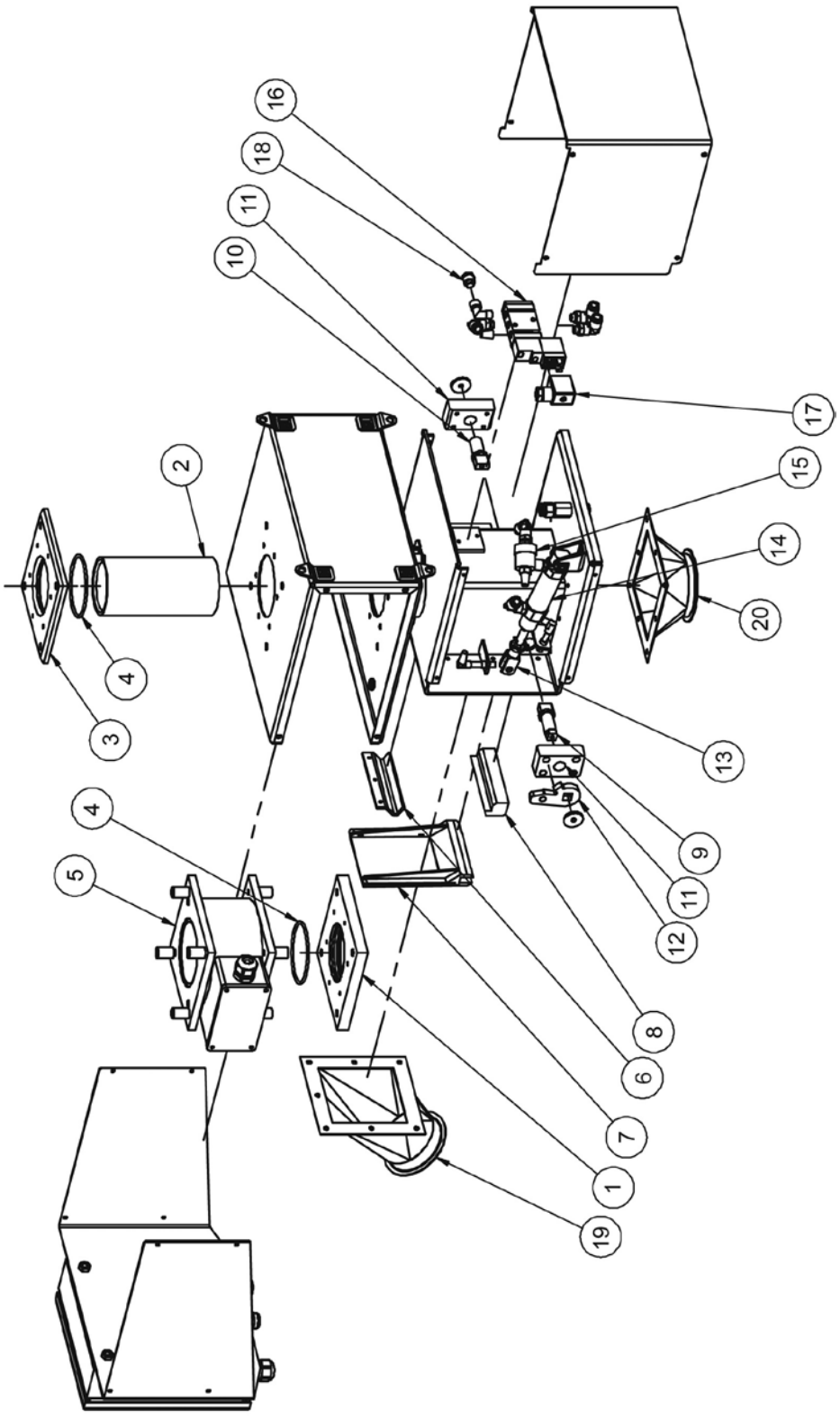
• Do not use water jets

• No high pressure cleaning

Spare Parts

Please state type of equipment and serial number when contacting us.

Spare Parts Drawing, FF-30



Spare Parts (cont.)

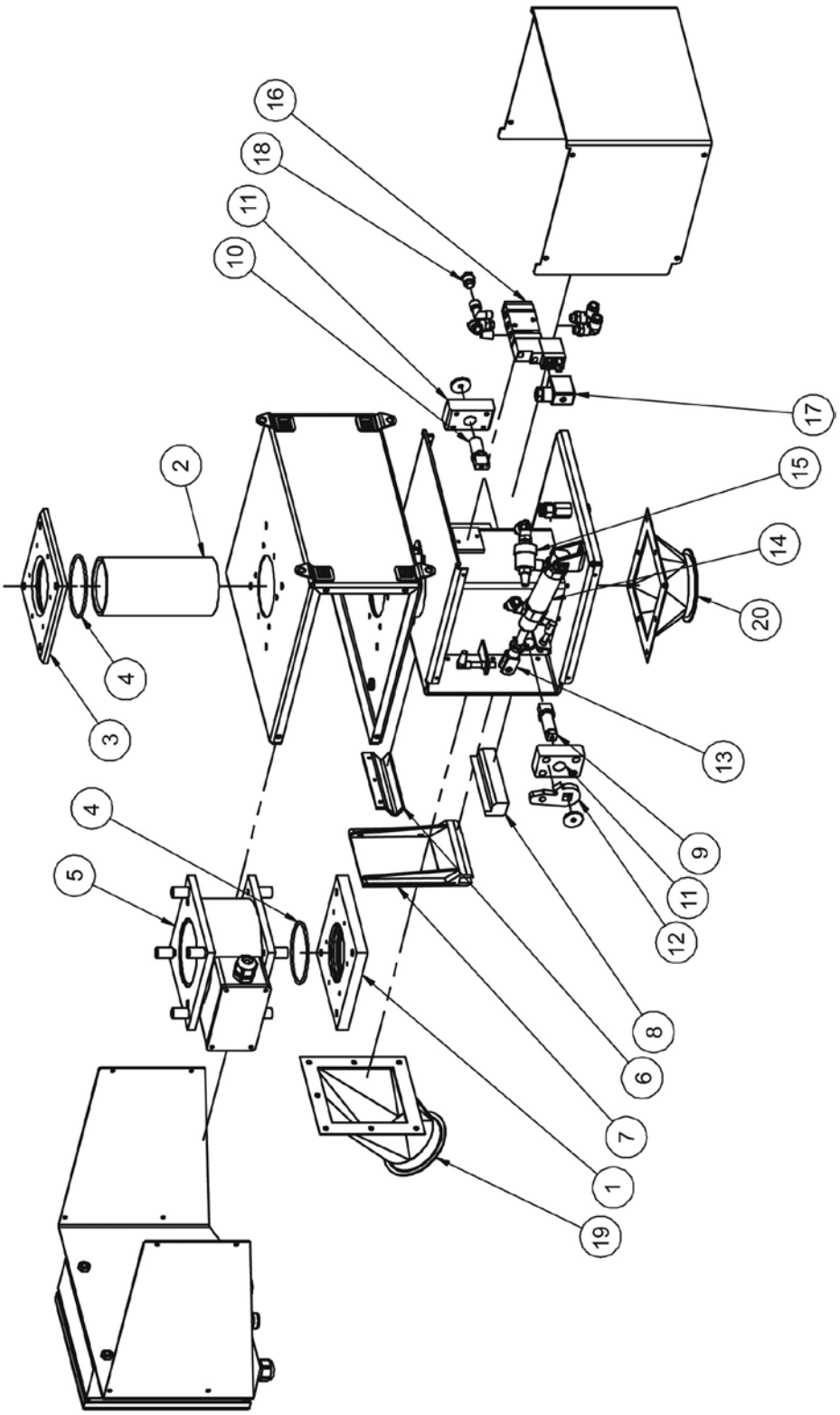
Spare Parts List, FF-30

Item	Qty	Sp/Con*	Part	Drawing no. / standard	Material	Item No.
1	1	Sp	Sealing plate	MM1935.030.TE.006	Aluminum	33007316
2	1	Con	Scanning pipe (standard)	MM1935.030.TE.002	PE-EL	44003520
2	1	Con	Scanning pipe, low-wear, high temperature resistant, foodgrade (option)	Z0001382	PVDF	77001392
3	1	Sp	Cover plate	MM1935.030.TE.004	Aluminum	33007314
4	2	Con	O ring seal	Ø.118 in. (3mm) - conductive	Silicon-Carbon	08023301
5	1	Sp	Detection coil RZ-P 40	MM2125.036BG037.2		44003390
6	1	Con	Guide rod	MM1935.070.TE.009	1.4301	44003452
7	1	Con	Reject flap NW70	MM1935.070.TE.028	1.4301	44005160
8	1	Sp	Seal	MM1935.070.TE.024	POM	33006458
9	1	Sp	Axle	MM1935.070.TE.029	1.4301	33006424
10	1	Sp	Short axle	MM1935.070.TE.030	1.4301	33006426
11	2	Con	Bearing shell	MM1935.120.TE.016	S green	33006380
12	1	Sp	Lever	MM1935.070.TE.031	1.4301	44003456
13	1	Sp	Fork head	PSA0012		08012458
14	1	Sp	Pneumatic cylinder	RM/8026/M/25		21034600
15	1	Sp	Quick-action ventilation valve	P06.02331		56201251
16	1	Sp	Pneumatic valve	5/2-Wege -G1/8 - 411A-C0A-DM-DDAJ-1JM		08024898
17	1	Sp	Solenoid valve box	GM 209 NJ / 932 977-106		04015266
18	1	Con	Screwed choke	DVE-06 - G1/8 / KY6952	MS / Sintered bronze	21040700
19	1	Sp	Transition piece reject outlet	45°-NW080 / 11083420	1.4301	08012407
20	1	Sp	Transition piece material outlet	NW080 / 11083400	1.4301	08015236

*Sp/Con = Spare part / Consumable
When ordering please state type of equipment

Spare Parts (cont.)

Spare Parts Drawing, FF-50



Spare Parts (cont.)

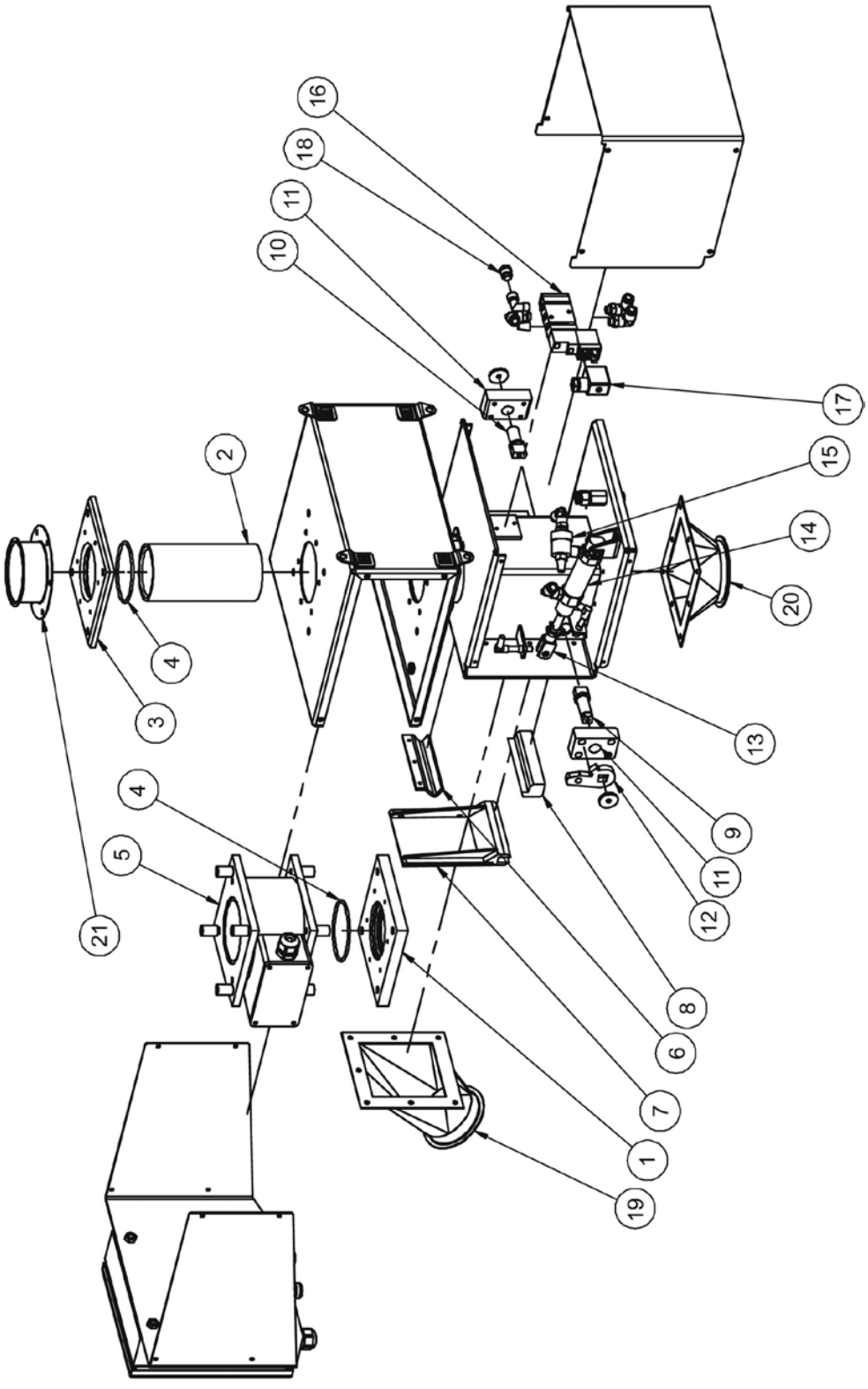
Spare Parts List, FF-50

Item	Qty	Sp/Con*	Part	Drawing no. / standard	Material	Item No.
1	1	Sp	Sealing plate	MM1935.050.TE.007	Aluminum	33006444
2	1	Con	Scanning pipe (standard)	MM1935.050.TE.010	PE-EL	33007544
2	1	Con	Scanning pipe, low-wear, high temperature resistant, foodgrade (option)		PVDF	44005176
3	1	Sp	Cover plate	MM1935.050.TE.011	Aluminum	33007528
4	2	Con	O ring band	Ø.118 in. (3mm) - conductive	Silicon carbon	08023301
5	1	Sp	Detection coil RZ-P 55	MM2125.036BG038.2		44003214
6	1	Con	Guide rod	MM1935.070.TE.009	1.4301	44003452
7	1	Con	Reject flap NW70	MM1935.070.TE.028	1.4301	44005160
8	1	Sp	Seal	MM1935.070.TE.024	POM	33006458
9	1	Sp	Axle	MM1935.070.TE.029	1.4301	33006424
10	1	Sp	Short axle	MM1935.070.TE.030	1.4301	33006426
11	2	Con	Bearing shell	MM1935.120.TE.016	S green	33006380
12	1	Sp	Lever	MM1935.070.TE.031	1.4301	44003456
13	1	Sp	Fork head	PSA0012		08012458
14	1	Sp	Pneumatic cylinder	RM/8026/M/25		21034600
15	1	Sp	Quick-action ventilation valve	P06.02331		56201251
16	1	Sp	Pneumatic valve	5/2-Wege -G1/8 - 411A-C0A-DM-DDAJ-1JM		08024898
17	1	Sp	Solenoid valve box	GM 209 NJ / 932 977-106		04015266
18	1	Con	Screwed choke	DVE-06 - G1/8 / KY6952	MS / Sintered bronze	21040700
19	1	Sp	Transition piece reject outlet	45°-NW080 / 11083420	1.4301	08012407
20	1	Sp	Transition piece material outlet	NW080 / 11083400	1.4301	08015236

*Sp/Con = Spare part / Consumable
When ordering please state type of equipment

Spare Parts (cont.)

Spare Parts Drawing, FF-70



Spare Parts (cont.)

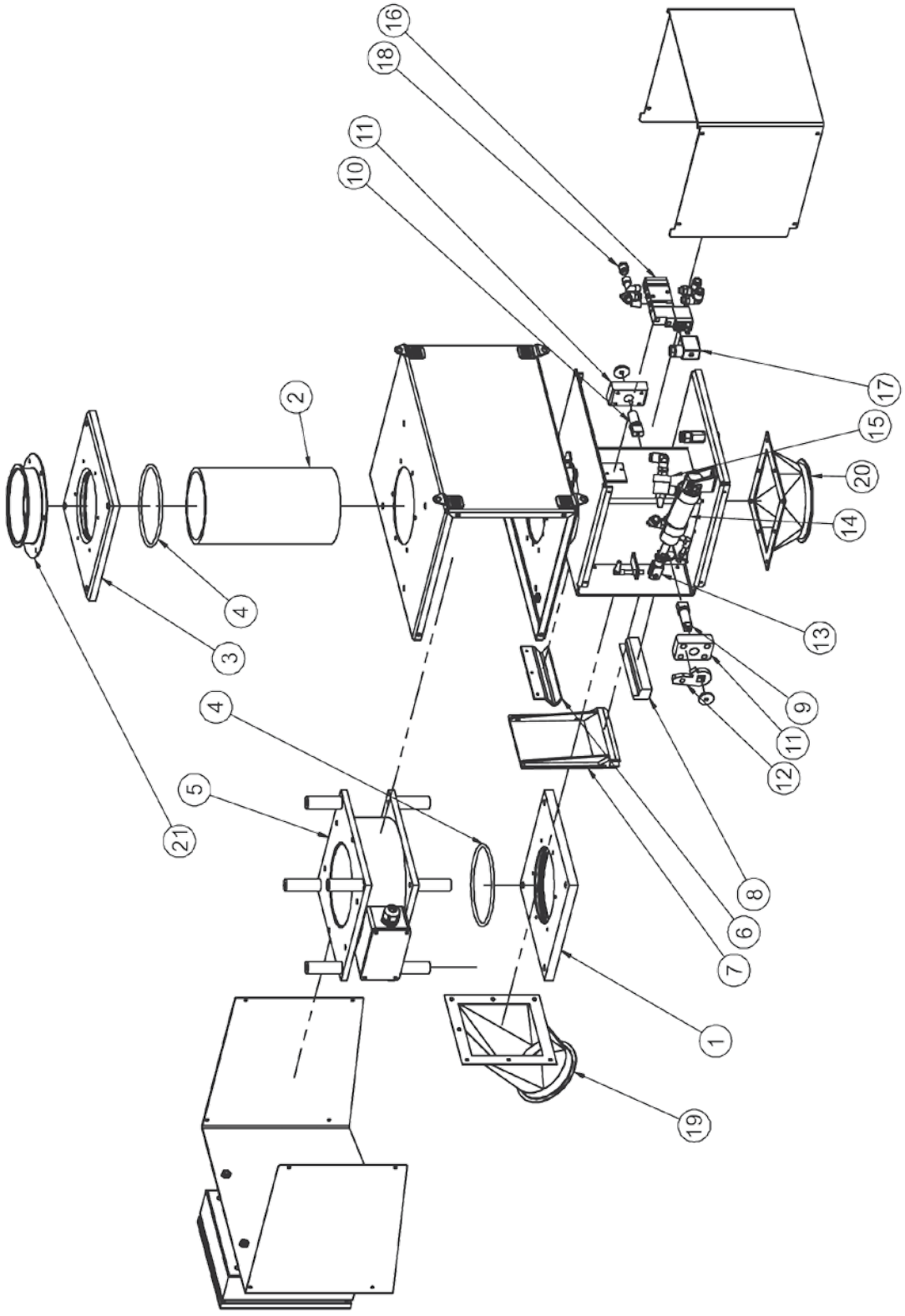
Spare Parts List, FF-70

Item	Qty	Sp/Con*	Part	Drawing no. / standard	Material	Item No.
1	1	Sp	Sealing plate	MM1935.070.TE.041	Aluminum	33007536
2	1	Con	Scanning pipe (standard)	MM1935.070.TE.035	PE-EL	33007546
2	1	Con	Scanning pipe, low-wear, high temperature resistant, foodgrade (option)		PVDF	44005148
3	1	Sp	Cover plate	MM1935.070.TE.032	Aluminum	33007530
4	2	Con	O ring band	Ø.118 in. (3mm) - conductive	Silicon carbon	08023301
5	1	Sp	Detection coil RZ-P 80	MM2125.036BG039.2		44003216
6	1	Con	Guide rod	MM1935.070.TE.009	1.4301	44003452
7	1	Con	Reject flap NW70	MM1935.070.TE.028	1.4301	44005160
8	1	Sp	Seal	MM1935.070.TE.024	POM	33006458
9	1	Sp	Axle	MM1935.070.TE.029	1.4301	33006424
10	1	Sp	Short axle	MM1935.070.TE.030	1.4301	33006426
11	2	Con	Bearing shell	MM1935.120.TE.016	S green	33006380
12	1	Sp	Lever	MM1935.070.TE.031	1.4301	44003456
13	1	Sp	Fork head	PSA0012		08012458
14	1	Sp	Pneumatic cylinder	RM/8026/M/25		21034600
15	1	Sp	Quick-action ventilation valve	P06.02331		56201251
16	1	Sp	Pneumatic valve	5/2-Wege -G1/8 - 411A-C0A-DM-DDAJ-1JM		08024898
17	1	Sp	Solenoid valve box	GM 209 NJ / 932 977-106		04015266
18	1	Con	Screwed choke	DVE-06 - G1/8 / KY6952	MS / Sintered bronze	21040700
19	1	Sp	Transition piece reject outlet	45°-NW080 / 11083420	1.4301	08012407
20	1	Sp	Transition piece material outlet	NW080 / 11083400	1.4301	08015236
21	1	Sp	Connectors NW080-1.5 mm	MM1935.070.TE.039	1.4301	33007568

*Sp/Con = Spare part / Consumable
When ordering please state type of equipment

Spare Parts (cont.)

Spare Parts Drawing, FF-100



Spare Parts (cont.)

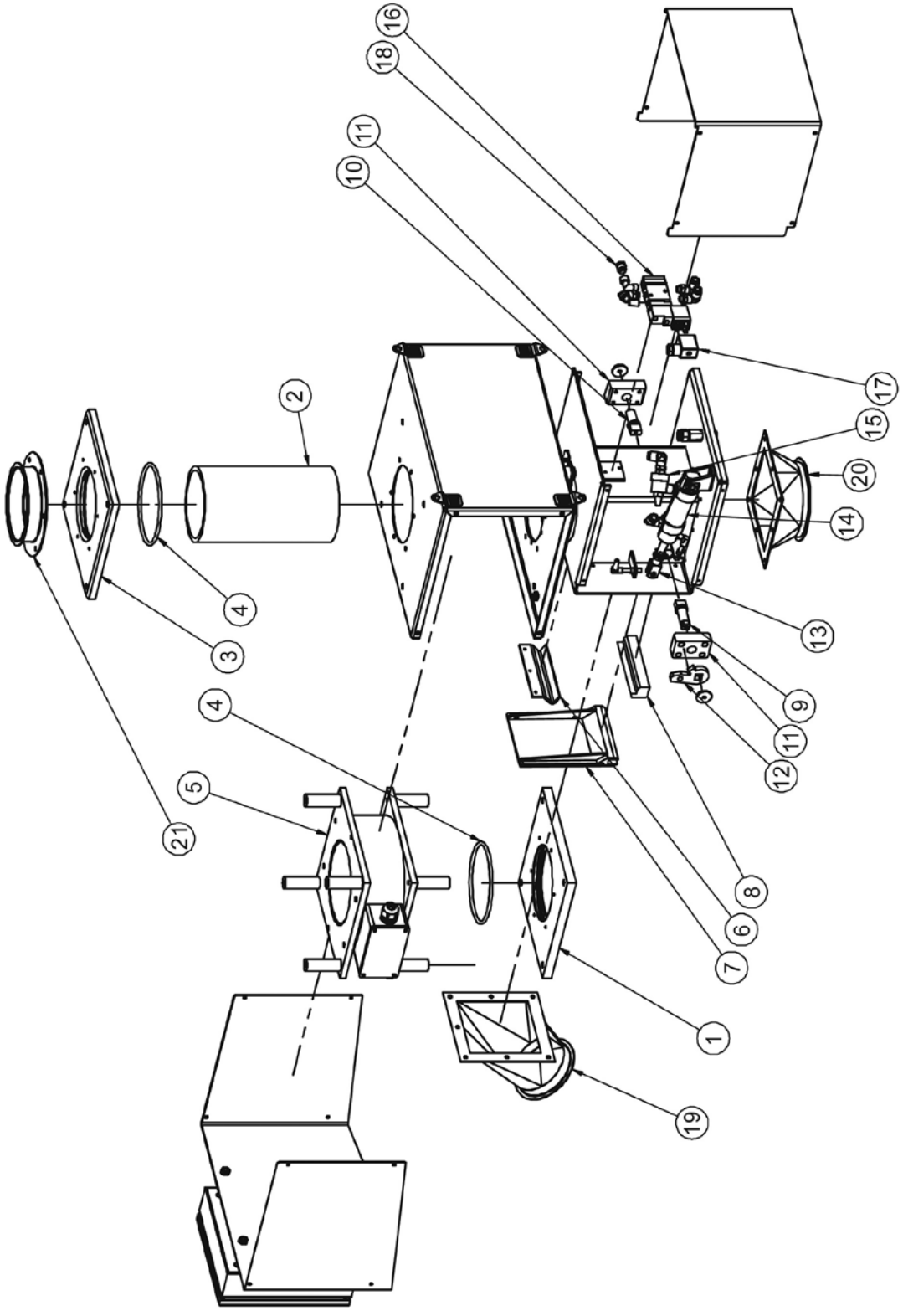
Spare Parts List, FF-100

Item	Qty	Sp/Con*	Part	Drawing no. / standard	Material	Item No.
1	1	Sp	Sealing plate	MM1935.100.TE.008	Aluminum	33007042
2	1	Con	Scanning pipe (standard)	MM1935.100.TE.011	PE-EL	33007548
2	1	Con	Scanning pipe, low-wear, high temperature resistant, foodgrade (option)	MM1935.100TE023	PVDF	77001116
3	1	Sp	Cover plate	MM1935.100.TE.012	Aluminum	33007154
4	2	Con	O ring band	Ø.197 in. (5mm) - conductive	Silicon carbon	08023328
5	1	Sp	Detection coil RZ-P 120	MM2125.036BG040.2		44003394
6	1	Con	Guide rod	MM1935.120.TE.007	1.4301	44003454
7	1	Con	Reject flap NW120	MM1935.120.TE.022	1.4301	44005018
8	1	Sp	Seal	MM1935.120.TE.010	POM	33006428
9	1	Sp	Axle	MM1935.070.TE.029	1.4301	33006424
10	1	Sp	Short axle	MM1935.070.TE.030	1.4301	33006426
11	2	Con	Bearing shell	MM1935.120.TE.016	S green	33006380
12	1	Sp	Lever	MM1935.120.TE.013	1.4301	44003590
13	1	Sp	Fork head	PSA0012		08012458
14	1	Sp	Pneumatic cylinder	DSNU-32-25-P-A / 195980		33006414
15	1	Sp	Quick-action ventilation valve	P06.02331		56201251
16	1	Sp	Pneumatic valve	5/2-Wege -G1/8 - 411A-C0A-DM-DDAJ-1JM		08024898
17	1	Sp	Solenoid valve box	GM 209 NJ / 932 977-106		04015266
18	1	Con	Screwed choke	DVE-06 - G1/8 / KY6952	MS / Sintered bronze	21040700
19	1	Sp	Transition piece reject outlet	45°-NW100 / 11103420	1.4301	08014108
20	1	Sp	Transition piece material outlet	NW100 / 11103400	1.4301	08014094
21	1	Sp	Connectors	NW100-1.5 mm / 11103431	1.4301	15080900

*Sp/Con = Spare part / Consumable
When ordering please state type of equipment

Spare Parts (cont.)

Spare Parts Drawing, FF-120



Spare Parts (cont.)

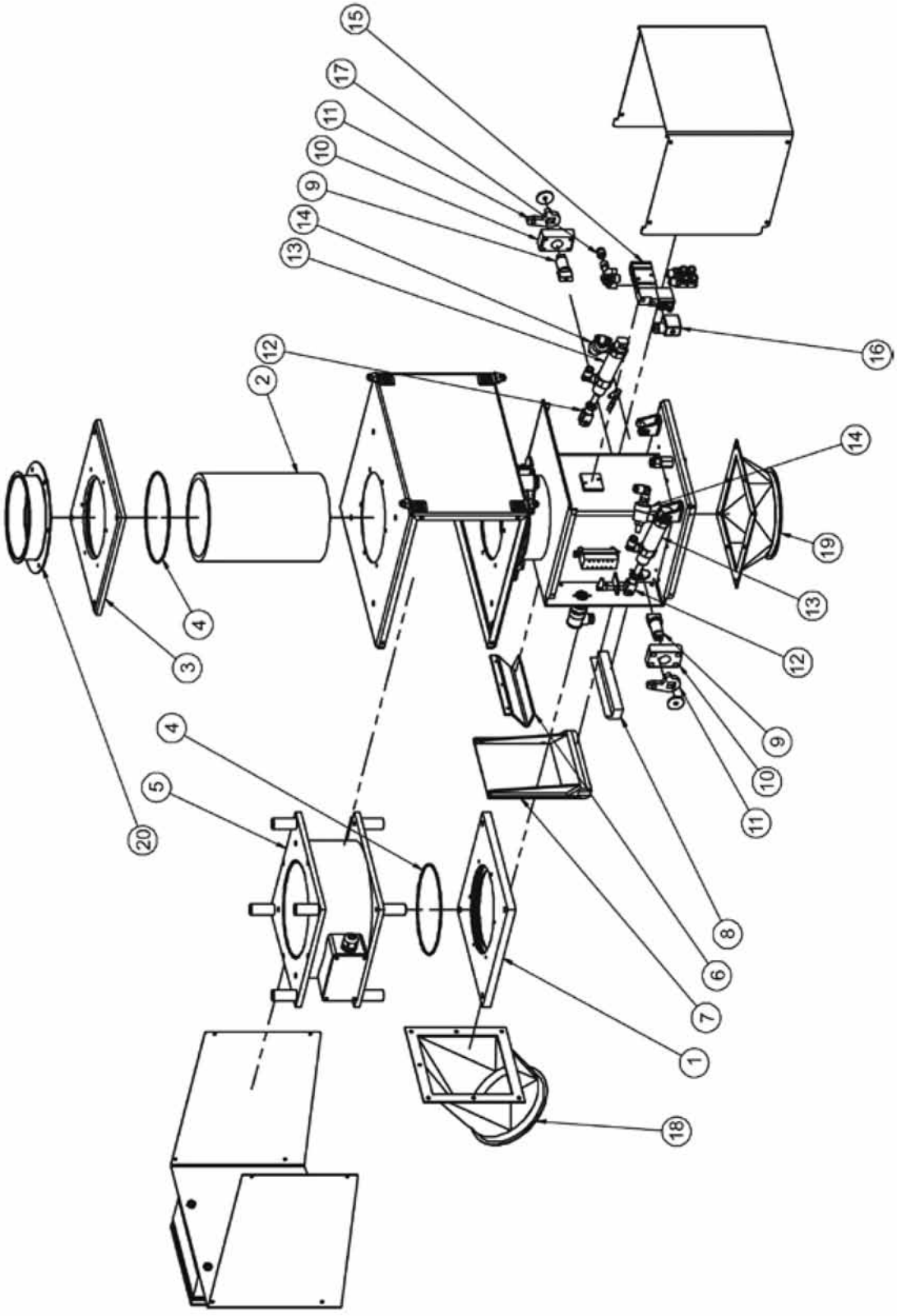
Spare Parts List, FF-120

Item	Qty	Sp/Con*	Part	Drawing no. / standard	Material	Item No.
1	1	Sp	Sealing plate	MM1935.120.TE.017	Aluminum	33007538
2	1	Con	Scanning pipe (standard)	MM1935.120.TE.025	PE-EL	33007550
2	1	Con	Scanning pipe, low-wear, high temperature resistant, foodgrade (option)		PVDF	44005150
3	1	Sp	Cover plate	MM1935.120.TE.024	Aluminum	33007156
4	2	Con	O ring band	Ø.197 in. (5mm) - conductive	Silicon carbon	08023328
5	1	Sp	Detection coil RZ-P 133	MM2125.036BG044.2		44003396
6	1	Con	Guide rod	MM1935.120.TE.007	1.4301	44003454
7	1	Con	Reject flap NW120	MM1935.120.TE.022	1.4301	44005018
8	1	Sp	Seal	MM1935.120.TE.010	POM	33006428
9	1	Sp	Axle	MM1935.070.TE.029	1.4301	33006424
10	1	Sp	Short axle	MM1935.070.TE.030	1.4301	33006426
11	2	Con	Bearing shell	MM1935.120.TE.016	S green	33006380
12	1	Sp	Lever	MM1935.120.TE.013	1.4301	44003590
13	1	Sp	Fork head	PSA0012		08012458
14	1	Sp	Pneumatic cylinder	DSNU-32-25-P-A / 195980		33006414
15	1	Sp	Quick-action ventilation valve	P06.02331		56201251
16	1	Sp	Pneumatic valve	5/2-Wege -G1/8 - 411A-C0A-DM-DDAJ-1JM		08024898
17	1	Sp	Solenoid valve box	GM 209 NJ / 932 977-106		04015266
18	1	Con	Screwed choke	DVE-06 - G1/8 / KY6952	MS / Sintered bronze	21040700
19	1	Sp	Transition piece reject outlet	45°-NW100 / 11103420	1.4301	08014108
20	1	Sp	Transition piece material outlet	MM1935.001.TE.008.4	1.4301	08012296
21	1	Sp	Connectors	NW120-1.5 mm / 11123431	1.4301	15081100

*Sp/Con = Spare part / Consumable
When ordering please state type of equipment

Spare Parts (cont.)

Spare Parts Drawing, FF-150



Spare Parts (cont.)

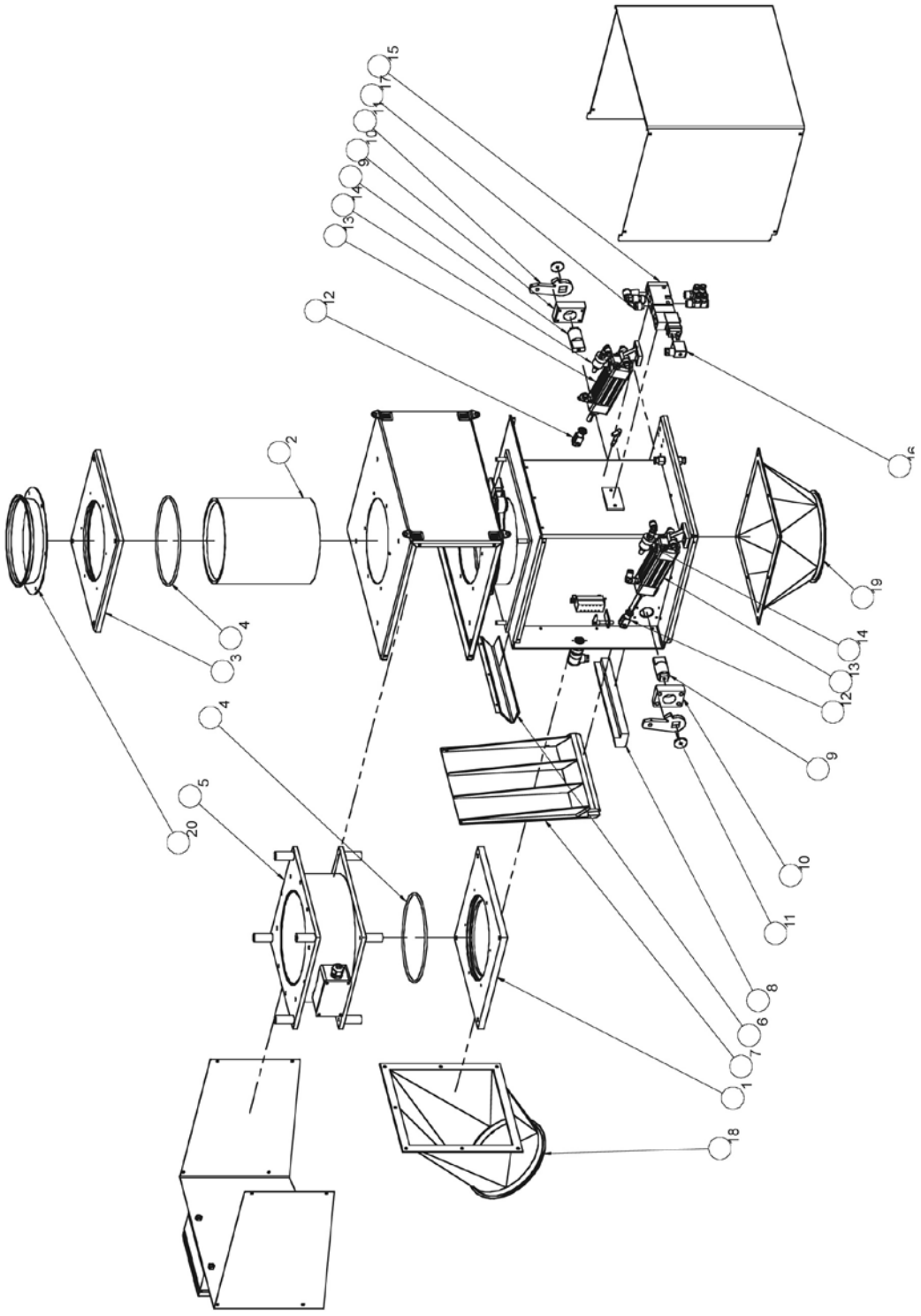
Spare Parts List, FF-150

Item	Qty	Sp/Con*	Part	Drawing no. / standard	Material	Item No.
1	1	Sp	Sealing plate	MM1935.150.TE.014	Aluminum	33007140
2	1	Con	Scanning pipe (standard)	MM1935.150.TE.017	PE-EL	33007252
2	1	Con	Scanning pipe, low-wear, high temperature resistant, foodgrade (option)		PVDF	44005174
3	1	Sp	Cover plate	MM1935.150.TE.022	Aluminum	33007138
4	2	Con	O ring band	Ø.197 in. (5mm) - conductive	Silicon carbon	08023328
5	1	Sp	Detection coil RZ-P 170	MM2125.036BG054.2		44003400
6	1	Con	Guide rod	MM1935.150.TE.007	1.4301	44003540
7	1	Con	Reject flap NW150	MM1935.150.TE.024	1.4301	44005024
8	1	Sp	Seal	MM1935.150.TE.010	POM	33006628
9	2	Sp	Axle	MM1935.150.TE.009	1.4301	33006642
10	2	Con	Bearing shell	MM1935.150.TE.012	S green	33006624
11	2	Sp	Lever	MM1935.150.TE.016	1.4301	44003536
12	2	Sp	Fork head	PSA0012		08012458
13	2	Sp	Pneumatic cylinder	RM/8026/M/25		21034600
14	2	Sp	Quick-action ventilation valve	P06.02331		56201251
15	1	Sp	Pneumatic valve	5/2-Wege -G1/4 - 411A-C0A-DM-DDAJ-1JM		08024898
16	1	Sp	Solenoid valve box	GM 209 NJ / 932 977-106		04015266
17	1	Con	Screwed choke	DVE-06 - G1/8 / KY6952	MS / Sintered bronze	21040700
18	1	Sp	Transition piece reject outlet	MM1935.022.TE.016.3	1.4301	08023549
19	1	Sp	Transition piece material outlet	MM1935.022.TE.015.3	1.4301	08023557
20	1	Sp	Connectors	NW150-1.5 mm / 11153431	1.4301	15081300

*Sp/Con = Spare part / Consumable
When ordering please state type of equipment

Spare Parts (cont.)

Spare Parts Drawing, FF-200



Spare Parts (cont.)

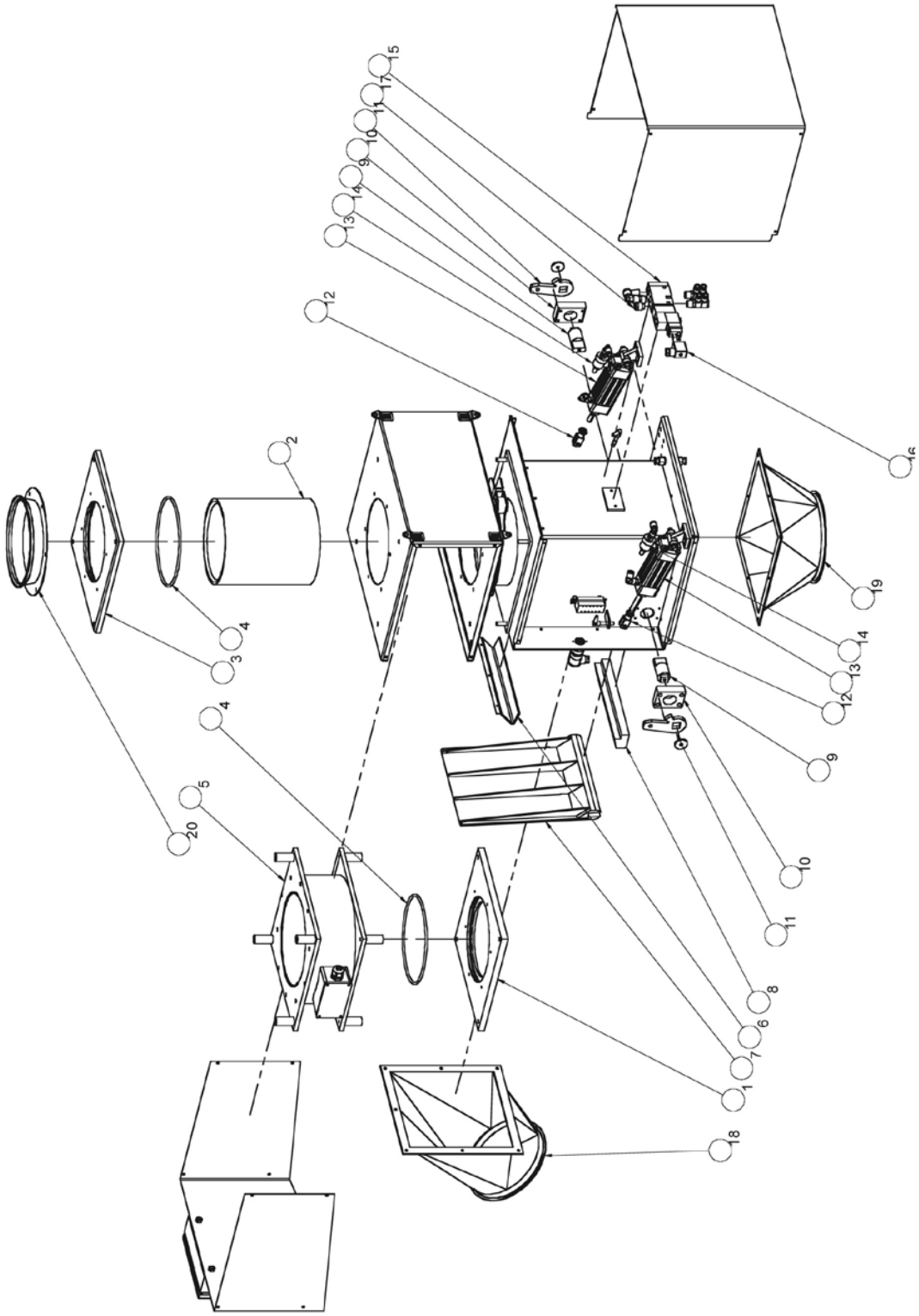
Spare Parts List, FF-200

Item	Qty	Sp/Con*	Part	Drawing no. / standard	Material	Item No.
1	1	Sp	Sealing plate	MM1935.200.TE.020	Aluminium	33007540
2	1	Con	Scanning pipe (standard)	MM1935.200.TE.019	PE-EL	33007552
2	1	Con	Scanning pipe, low-wear, high temperature resistant, foodgrade (option)		PVDF	44005180
3	1	Sp	Cover plate	MM1935.200.TE.005	Aluminium	33006462
4	2	Con	O ring seal	Ø .197 in. (5 mm) - conductive	Silicon-Carbon	08023328
5	1	Sp	Detection coil RZ-P 210	MM2125.036BG087.2		77001126
6	1	Con	Guide rod	MM1935.250.TE.010	1.4301	44003542
7	1	Con	Reject flap NW 250	MM1935.250.TE.011	1.4301	44005102
8	1	Sp	Seal	MM1935.250.TE.014	POM	33006468
9	2	Sp	Axle	MM1935.250.TE.012	1.4305	33006470
10	2	Con	Bearing shell	MM1935.250.TE.021	Aluminium	33007060
11	2	Sp	Lever	MM1935.250.TE.013	1.4301	44003538
12	2	Sp	Fork head	PSA0012		08012458
13	2	Sp	Pneumatic cylinder	CP95SB32-50		33003274
14	2	Sp	Quick-action ventilation valve	P06.02331		56201251
15	1	Sp	Pneumatic valve	5/2-Wege - G3/8 - 811C-PM-501JM-155		08024871
16	1	Sp	Solenoid valve box	GM 209 NJ / 932 977-106		04015266
17	1	Con	Screwed choke	DVE-06 - G1/8 / KY6952	MS / Sintered bronze	21040600
18	1	Sp	Transition piece reject outlet	45°-NW200 / 12203420	1.4301	08023883
19	1	Sp	Transition piece material outlet	NW200 / 12203400	1.4301	08023875
20	1	Sp	Inlet NW 200	MM1943.044.TE.001	1.4301	33003474

*Sp/Con = Spare part / Consumable
When ordering please state type of equipment

Spare Parts (cont.)

Spare Parts Drawing, FF-250



Spare Parts (cont.)

Spare Parts List, FF-250

Item	Qty	Sp/Con*	Part	Drawing no. / standard	Material	Item No.
1	1	Sp	Sealing plate	MM1935.250.TE.025	Aluminium	33007542
2	1	Con	Scanning pipe (standard)	MM1935.250.TE.027	PE-EL	33007554
2	1	Con	Scanning pipe, low-wear, high temperature resistant, foodgrade (option)		PVDF	44005182
3	1	Sp	Cover plate	MM1935.250.TE.026	Aluminium	33007534
4	2	Con	O ring seal	Ø.197 in. (5 mm) - conductive	Silicon-Carbon	08023328
5	1	Sp	Detection coil RZ-P 265	MM2125.036BG058.2		44003404
6	1	Con	Guide rod	MM1935.250.TE.010	1.4301	44003542
7	1	Con	Reject flap NW 250	MM1935.250.TE.011	1.4301	44005102
8	1	Sp	Seal	MM1935.250.TE.014	POM	33006468
9	2	Sp	Axle	MM1935.250.TE.012	1.4305	33006470
10	2	Con	Bearing shell	MM1935.250.TE.015	Aluminium	33007060
11	2	Sp	Lever	MM1935.250.TE.013	1.4301	44003538
12	2	Sp	Fork head	PSA0012		08012458
13	2	Sp	Pneumatic cylinder	CP95SB32-50		33003274
14	2	Sp	Quick-action ventilation valve	P06.02331		56201251
15	1	Sp	Pneumatic valve	5/2-Wege - G3/8 - 811C-PM-501JM-155		08024871
16	1	Sp	Solenoid valve box	GM 209 NJ / 932 977-106		04015266
17	1	Con	Screwed choke	DVE-06 - G1/8 / KY6952	MS / Sintered bronze	21040600
18	1	Sp	Transition piece reject outlet	45°-NW200 / 12203420	1.4301	08023883
19	1	Sp	Transition piece material outlet	MM1935.026.TE.001.3	1.4301	08022127
20	1	Sp	Inlet NW 250	MM1943.044.TE.002	1.4301	33003476

*Sp/Con = Spare part / Consumable
When ordering please state type of equipment

Storage Requirements

Storage

• The equipment should be stored in an enclosed room until final assembly.

• If the equipment is to be stored outside, it must be covered with tarpaulins and left open underneath so that any condensation can run off.

• Sea-freight shipments should not be opened or damaged during transport and storage. The equipment should rest on waterproof mats to prevent moisture from the ground penetrating the machinery.

• To ensure equipment is stored correctly, please observe the following shipping and storage symbols

Keep dry

Glass – handle with care

Up

MODEL FF
METAL SEPARATOR CONTROL

Installation, Operation and Maintenance Instructions

Table of Contents

Eriez Model FF Metal Separator

Table of Contents (cont.)

General Information

Introduction

The texts and illustrations in this instruction manual are for the exclusive purpose of explaining how to operate and handle the metal separator. Please check that this is the correct manual for your equipment. The manufacturer accepts no responsibility for damage resulting from the use or misuse of this equipment. All appropriate safety rules and regulations for the use of this equipment must be adhered to. If you have any questions with regard to the installation and operation of this equipment, please do not hesitate to contact us.

This instruction manual must not be copied, saved on computer or otherwise reproduced without prior permission of the manufacturer. Nor should any extract of this instruction manual be similarly reproduced.

Symbols used


Important Notes


Danger Notes


Safety Notes


Danger!

Risk of hand injury due to pneumatic reject flap.

Legal Compliance

This equipment complies with machine guideline 98/37/EWG

Fields of Application

- Product liability
- ISO 9000
- TQM (Total Quality Management)
- Protection of machines and operators

Important Functional Notes

The metal separator is designed and built to provide optimum detection and separation of metal contaminants.

However, it is important to be aware of the circumstances in which metal detection may be compromised when conveying and processing bulk materials.

- Accumulation of metal particles in a batch of bulk material. This may occur with ground or shredded material if a larger piece has been ground.
- Turbulence in the reject unit and reject flap reaction time. If there is an accumulation of metal particles the flap cannot react to the control signals without delay. Occurs when recycled or reground material is processed, even when blended with virgin material.
- Material back draught with gravity feed type metal separators using a reject flap separation system (wrong type of equipment).
- Pipe conveying with high fill ratio.

Depends on the bulk material, particularly for gravity and vacuum/pressure systems.

- Recommended conveying speed exceeded.

For these reasons, no general guarantee can be given that the unit will operate with 100% accuracy.

For bulk materials containing a high proportion of metal contaminants, it is recommended that two separators are connected one after the other (for gravity systems) and additional permanent magnets are installed in freefall pipes or hoppers (for pipeline systems).

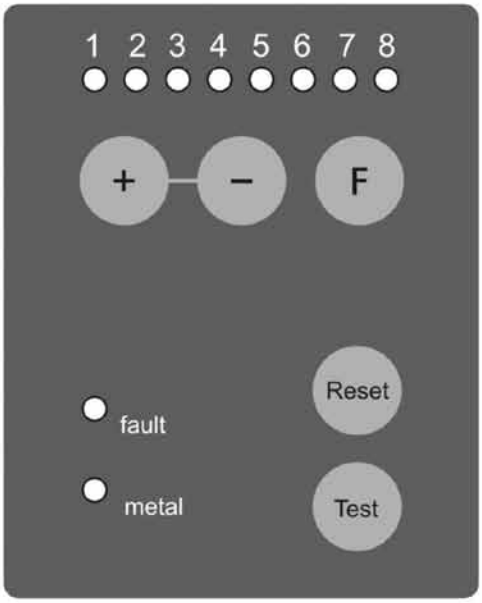
For preliminary cleaning, special separators are available for vacuum and pressure pipes.

General Information (cont.)

General View

Control unit standard version

Control unit – optional version

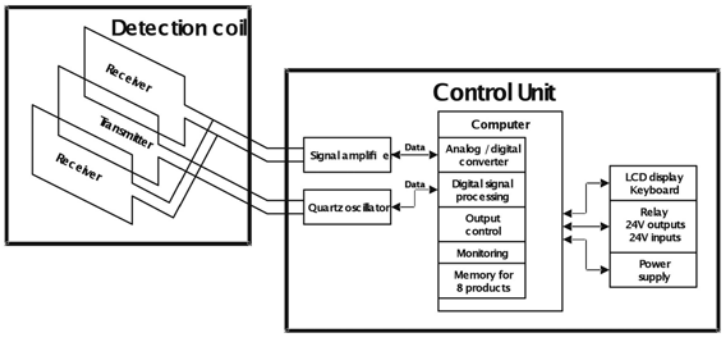


Control unit membrane keypad

Design and Method of Operation

Functional Principle

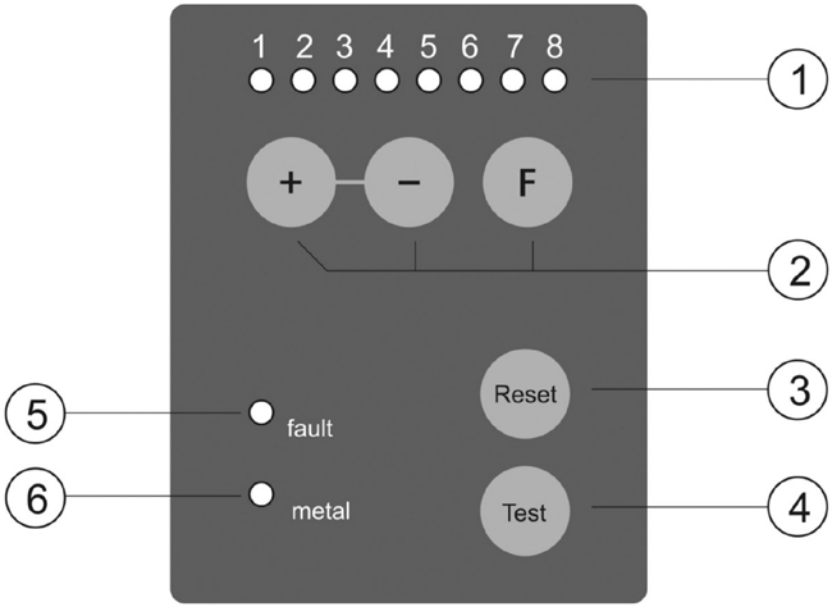
Any metal impurity in the product flow causes a change in the detector's high frequency electromagnetic field. This change is evaluated by the control unit. Since the product itself may have an influence on the field (this is referred to as a product effect), this behavior can be stored in order to avoid false activation caused by the product effect. There is space to store up to 8 products in total.



Functional and Control Elements

Membrane Keypad

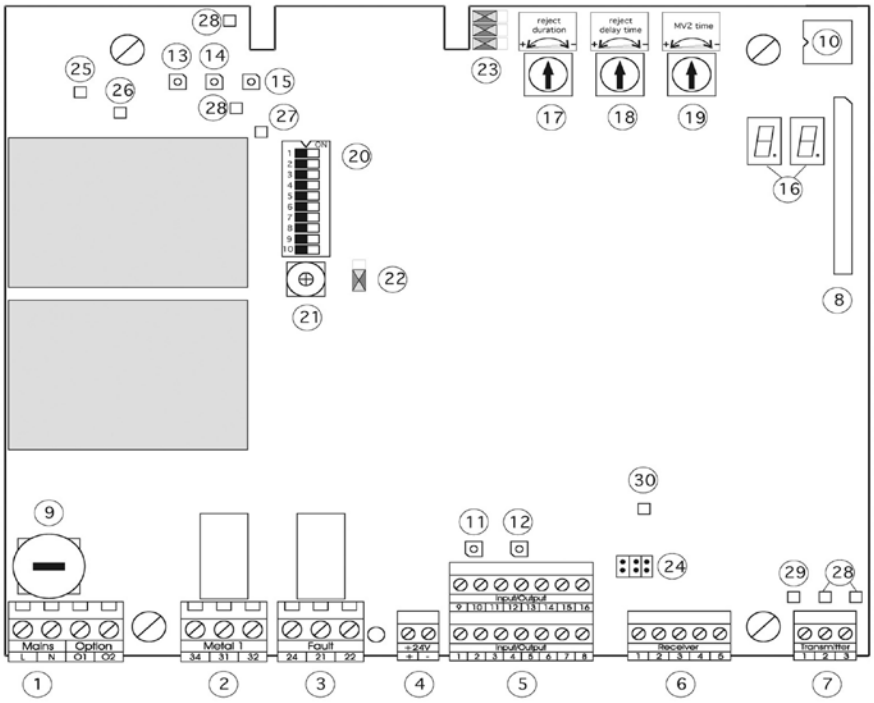
The control panel of the control unit has the following control and indication elements



1	LED display	8 digits	For machine operation and metal signal display
2	Operator keys	+ , - , F	For operation and machine setting
3	Function key	Reset	Reset to restore the unit after metal or fault signal
4	Function key	Test	Test function for metal detector
5	Red light	Fault	Flashes when fault detected
6	Yellow light	Metal	Illuminates when metal detected

Design and Method of Operation (cont.)

Electronics Board



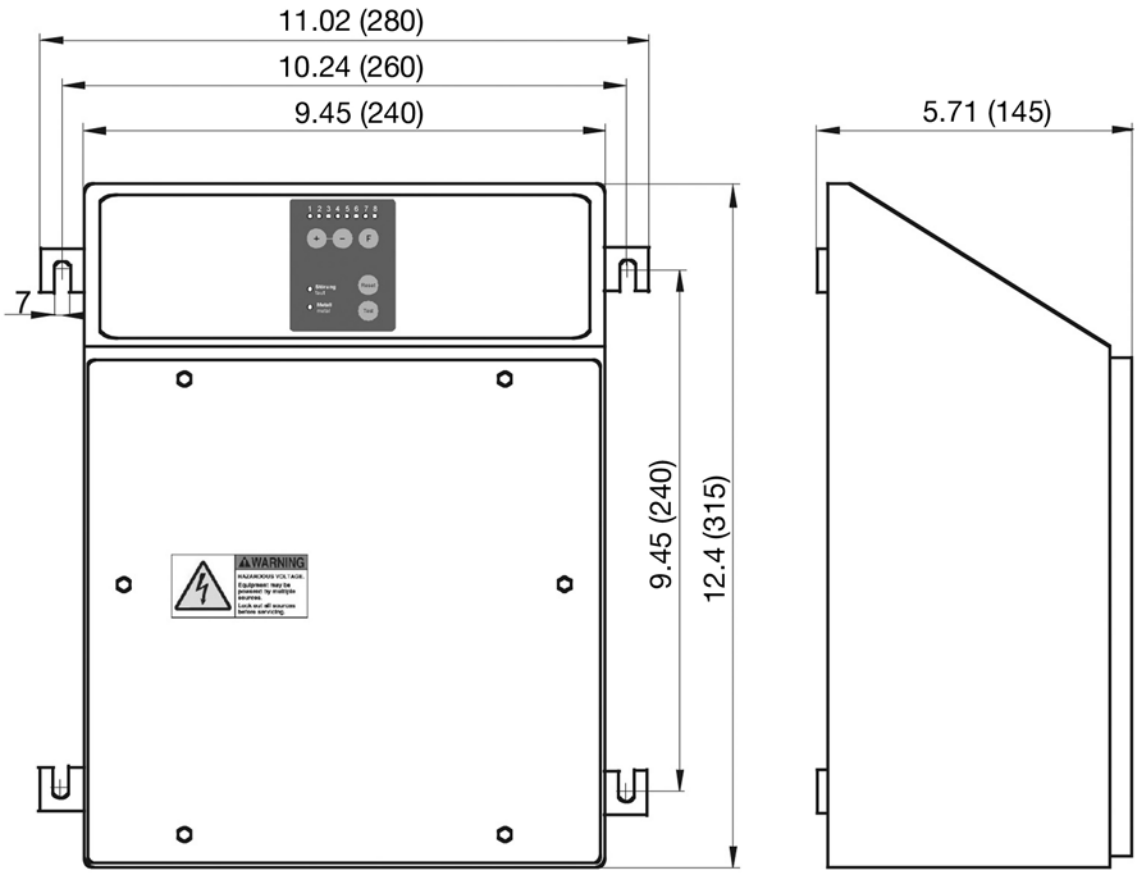
Connectors and terminals:	(1) "Mains/Option":	L/N: Control unit power supply O1/O2: Optional 24V module power supply
	(2) "Metal 1":	Potential free change over contact
	(3) "Fault":	Potential free change over contact
	(4) "+24V":	+24V external supply **(only for solenoid supply)**
	(5) "Input/Output"	24V Inputs/Outputs
	(6) "Receiver"	Receiver connector
	(7) "Transmitter"	Transmitter connector
	(8) Ribbon cable connector	Connector for control panel
Elements connected to mains voltage	(1) "Mains/Option": (9) Mains fuses	
Elements connected to external voltage:	(2) "Metal 1": (3) "Fault"	
Memory devices:	(10) Machine and product data	
Light diodes	(11) Magnetic valve 1 status (MV1) (12) Magnetic valve 2 status (MV2) (13) Active light supply voltage -15V (14) Active light supply voltage +15V (15) Active light supply voltage +5V (16) 7-segment display for parameters, faults and time functions	
Potentiometer:	(17) Reject duration MV1 potentiometer (18) Reject delay potentiometer (19) Reject duration MV2 potentiometer	
Switches:	(20) DIP switch machine parameters (21) BCD switch system setup	
Jumper:	(22) Clear system setup parameters (23) Clear operation "sensitivity, product change, learn product" (24) Amplification low/medium/high	
Test points:	(25) Supply voltage +5V (26) Supply voltage +15V (27) Supply voltage -15V (28) Common ground for all signals (GND) (29) Sine wave signal to detection coil (transmitter) (30) Sine wave signal from detection coil (receiver)	

Dimensions and Technical Data

Technical Data Sheet

(see pages 43 & 44)

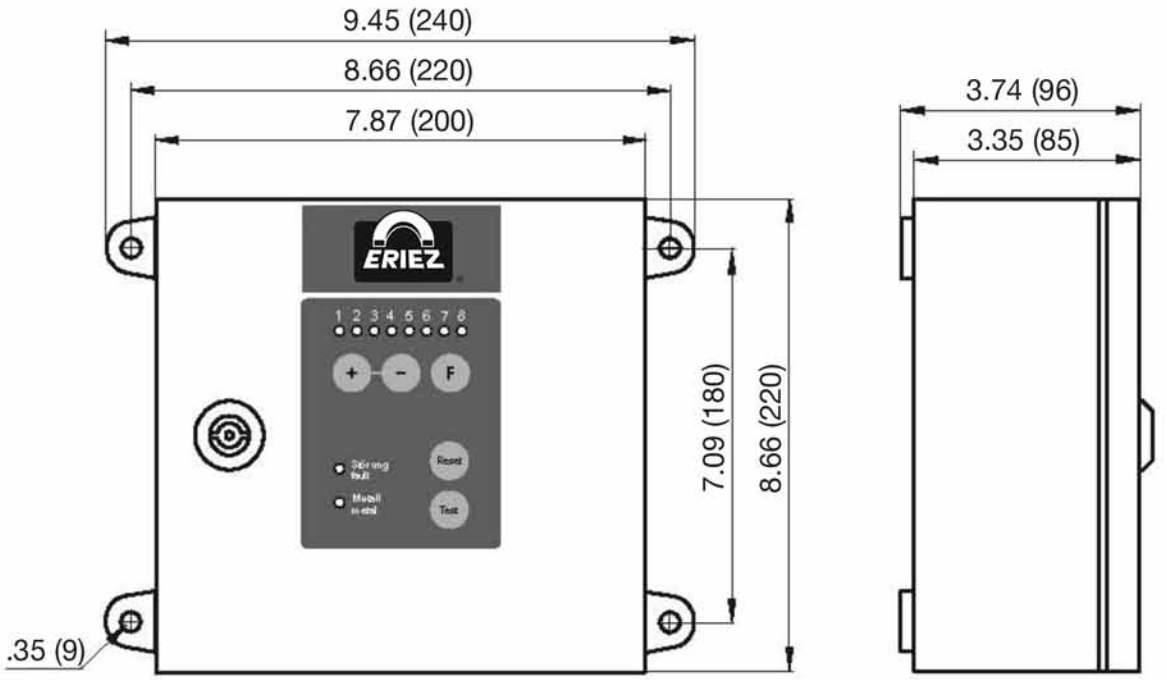
Control Unit – Optional Version



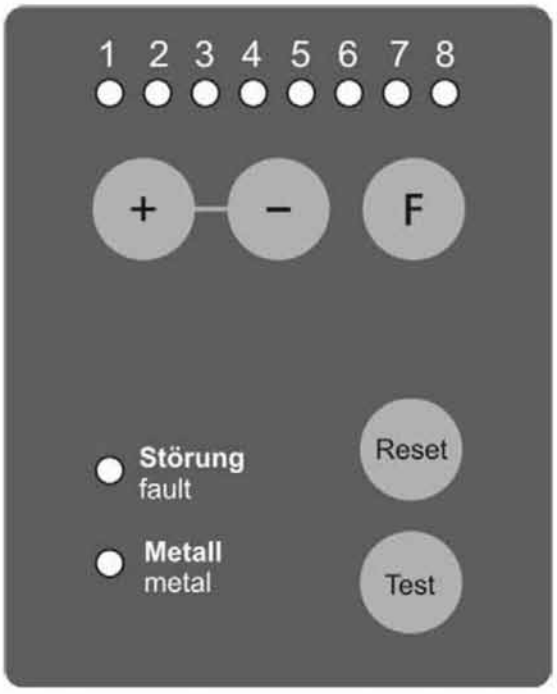
All Dimensions are in inches (mm)

Technical Data Sheet

■ Dimensions



All dimensions in in. (mm)



Technical Data Sheet (cont.)

■ Standard Design

Performance data:

- Compact, single board
- Digital signal processing and quartz-stabilized search coil frequency
- Advanced microprocessor technology, self-monitoring, self-balancing
- Auto-learn for product effect compensation
- Product parameter memory for 8 different products
- Metal alarm – with automatic or manual reset
- CE certification

Operating:

- Membrane keypad with 3 keys as well as Reset and Test buttons
- Access protection
- LED lamps for operation, metal alarm and fault

Housing:	Mild steel, varnished, gray aluminium (RAL 9007)
Level of protection:	IP 65
Ambient temperature:	14° F to 140° -10° C to +60° C
Weight:	6.61 lbs (3.0kg)
Operating voltage:	100-240 VAC (±10%), 50/60 Hz
Current input:	Approx.200 mA/115 V, approx 100 mA/230 V
Fuse:	1,6 A, slow-blowing
Mains cable:	5.90 ft (1.8m) with plug
Switching inputs:	1 switching input RESET 1 switching input manual ejection 1 switching input for air pressure monitor 1 switching input for level indicator 1 switching input for proximity switch (NPN)
Switching outputs:	1 relay switching output for metal signal 1 relay switching output for fault / alarm signal 2 switching output 24 V DC, 100 mA metal signal
Conveying speed:	See data sheet of selected detection coil or complete unit
Can be combined with:	Detection coils: GLS, DLS, RZ-P, ELS and OCTAGON
Scanning sensitivity:	See data sheet of selected detection coil or complete unit
Self monitoring:	Detection coil and outputs
Performance validation:	Test button (only in connection with metal separator)

■ Options / Accessories

- ☐ Control unit remote link up to 49.2 Ft (15 m)
- ☐ Metal counter (integrated in housing cover)
- ☐ "manual ejection" button (integrated in housing cover)
- ☐ .....

■ Special Versions

- ☐ Special varnishes
- ☐ .....

Safety

Our equipment conforms with all official technical safety regulations. However, as a manufacturer we believe it is our duty to make you aware of the following information.

Intended Use

The equipment is to be used in the following applications only with the appropriate detection coil: Vacuum / pressure conveying and freefall. The ambient temperature of the machine must not exceed 140° F (60° C). Ensure that the installation area is free from steam, plasticizers or other materials that may damage the PVC cable sheathing.

Safety Signs

Mains voltage runs through the control unit housing and may also be connected to any external electric circuits (e.g. metal relays).

Therefore, the safety sign shown on the right is displayed on the cover of the electronics housing.

"Mains" connection shown with (1)

"Metal" and "Fault" with (2) (3)

Observe note 4.5 when removing the cover during maintenance or repair.

Dangers Arising from Non-Compliance Safety Notices

Life-endangering electric shocks are likely in cases of non-compliance with the safety notices.

Safety Information for Operators

The control unit must be in perfect working order and used for the purpose for which it was designed, in particular, ensure that the cover of the electronic housing is closed during operation. Any moisture which penetrates the electronic housing must be removed. Safety signage must not be removed and must be maintained in good condition. The instruction manual must remain complete and in good, readable condition. Only qualified personnel must operate, maintain and repair the equipment. People with heart pace-makers should not spend long periods near the detection coil. When inspecting materials, which are likely to explode, follow the appropriate regulations.

Safety Information for Operation and Maintenance

Before opening the electronics housing clean the outside area to reduce the risk of dirt and moisture penetrating inside. Disconnect power supply and external circuits before opening the cover. Any moisture which penetrates the electronic housing must be removed.
Only qualified personnel should operate, maintain and repair the equipment.

Notes on Residual Risks

Electrical circuits may still be live even after having been isolated from the mains.

Consequences of Unauthorized Modification

Unauthorized modification or repair will invalidate all manufacturer declarations and guarantees.

Improper Use

The control unit is not designed for use other than that stipulated in section 4.1. All operations must be within the specifications detailed in the technical data. Improper use also includes operating the equipment with excessive mechanical, static or dynamic loads (eg heavy machine parts or strong vibration). The inspection of aggressive materials such as those containing alkalis, acids and solvents is not permitted, nor is the equipment to be used in an environment where there is risk of explosion.

Commissioning

Mechanical Installation

• Ensure that the equipment is securely installed and vibration-free. Installation under cover. Do not install in an environment where there is risk of explosion.

• Do not install in the vicinity of interference fields (e. g. near large electric motors or frequency inverters). The safe distance depends on the power of the motor or frequency inverter (approx. 16.4 ft. (5 m).

• Fix the control unit cabinet to a wall or frame using the screw holes provided (check the drawing for dimensions). Ensure that it is securely fixed to support the weight of the control unit approx. 6.6lbs. (3 kg).

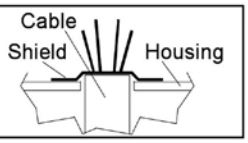
• The control unit must be installed in its own cabinet. On no account install it in other switchgear cabinets as there is a high risk of interference.

• Always discuss with manufacturer prior to altering cable lengths between the electronic unit and the detection coil. Always use original cables supplied with the machine. These connector cables must be laid separately from other cables (use fixing clips or lay them in separate cable conduit).

• Where several metal detectors are to be installed next to one another the distance between detection coils must not be less than 6.6 ft (2 m.) Where metal detectors are installed opposite one another, the distance between them must not be less than 32.8 ft. (10 m). These figures are for large machines, reduce the distance by up to 1.64 ft. (50 cm) for smaller machines. Please contact manufacturer if space is limited and the distance between machines is less than that recommended.

Connecting the Equipment

To conform to CE standards all cables external to the electronics and electrical control housings must be shielded. The shielding must be earthed immediately after the cable gland.



Pin Configuration

Electrical Connections

Model number	Type of connection	Function
"Mains/Option"	Connector for mains supply	L/N: Electronics power supply O1/O2: Optional 24V module power supply connector
"Metal 1"	Voltage free relay contact	Normal operation: Contacts 31 and 32 closed On metal detected Contacts 31 and 34 closed
"Fault"	Voltage free relay contact	Normal operation: Contacts 21 and 24 closed In case of fault: Contacts 21 and 22 closed
"+24V"	+24V external	Connector external power supply (+24V) **Solenoid supply (MV1 / MV2)**. Required for solenoids valve with power consumption >5W

Commissioning (cont.)

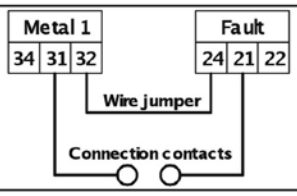
Model number	Type of connection	Function	
"Input/Output"	24V inputs and outputs	1,2	MV1 switching output Remove bridge when load (valve) to be connected
		3,4	Ext. Reset button
		4,5	Ext. Metal count
		6,7	Ext. Test button
		7,8	Manual separation
		9,10	Pressure switch
		10,11,12	NPN sensor 2 (level monitoring)
		11,12	Bypass, isolates machine functions
		12,13,14	NPN sensor 1 (flaps monitoring)
		15,16	MV2 switching output Remove bridge when load (valve) to be connected
"Receiver"	Connection for detection coil: Receiver	1 2 3 4 5	 Receiver signal Reference size for receiver signal -15V +15V
"Transmitter"	Connection for detection coil: Transmitter	1 2 3	Transmitter 1 Reference size for transmitter signal Transmitter 2

Performance Data - Connectors

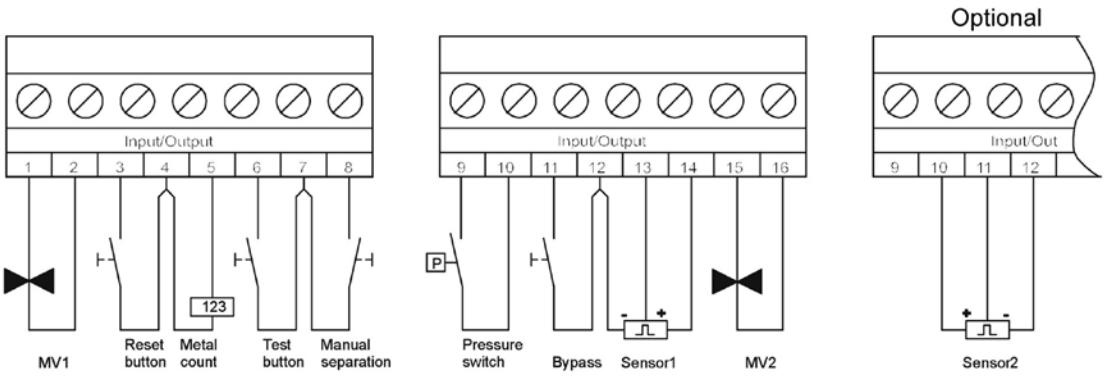
Dry relay contacts	250VAC / 3A 120VDC / 3A
Switching outputs (MV1 / MV2)	Maximum current load: 200 mA
Switching inputs	Connection of 'make contacts' against ⊥ or 24V, or PNP-outputs (NPN on request)

Switching elements (contactors, relays etc.) may only be connected to the potential-free contacts if interference is suppressed.

Relay connection for machine protection:
For the conveyor system to stop, both when metal is detected or when there is a fault, the relays "Metal" and "Fault" must be connected in series (see drawing on the right).

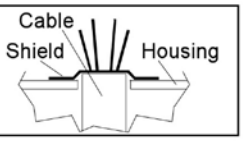


Drawing of Input / Output Connections



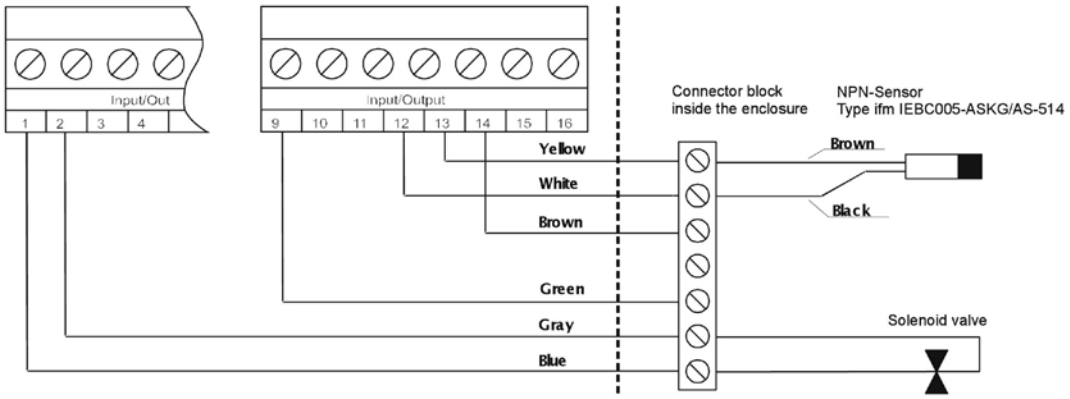
Commissioning (cont.)

Maximum cable length for external components, **switches** and **sensors** is 49.2 ft. (15 m.)
Only shielded cables should be used.
The shields must be attached directly to the electronics housing.



Option Flap Monitor

(Manufacturer factory set wiring)



Mains Supply via Safety Socket

1. Connect the cable with mains plug to an existing socket.
2. After approximately 5 seconds the machine is ready for operation.

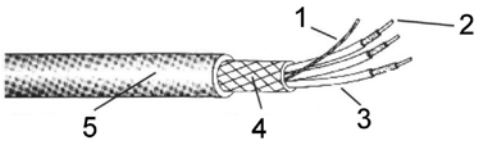
Mains Supply via Connection Box

The following procedures should only be undertaken by qualified personnel. Before removing cover plates etc., make sure the equipment is isolated from mains or external voltage.

Do not remove either the mains cable or the protective gland as these are essential parts of the EMC configuration.
The main cable is a special EMC protected cable and should not be replaced by any other cable.
If the mains plug is not being used, a connection box must be used instead.

1. Remove mains plug.
2. Strip 1.97 in. (5 cm) length of insulation from cable and .39 in. (1 cm) from leads and attach cable cores.

Mains cable:

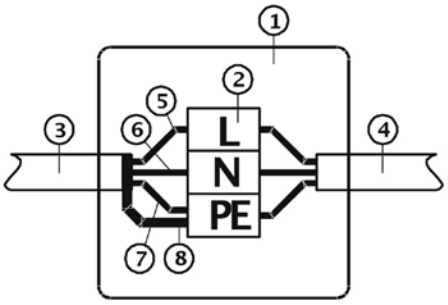


1 Shield
2 Conductor
3 PVC insulation
4 Isolation
5 PVC covering

3. Feed cable into connection box according to diagram on following page.

Commissioning (cont.)

Make sure that the mains supply is switched off.



1	Terminal box	
2	3 pin terminal	
3	Control unit mains cable	
4	Main supply	
5	Conductor L (brown)	To terminal L
6	Conductor N (blue)	To terminal N
7	Conductor PE (yellow/green)	To terminal PE
8	Shield	To terminal PE

IMPORTANT! **Connect the shield to PE**

4. Close the terminal box
5. The unit is ready for operation approximately 5 seconds after switching it on.

Note:

The mains cable has a wire cross-section of .030 in.^{2} (0.75 mm².) The main supply fuse protection should be set accordingly.
The control unit contains a mains fuse.

Behavior of Machine at Start Up

Lamps and outputs during start up phase:

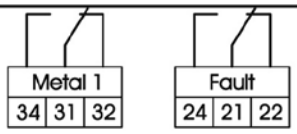
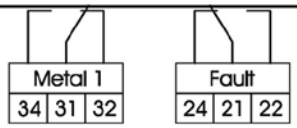
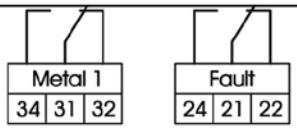
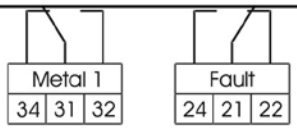
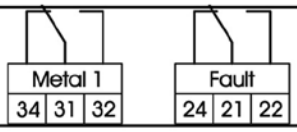
Lamp / output	Contact status
Red light	illuminates
Yellow light	illuminates
Metal relay 1	Contacts 31 and 34 closed (consistent with metal alarm)
Fault relay	Contacts 21 and 22 closed (consistent with fault status)
MV1 / MV2 switching outputs	As programmed High active or Low active

Lamps and outputs after start up phase (approx.5 seconds)

Lamp / output	Contact status
Red light	off
Yellow light	off
Metal relay 1	Contacts 31 and 32 closed
Fault relay	Contacts 21 and 24 closed
MV1 / MV2 switching outputs	As programmed High active or Low active

Commissioning (cont.)

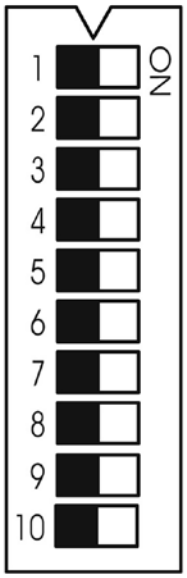
Relays - Operating Status

	Without power
	Operating
	Fault → DIP switch 5 = OFF
	Fault → DIP switch 5- = ON (metal on error)
	Metal

Setting Machine Parameters

DIP Switches

Various machine parameters may be set by means of the 10 pin DIP switch (see page 10, item 20)



Switch 1:	Reset mode	Hand	Auto
Switch 2:	Half wave evaluation	OFF	ON
Switch 3:	MV1 active	Low Active	High Active
Switch 4:	MV2 active	Low Active	High Active
Switch 5:	Metal on error	OFF	ON
Switch 6:	Frequency deviation P	OFF	ON
Switch 7:	Frequency deviation M	OFF	ON
Switch 8:	Metal Signal locked	OFF	ON
Switch 9:	Spare	OFF	ON
Switch 10:	Monitoring	OFF	ON

Switch 1: This position determines whether the metal outputs should be reset manually or automatically (after preset reject duration).

Switch 2: One and two half wave evaluation can be set here.

Switch 3: This sets the switch status of magnetic valve connector 1 when metal is detected.

Low Active: Normal output 24V on metal detected 0V
High Active: Normal output 0V on metal detected 24V

Switch 4: This sets the switch status of magnetic valve connector 2 when metal is detected.

Low Active: Normal output 24V on metal detected 0V
High Active: Normal output 0V on metal detected 24V

Switch 5: This sets the switch status of metal relay 1 if the machine is at fault status.

In case that several metal separators are operated close to each other, different operating frequencies have to be set to avoid interferences.

Switch 6:	**OFF**	**ON**	**OFF (ON)**
Switch 7:	**OFF** no deviation	**OFF** positive deviation	**ON (ON)** negative deviation

Switch 8: Metal signal relay, locked (indicates metal signal)
When **ON**, the metal relay output remains closed untill the 'RESET' button has been pushed (only enabled in Freefall (RAPID) or slow motion (PROTECTOR) mode)

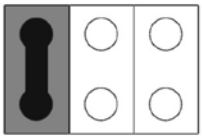
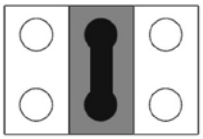
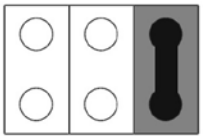
Switch 9: Spare

Switch 10: This activates and deactivates the self-monitoring function of the control unit.

Setting Machine Parameters

Amplification Jumper

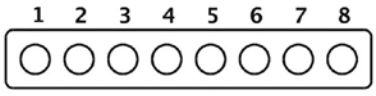
By using the amplification jumper (see page 7, item 24) 3 sensitivity windows can be preset (low – medium – high). By using the + and - buttons on the membrane keypad the sensitivity in each window can be adjusted.

	Low amplification
	Medium amplification
	High amplification

Operation

Using the Membrane Keypad

LED Display: Operating Status and Product Displays



Example: LED 8 flashes in 1-second pulses

- The position of the flashing LED shows which product memory (here, product 3 = standard).
- Flashing LED (any) means machine is ready for operation.

LED Display: Metal Signal Display

If metal is detected the LEDs begin to light up from left to right. Only when all 8 LEDs are illuminated is a metal alarm triggered.
When metal triggers a signal and an LED is already flashing, it will continue to flash.

Preset Product Memories

The control unit controller incorporates 8 product memories of which memories **1, 2** and **3** are **preset** and **cannot be changed**.
a) Sensitivity
b) Phase angle
c) **Product learn** cannot be carried out on the preset products (product change only)

Presetting with following values.

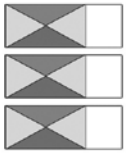
Product 1: low sensitivity,	Step 3: Product angle corresponds to vibration angle
Product 2: medium sensitivity,	Step 6: Product angle corresponds to vibration angle
Product 3: maximum sensitivity,	Step 8: Product angle corresponds to vibration angle

Products 4 and 8 are preset on delivery, preset parameters will vary depending on the model however they can be changed at any time by the customer once access to the individual operator functions has been given.

Vibration angle (greatest machine stability) is dependent on the coil and is therefore preset.

Sensivity Setting, Product Teach-In Process and Product Change

Only the following modes can be set if these switches are in ON position (see page 7, item 23).



Position ON: Clear product teach-in

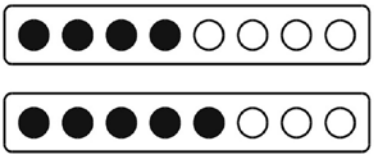
Position ON: Clear product change

Position ON: Clear sensitivity parameters

By removing the jumpers the settings can be locked against unauthorized changes.

Operation

Sensitivity Setting

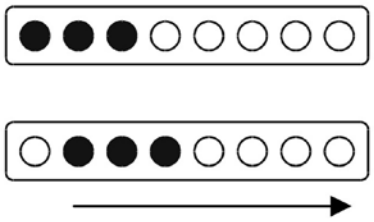


By pressing the + or – button briefly the current sensitivity is displayed.
By pressing the + or – button again sensitivity is increased or decreased by one.
The example on the left shows sensitivity increased by one.
By pressing the "F" button the chosen sensitivity is saved.
If the "F" button is not pressed within 5 seconds the original setting remains.

Product Teach-In Process

	Ensure that only metal-free products are being used.

	Automatic teach- in process is not possible if vacuum / pressure equipment conveying speeds are > 1,575 fpm (8 m/sec.)

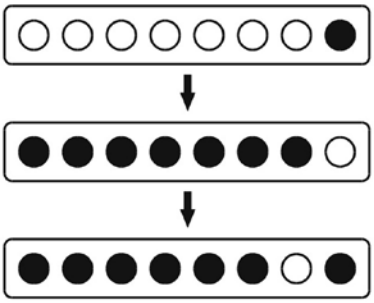


By pressing the **"F"** button for approximately 3 seconds the product teach-in process is activated. The display changes and a block of three LEDs will flash alternately from the left to the right continuously. (see diagram)
During this time (approx. 1 minute) the products must be conveyed through the detector. Press the **"F"** button again to end the teach-in process. If the electronics unit identifies a phase angle, this is set.
If the product effect is too high, no phase angle is identified and the phase angle setting remains unchanged.

If the "F" button is not pressed within 1 minute the teach-in process is automatically ended.
(All product data remains unchanged)

Abort teach-in process by pressing "Reset" button.
Phase angle set for chosen product is restored.

Product Change

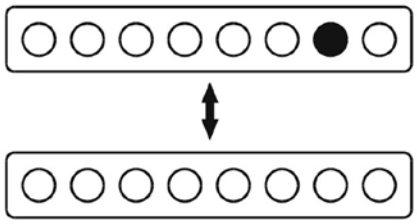


Product 8 chosen, LED 8 flashes. The product change process is activated by **pressing the "F" button.** The display changes to show the inverse of the operating display.
By pressing the + or – button again another product is selected.
In the example on the left product 7 has been selected
Change to the selected product by **pressing the "F" button.**

If the "F" button is not pressed within 5 seconds the original setting remains.

Operation

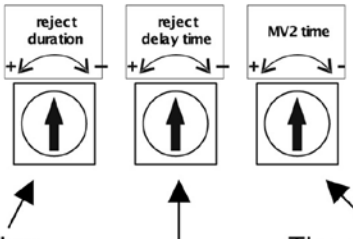
Changing to a new operating status



Product 7 is selected and is active (i.e. LED 7 is flashing.)

Operation Board

The following parameters can be selected via 3 potentiometers (see page 7 items 17, 18, 19) on the control unit.



Reject duration magnetic valve 1 / metal relay

Reject delay magnetic valve / metal relay

Time function magnetic valve 2

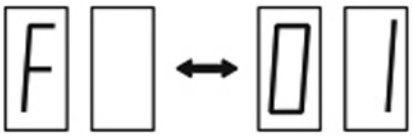
Errors and Fault Rectification

If you have any questions, please state the equipment type and serial number!

Error Messages

When an error message is detected the red “Fault” LED on the operator panel flashes and the fault relay trips out. In addition, on standard versions, a metal alarm signal is triggered. The appropriate fault status is shown on the 7-segment display.

*Example: The letter **F** and the fault number flash up alternately.*



Faults on Magnetic Valves MV1 and MV2

This message is displayed if there is a short circuit or break in the magnetic valve switching outputs.

Error messages	Possible causes	Action
F 01	Short circuit or connection broken to magnetic valve 1.	Check valve cable for breaks and renew if necessary. Check valve cable plug and socket connections, remove and reinsert if necessary.
F 02	Short circuit or connection broken to magnetic valve 2.	Check valve cable and connectors with Ohm meter for short circuit, replace if necessary. Check magnetic valve resistance which should be 320...340 Ω (or 100...140 Ω for pusher application).

Transmitter Faulty

This message is displayed if the transmitter signal is not detected or the connection to the detector is broken.

Error message	Possible causes	Action
F 03	Transmitter cable between control unit and detector has a short circuit or transmitter frequency is incorrect.	Disconnect transmitter cable at the detector (triax cable) and measure with Ohm meter: replace if necessary or check transmitter frequency.

Flap Position Monitoring

Sensor 1 is an initiating signal sensor is connected to “Input/Output”, terminals 12-13-14

Sensor 1 controls the reject outlet.

Error messages	Possible causes	Action
F 04	Is the reject mechanism faulty?	Check reject mechanism
	No air pressure?	Check air pressure, pressure
	Is the sensor faulty?	Change sensor

Errors and Fault Rectification

Compressed Air Monitor

A compressed air monitor sensor is connected to "Input/Output", terminals 9-10

This message is displayed when there is no air pressure or air pressure is too low.

Error messages	Possible causes	Action
F 05	No air pressure or air pipe broken	Check air supply
	Operating threshold of pressure monitor is set too high.	Adjust pressure monitor
	After discharge of compressed air, pressure monitor should be disregarded for a certain time. This error may appear if the time interval is too short.	Increase time interval

Level Monitoring

Sensor 2 is a level monitoring sensor connected to "Input/Output", terminals 10-11-12

Error messages	Possible causes	Action
F 08	The container is full.	Empty container
	Is the sensor faulty?	Change sensor
	Sensor is not connected or connection cable is broken.	Check sensor connection

Receiver Voltage Too High

This message is displayed if the RF voltage at the receiver is too high.

Error message	Possible causes	Action
F 09	Large piece of metal (e.g. aluminium ladder, screwdriver, hammer, bracelet) directly beside or in the detection coil. Detection coil installed incorrectly.	Check the coil and its immediate surrounding area. Sometimes pieces of metal can be lodged inside or underneath the belt.
	Detection coil installed incorrectly.	Check detection coil Operating Instructions "Assembly"). If the detector is a DLS model check that the center sleeve or locking screws are not loose.

Receiver Connection

This error message is displayed if there is a break in the receiver connection cable.

Error message	Possible causes	Action
F 10	Break in receiver cable between electronics and coil.	Check receiver cable for breaks and renew if necessary. Check connection cable plug and socket connections, remove and reinsert if necessary.

Parameter Memory

This message is displayed if the parameter memory (EEPROM) is unavailable or faulty

Error message	Possible causes	Action
F 11	EEPROM unavailable or faulty.	Check that EEPROM is properly sited (see page 7 item 10). If necessary replace EEPROM.

Errors and Fault Rectification

Transmitter Connection

This message is displayed if there is a break in the transmitter connection cable.

Error message	Possible causes	Action
F 12	Break in transmitter cable to detection coil.	Check transmitter cable for breaks and renew if necessary. Check transmitter cable plug and socket connections, remove and reinsert if necessary.

Undefined Activation of Switching Outputs

Possible causes	Action
Machine incorrectly installed	See “Assembly”
Conveyor belt systems: Intermittent contacts on the conveyor frame for example due to: • Loose guide plates • Loose screw connections on the frame parts	Check and tighten all screw connections If necessary weld frame parts.
Changing contact resistance on the tension and deflection roller bearings or on the drive roller	Insulate cross connections or tension and deflection rollers on one side.
Certain parts of the conveyor belt are conductive: • Contaminated with metal (welding spatter, metal chips, abraded material….) • Belt junction causing metal alarm to signal even when no product on moving conveyor	Clean conveyor belt of all residue. If necessary replace conveyor belt.
Circular coils: Mechanical contact between scanning pipe and detection coil.	Observe a minimum distance of 1.394 in. (10mm) between pipe and coil. If necessary use a scanning pipe with smaller diameter.
Sensitivity setting too high	Repeat product teach-in procedure, if necessary reduce sensitivity manually.
Metal particles hard to identify due to corrosion or encapsulation	Check processed material carefully, if necessary pass through detector again.
Loose contact at the detector cables	Check connections
Material or conveyor statically charged (cracking sound heard at the detection coil).	Prevent static by additional earthing (please consult manufacturer) or by using ion spraying devices.

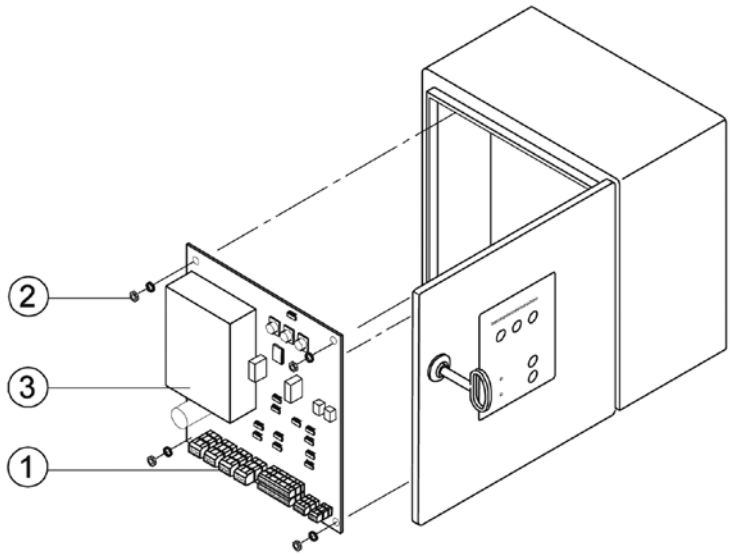
Special Notes on Separators

Metal is detected but is not rejected despite activation of the reject unit

Possible causes	Action
Mechanism too slow	• Check air pressure 73 psi(5 bar minimum) • Replace air hoses that are too thin and too long with hoses that are as short as possible and have a large diameter • Check the reject flap for jammed product
	Attention! Risk of accident **Disconnect compressed air supply beforehand**
Reject duration too short	Increase reject duration

Errors and Fault Rectification

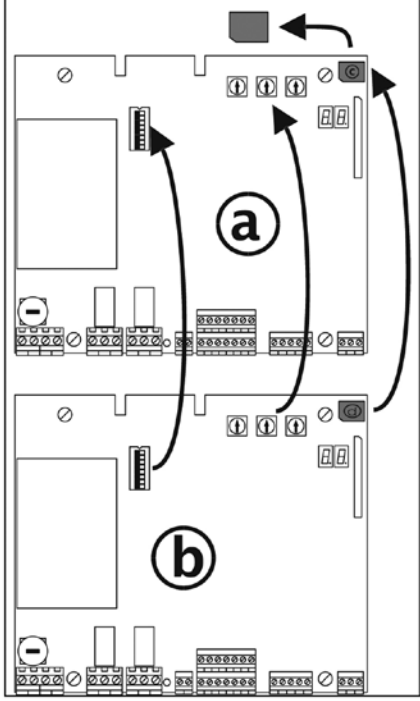
Replacement of Electronic Boards



1. Disconnect mains supply and external circuits and open cover of electronics housing
2. Remove connectors (1) and remove fastening screws (2)
3. Remove evaluation electronics board (3)
4. Install the new board in reverse order but **do not connect to mains power supply!**

The "control unit" electronic board is equipped with a memory module which contains all the equipment settings and product data. If this memory board is transferred to the new controller board no new settings need to be programmed.

Transferring all settings



(a) New control unit

(b) Old control unit

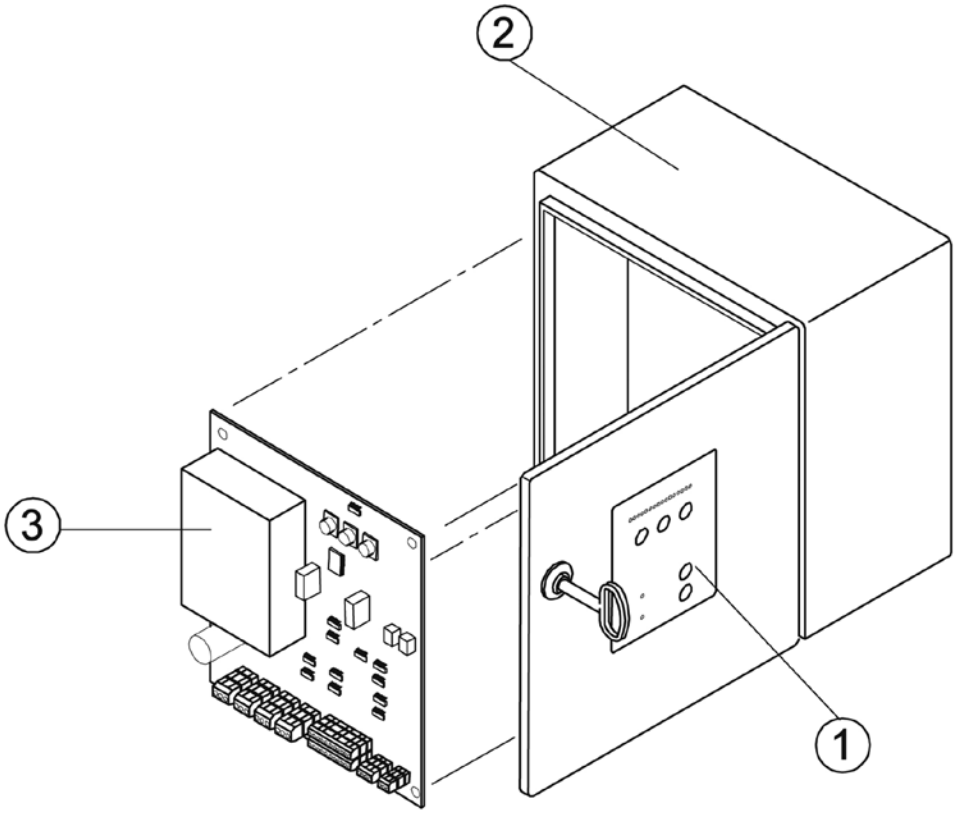
Procedure:

1. Remove data memory from the new (already installed) controller board (a) and put to one side.
2. Remove data memory from the old controller board (b) and plug it carefully into the new controller board (a).
   Ensure that the clipped corner on the memory device points to the left.
3. All machine settings (DIP switches), as well as all potentiometer and jumper settings must be transferred to the new board.
4. Switch on power supply. The new board runs with the "old" parameters.

Spare Parts

Please state type of equipment and serial number when contacting us.

Spare Parts Drawing Control Unit Standard Version

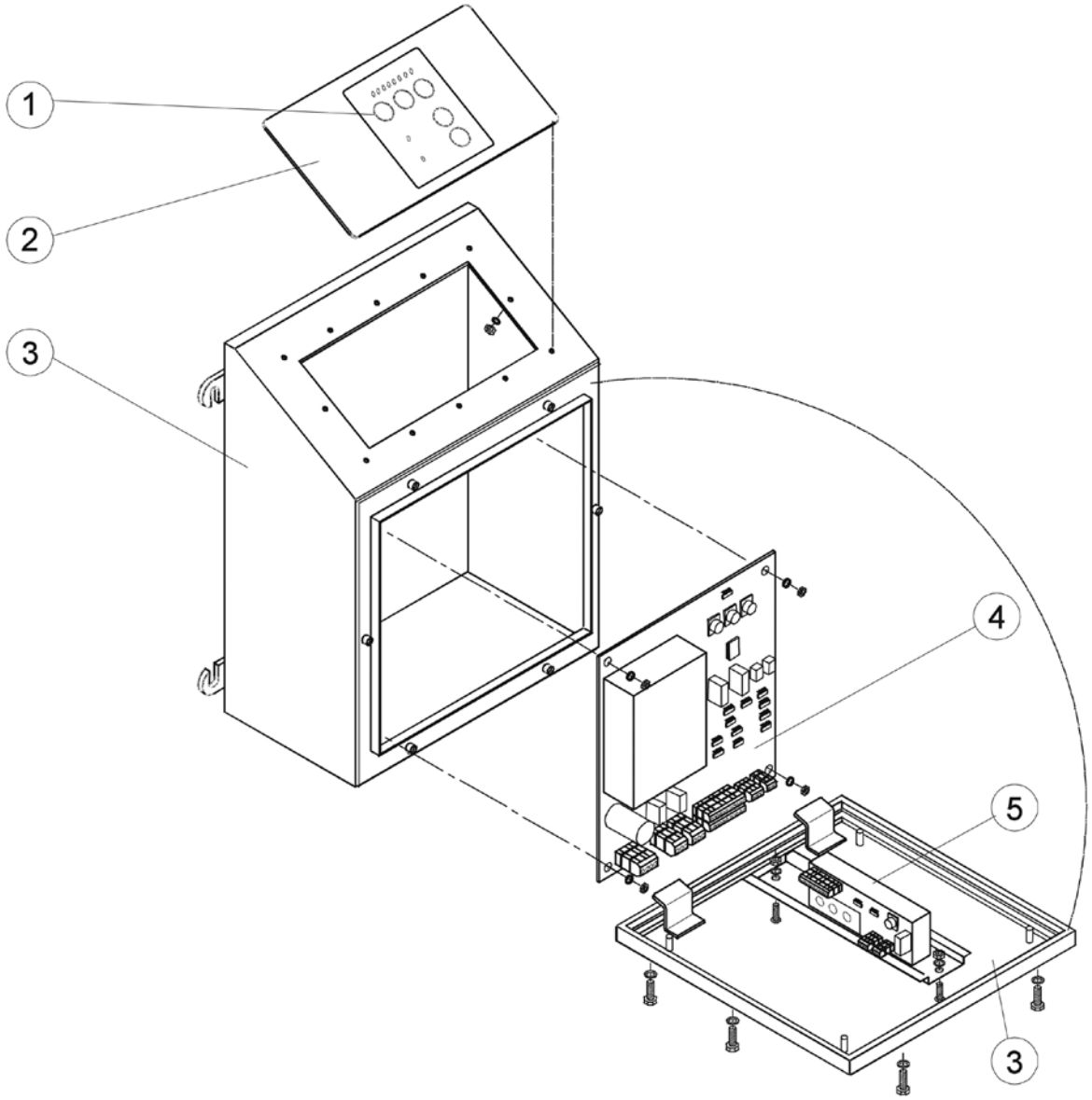


Spare Parts List Control Unit Standard Version

Item No.	Part	Remarks Drawing no.
1	Membrane keypad (33005240)	
2	Electronics housing with cover plate less membrane keypad (33005970)	Standard (RAL 9007)
2	Electronics housing	color
3	Evaluation electronics (44003888)	
	EMC mains cable (not shown) (44003772)	

Spare Parts

Spare Parts Drawing Control Unit Optional Version



Spare Parts List Control Unit Optional Version

Item No.	Part	Remarks Drawing no.
1	Membrane keypad control unit (33005240)	
2	Adapter plate for front panel (44003638)	
3	Electronics housing with cover plate (33002708)	
4	Evaluation electronics (44003888)	
5	Interface (44001018)	
	EMC mains cable (not shown) (04015479)	

Shipping

Shipping, Preservation, Waste Disposal

1. Choose packing that is suitable for the type and size of unit, taking into account whether the shipment is for export by sea or airfreight, or for national or international road transport The packing material must protect the goods from all damage under normal transport conditions.

2. Depending on the size, weight and nature of the goods packing in cardboard boxes, boxed pallets etc is only suitable for road transport.
Use reinforced card, corrugated cardboard, blister packing and shredded paper to fill and protect the goods.
Electrostatic sensitive components (electronic boards, electronic modules, etc.) must be packed in antistatic foil or foil bags prior to packing!
(this is essential!)
Stick additional warning labels on the outside of the packaging eg "Attention, electronic equipment, do not drop," etc. The packing should be sealed with adhesive tape and, where the weight exceeds 50kg, additionally with wrapping tape.

2a. When packing for international road transport use the instructions above (see point 2). Larger and heavier shipments must also be protected as for export in wooden crates. Care must be taken to ensure that the goods inside the packing are protected against corrosion.
Any parts that will corrode easily must be wrapped in oil paper or corrosion-protective foil. Care must be taken to prevent the components moving around within the packaging.

2b. International air freight shipments must be packed in wooden crates or on export paltainers.
Care must be taken that the goods are secure and well-protected inside the packing.
Any parts liable to corrode must be wrapped in oil paper, protective foil or sprayed with anti-corrosion spray.

2c. Sea-freight must be packed in seaworthy export crates. These crates can be obtained from specialist suppliers.
The crates must be lined with oil paper to make them resistant to sea water and prevent corrosion.
In addition the goods must be protected against corrosion by use of a spray or be wrapping in protective foil.
Care must be taken to ensure that the goods cannot move around inside the crate.
After packing the sea-freight crates must be properly closed.
The sea crates must also be fastened externally with securing tapes.

During loading care must be taken not to damage the external packaging.
The carrier must certify that the shipment has been accepted and loaded correctly by detailing this on the bill of lading, loading list etc.

3. Waste disposal: Observe the national waste disposal regulations.

Shipping

Shipping

- Ensure the unit is transported with care to avoid endangering people and prevent damage to the machine. In addition to the following advice, local safety and accident prevention procedures must be observed.
- Note the following symbols for shipping and storage:

Keep dry

Glass – handle with care

Up

Center of gravity

- Do not compress the side walls of the unit or any attached parts by pulling obliquely on ropes or chains.
- If any red transportation locks have been fitted either between moving parts or elsewhere on the unit, these must be removed prior to commissioning.
- Care must be taken to ensure that the equipment does not topple over or slide off loading areas.
- Any damage incurred in transit must be reported to the manufacturer.

Storage

- The equipment should be stored in an enclosed room until final assembly.
- If the equipment is to be stored outside it must be covered with tarpaulins and left open underneath so that any condensation can run off.
- Sea-freight shipments should not be opened or damaged during transport and storage. The equipment should rest on waterproof mats to prevent moisture from the ground penetrating the machinery.
- To ensure equipment is stored correctly please observe the following shipping and storage symbols

Keep dry

Glass – handle with care

Up

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