

Make the Filling of Element Tubes more productive



GRANLUND KSO Automatic Sealing Machine

Designed to seal the upper end

The machine is designed to seal the upper end of the tubular element after leaving the filling machine. The tubular elements are taken by a rack from the filling machine and placed into the sealing machine. The elements are sealed off one by one and are thereafter fed into the reducing rolling mill.

Components

The machine is built up of the following components:

- Support pillar with blocking unit and tube holder.
- Two tube holders with motorized movement for the positioning of the element.
- Automatic sealing plug feeder.
- Sensor for terminal pin.
- Device for levelling the MgO powder.
- Electronic and electro pneumatic control by PLC.

Granlund Machinery

Visiting address: Kungsgatan 90 • P.O.Box 377, SE-631 05 Eskilstuna, Sweden
Tel:+46(0)16-16 72 00 • Fax:+46(0)16-16 72 72 • mail@granlund.se • www.granlund.se

7. FILLING KOF, KTS, KSO

The tube is filled with an insulating powder, normally magnesium oxide, in order to provide electrical insulation. GRANLUND Machinery presents a range of machines for the filling operation:

GRANLUND KOF-104 and KOF-106	upgrade version of KOF-4/6
GRANLUND KOF-112, KOF-118 and KOF-124	long run filling machines
GRANLUND KOF-25 and KOF-125/130	high-speed filling machines
GRANLUND KOF-24B	high-speed conversion kit for KOF-24
GRANLUND KTS	tube stacker
GRANLUND KSO	sealing upper end of element

The KOF filling machines all use the gravity filling principle. The principle differences between them are the number of tubes filled simultaneously (4 to 25), the number of filling tubes per element tube (two in KOF-112/118/124; one in KOF-25 and three in KOF-125, KOF-24B and KOF-106), and the principle of regulating the flow of MgO.

The machines are also different regarding automation (changing parameters, control system, loading and unloading, etc.).

New!

KOF-104 and KOF-106 represents upgraded versions of the classical KOF-4 and KOF-6. Contact GRANLUND Machinery for more information.

KOF-12, KOF-18 and KOF-24 has been updated and changed names to KOF-112, KOF-118 and KOF-124.

This information, which may be subject to change, is offered solely for your consideration, and should not be taken as a warranty or representation for which we assume any legal responsibility.

Sales Catalogue

KOF-104 and KOF-106

Filling Machines

- simple operation
- short setting time for different lengths
- suitable for small series production
- three tube filling system

KOF-104 and KOF-106 are basically the same machine. This machine is designed mainly for short to medium filling runs, e.g. for industrial heaters and trial runs before mass production, and incorporate adjustment for different tube lengths and diameters.

KOF-106 is the normal version, but for thicker elements, where there is not enough space for 6 tubes, KOF-104 is supplied.

Construction

The machine consists of three parts. All parts should be mounted to a wall or a pillar. Vibration dampers are required when more than one machine is mounted on the same wall. The vibration from one machine can cause too loose MgO in another.

- bottom stand for the element tube
- top stand with motor and clutch
- control box with frequency converter
- cable connection between control box and machine
- equipment for filling cartridge heaters (option)
- equipment for filling elements with 2, 3 or 4 coils (option)

The assembly of the machine is very simple.

Function

GRANLUND KOF-104/106 is simple to operate and requires little training. The element tubes and coils are inserted manually. Filling tubes are lowered manually.

The actual filling of MgO is done while a motor is lifting the element tubes. The MgO is fed into the element tube between an inner and an outer filling tube. An electric vibrator hammers on the element tube, compacting the MgO.

In order to achieve the best results, every combination of element tube diameter and coil, or terminal pin diameter, requires a separate set of filling tubes. We work with as small tolerances as possible on the filling tubes, in order to get the best filling results and the best centralization of the coil.

This information, which may be subject to change, is offered solely for your consideration, and should not be taken as a warranty or representation for which we assume any legal responsibility.

Sales Catalogue

KOF-104 and KOF-106, cont.

Technical data

total height	(2 x max element tube length) + 775 mm
height of bottom stand	element tube length + 150 mm
width	890 mm (excl control box)
depth	320 mm
weight	appr. 160 kg (1,5 m max element tube length) to 235 kg (6,0 m max element tube length)
filling speed	100-500 mm/min
element tube length	min 150 mm max 6 000 mm
outer tube diameter	min 7 mm max 20 mm (KOF-6) 30 mm (KOF-4)
coil diameter	min 1,5 mm
vibrator frequency	variable 25-35 Hz
electrical connection	single-phase 230 V, 50/60 Hz, 350 W

Required information for ordering

- max element tube length, outer and inner diameter of element tube
- max outer diameter of coil and terminal pin

New!

GRANLUND KOF-104 and KOF-106 represents upgraded versions of the classical KOF-4 and KOF-6. KOF-104/106 are equipped with three-tube filling system and frequency control of hoist motor to regulated the filling speed. This makes KOF-104/106 into a high speed filling machine for short series production.

Both KOF-104 and KOF-106 are equipped with a frequency converter for the vibrator.

This information, which may be subject to change, is offered solely for your consideration, and should not be taken as a warranty or representation for which we assume any legal responsibility.

Sales Catalogue

KOF-112, KOF-118 and KOF-124 Filling Machines

- higher filling capacity
- easy to operate
- reliable function with rigid design
- suitable for medium to large series production

New!

KOF-12, KOF-18 and KOF-24 has been updated and changed names to KOF-112, KOF-118 and KOF-124.

GRANLUND KOF-112, KOF-118 and KOF-124 are basically the same machine. The machine is designed for medium to long filling runs. More element are filled simultaneously with fewer manhours needed per element, as compared with KOF-6.

GRANLUND KOD-124 is the basic version, but for thicker elements, where there is not enough space for 24 tubes, KOF-118 or KOF-112 is supplied.

Construction

The machine comprise the following:

- frame
- control box
- equipment for filling cartridge heaters (option)
- equipment for fillig elements with 2, 3 or 4 coils (option)

The frame should be mounted to a wall or a pillar. It is recommended to use vibration dampers between wall and machine.

Function

The filling principle is the same as in KOF-6. Inner and outer filling tubes with a nozzle and a central rod which holds the coil. The MgO is fed between the two tubes.

The machine is semi-automatic. The element tubes and coils are loaded by hand, but the lifting of the element tubes, and lowering of them after the coils have been mounted, is done by a motor.

The filling tubes are also lifted, by another motor, when the vibrator operates and the elements are filled with MgO.

The MgO comes from a big magazine hopper at the top, through a smaller travelling hopper into the element tubes. This smaller hopper is refilled every time it reaches its upper position, i e when the filled elements are removed.

This information, which may be subject to change, is offered solely for your consideration, and should not be taken as a warranty or representation for which we assume any legal responsibility.

Sales Catalogue

The machine will function even when the tubes are not perfectly straight. However, to achieve good results, the straightness is important. A length tolerance of $\pm 1,0$ to $\pm 1,5$ mm can be accepted.

Technical data

total height	(2 x max element tube length) + 920 mm the MgO hopper takes another 510 mm
width	1050 mm (excl motors) 2030 mm (incl motors)
depth	400 mm
weight	400 kg (1,5 m max element tube length) to 900 kg (5,5 m max element tube length)
filling speed	adjustable, by changing sprocket wheels, to 150, 200 or 300 mm/min
element tube length	min 150 mm max 5 500 mm
outer tube diameter	min 7,0 mm max 12 mm (KOF-124) 18 mm (KOF-118) 24 mm (KOF-112)
coil diameter	min 1,5 mm
vibrator frequency	variable 25-35 Hz
electrical connection	single-phase 230 V, 50/60 Hz, 800 W

This information, which may be subject to change, is offered solely for your consideration, and should not be taken as a warranty or representation for which we assume any legal responsibility.

Sales Catalogue

Required information for ordering

- max element tube length, outer and inner diameter of element tube
- max outer diameter of coil and terminal pin

Options

- * three-tube filling system
- * steplessly controlled filling speed
- * motorized second waggon

KOF-124 can be equipped with our three-tube filling system (same principle as in KOF-125) as an option, as well as frequency control of filling speed. It can also be delivered with a motorized second waggon (also equal to that of KOF-125).

This information, which may be subject to change, is offered solely for your consideration, and should not be taken as a warranty or representation for which we assume any legal responsibility.

Sales Catalogue

KOF-25 **High-Speed Filling Machine**

- filling speed up to 1000 mm/min
- uniform and high filling density
- minimum handling time
- programmable parameter setting
- easy operation and maintenance

New!

The control system of KOF-25, as well as that of KOF-125 and KOF-24B, has been converted to the PLC-type. While keeping the advantages of the previous computer-type systems, in particular its user-friendly interface, going over to standardized PLC-systems assures excellent reliability and service.

(It is GRANLUND Machinery's opinion that using standardized PLC-systems, a technology developing rapidly, improves reliability and facilitates service in all parts of the world.)

GRANLUND KOF-25 is designed for medium to long filling runs. 25 elements are filled simultaneously. It was a breakthrough on the market when it was introduced. The filling speed is significantly higher, compared with e.g. KOF-24. There are extensive possibilities of programming input data.

The machine is ready for automatic equipment. Loading and unloading is done by a frame and fixture. KOF-25 is especially suitable for smaller diameters, like Ø7,5 mm and smaller. An advantage compared with traditional types, is that there is no MgO waste.

Filling principle

The insulating powder is gravity-fed from a movable hopper, through the space between the filling tube (which guides the resistance coil), and the element tube. The rod secured at the top of the machine travel through the filling tube and holds the resistance coil by its upper terminal. Filling is made while the tubes vibrate, thereby increasing the powder density (filling density).

Construction

The machine can be erected on the floor or in a suitable pit, and the top of the machine should be secured to a wall or to the ceiling. As the large insulating powder hopper is at the top of the machine, ample space must be provided for easy access to this hopper for powder replenishment.

This information, which may be subject to change, is offered solely for your consideration, and should not be taken as a warranty or representation for which we assume any legal responsibility.

Sales Catalogue

Only one filling tube is used. The element tube is used the the outer filling tube. This means that there is more space available between coil and outer tube than in other types of filling machines. The coil is guided between the (inner) filling tube, and the nozzle tip. Thanks to it having only one filling tube, very small diameters of element tubes can be filled. As small as Ø6,35 x 0,45 mm with coil Ø2,2 mm has been filled.

The machine is built for the follwing fixed maximum lengths: 1000 - 1500 - 2000 - 2500 and 3000 mm.

The basic design is the same as for KOF-24 and KOF-125, and the overall dimension are close to the same. KOF-25 has four motors, as compared with two in KOF-24 and KOF-125. The motors in KOF-25 are very accurated servo-motors.

Length and time feedback is done from sensors and encoders.

This machine can also be delivered as a KOF-19 machine, i e for filling 19 tubes at the same time.

Function

The machine is loaded with a fixture. Therefore is can work with the automatic sealing equipment type KSO. Normally two KOF and one KSO work together.

High filling speed

The filling speed is steplessly controlled between 100 and 3000 mm/min (max 1000 mm/min practically). A speed of 1000 mm/min requires optimal conditions, a more normal speed being 700-800 mm/min. This means that the output from this machine is appr 3 times higher than from the KOF-124.

Uniform and high filling densities

With a thorough and stable design where all moving parts are guided separately, i thas been possible to reach high filling densities, in spite of the high filling speeds. The coils are constantly guided by the nozzle tips and subsequently well centralized.

Minimum handling time

All element tubes and filled elements are handled using an off-the-job loading fixture, thereby maximising the machine capacity. The tubes are also prepared on the loading frame. When the elements are longer than appr 1500 mm, loading and unloading supports are used on both sides of the unit, as the weight of the elements after filling will be quite high.

Programmable parameter setting

To achieve the best results, the machine has been designed to be very flexible and certain parameters can be set separately, viz:

This information, which may be subject to change, is offered solely for your consideration, and should not be taken as a warranty or representation for which we assume any legal responsibility.

Sales Catalogue

- element tube length,
- filling speed,
- terminal pin length,
- level of MgO, and
- sealing plug height

While the unit can have 30 different tube lengths stored in the programme, even more intermediate sizes could be run, if necessary. When designing the unit, great efforts were made in finding the best possible components and the degree of dissolution is 0,1 mm for length and 0,1 second for timing. This ensures excellent repeatability. To alter from one tube length to another takes around one minute, and from one tube diameter to another, using prepared items, takes maximum 20 minutes.

Easy operation

Highly qualified technicians are not required to operate the machine. Operators with reasonable technical experience and a short training period with our instructors, can easily operate the machine.

Easy maintenance

Complete documentation is supplied with the machine, including spare parts lists and operational drawings. The machine has a small number of parts, in order that the spares to be held in stock can be kept to a minimum.

Technical data

total height	(2 x max element tube length) + 1000 mm
width	2150 mm
depth	300 mm
weight	740 kg (1,5 m max element tube length) 970 kg (2,0 m) 1200 kg (2,5 m) 1430 kg (3,0 m)
filling speed	100-3000 (practical 1000) mm/min , stepless control
element tube length	min 350 mm (practical) max 3000 mm (2500, 2000, 1500, 1000 mm)
outer tube diameter	min 6,0 mm max 12 mm
electrical connection	3x400 V, neutral and earth (two phases used), 5 000 W
compressed air	400 - 500 kPa

This information, which may be subject to change, is offered solely for your consideration, and should not be taken as a warranty or representation for which we assume any legal responsibility.

Sales Catalogue

Required information for ordering

- max element tube length, outer and inner diameter of element tube
- max outer diameter of coil and terminal pin

This information, which may be subject to change, is offered solely for your consideration, and should not be taken as a warranty or representation for which we assume any legal responsibility.

Sales Catalogue

KOF-125/130 **High-Speed Filling Machine**

- high filling speed
- quick changes of filling parameters
- no MgO waste

New!

The control system of KOF-125, as well as that of KOF-25 and KOF-24B, has been converted to the PLC-type. While keeping the advantages of the previous computer-type systems, in particular its user-friendly interface, going over to standardized PLC-systems assures excellent reliability and service.

(It is GRANLUND Machinery's opinion that using standardized PLC-systems, a technology developing rapidly, improves reliability and facilitates service in all parts of the world.)

This is our newest filling machine. 25 elements are filled at the same time and the filling speed is higher compared with KOF-24. KOF-125 is used for elements of diameter 7,5 mm and thicker, since the system with three filling tubes requires more inner space than the systems with one or two filling tubes. The minimum tube diameter depends on outer coil diameter as well as on tube wall thickness. The filling speed and MgO grain size will also be influencing factors.

An advantage compared with traditional types of filling machine is that there is no MgO waste.

Construction

The machine should be mounted against a pillar or a wall. Vibration dampers are required for a smooth run.

The machine comprises:

- frame
- control panel
- filling set
- filling set for elements with 2, 3 or 4 coils (option)

This information, which may be subject to change, is offered solely for your consideration, and should not be taken as a warranty or representation for which we assume any legal responsibility.

Sales Catalogue

Function

KOF-125 uses a three-tube filling system, i.e. one more filling tube than the traditional filling machines. The third tube acts as a sleeve/valve, which opens and closes the flow of MgO. The flow can be opened and closed at any time during filling.

The big advantages with the three-tube filling system is:

- a. The MgO has free fall with a minimum resistance through the bores in the outer filling tube. The filling speed may be increased by as much as four times, in some cases. The risk of getting clogs in the MgO is smaller, which means that the tap density through a set of filled tubes will be more uniform.
- b. When the tubes are resting in between the fillings, no waste of MgO will be noticed leaving the filling tubes

The filling speed is steplessly controlled, and can be chosen based on tube and coil diameter.

Changing data is done within a minute from the control panel. The technique is simple and easily understood. The following data can be changed:

- filling speed
- element tube length
- MgO level
- terminal pin length outside tube
- post filling vibration time

The machine is loaded with a fixture (or by hand). Therefore, it can work with the automatic sealing equipment type KSO. An efficient filling cell can be formed by one KTS tube stacker, two KOF filling machines, and one KSO work together, with subsequent feeding of the elements into the feeding device of the rolling mill. The loading fixture shortens the time of handling considerably. (Note: If the elements are very long, it may not be possible to load and unload with the fixture.)

This information, which may be subject to change, is offered solely for your consideration, and should not be taken as a warranty or representation for which we assume any legal responsibility.

Sales Catalogue

KOF-125, cont.

Technical data

total height	(2 x max element tube length) + 1000 mm (exception: machine for 1,0 m element tubes is 3230 mm high)
width	960 mm
depth	240 mm
pit hole	1400 x 800 mm, depth depending on machine height
weight	450 kg (1,5 m max element tube length) 700 kg (3,0 m)
dimensions of control unit	600 x 500 x 900 mm
No of elements	25/30 pcs/cycle
filling speed (theoretical)	200-999 mm/min, stepless control
element tube length	min 200 mm max 3000 mm (2500, 2000, 1500, 1000 mm)
outer tube diameter	min appr 7,5 mm (depending on coil diam. and tube wall thickn.) max 12 mm (KOF-125) max 10 mm (KOF-130) 16 mm (KOF-119)
pin length	15-99 mm
MgO level	0-99 mm
coil diameter	min 1,5 mm
vibrator frequency	0-50 Hz
electrical connection	single phase 230 V, 16 A, 50/60 Hz, 2000 W
compressed air	min 400 kPa (4 bar), dehydrated and oil-free

Productivity

time for changing parameters:	appr 0,5-1 min (applies to length, pin and MgO level)
production capacity:	appr 250 elements/hour (1,2 m, 400 mm/min filling speed)

Productivity improvements can be reached, thanks to:

- + higher filling speeds (practically often around 400 mm/min)
- + rapid parameter changes
- + reduced handling time by introducing the stacker of empty tubes, rack loading of empty tubes, rack unloading of elements and automatic sealing of the elements

This information, which may be subject to change, is offered solely for your consideration, and should not be taken as a warranty or representation for which we assume any legal responsibility.

Sales Catalogue

KOF-125, cont.

Filling tests

The filling density depends on several factors, such as element tube length and dimensions, filling speed, and the grade and quality of MgO.

Filling tests have been made in order to check the variation in density over all tubes, and the results have been very good. We can supply test results showing the low variation in filling density as well as the influence of filling speed on filling density. The following four graphs show the influence of filling speeds, which is important as the 3-tube filling system allows higher filling speeds

These parameters are equal in all four graphs:

MgO grade	TSL 1 1GN1
Amplitude	70 units
Frequency	100 units
After-vibration	5 seconds
Element tube	10 x 0,5 x 600 mm, 18/8 stainless steel

Required information for ordering

- max element tube length, outer and inner diameter of element tube
- max outer diameter of coil and terminal pin

This information, which may be subject to change, is offered solely for your consideration, and should not be taken as a warranty or representation for which we assume any legal responsibility.

Sales Catalogue

KOF-24B

Conversion Kit for KOF-24.

GRANLUND KOF-24B is a conversion kit, enabling our customer to convert their existing KOF-24:s to a more productive and flexible filling machine.

The kit will upgrade the KOF-24 to the same performance as a KOF-125, using the same control system and three-tube filling system as KOF-125. For a lower cost, the customer can increase his filling capacity and tap density accuracy, as well as improve the flexibility of his existing machine.

Background

There are two main differences compared to the conventional KOF-24:

A) Control system

The main part of the kit is the control system with the operating panel from which the tube length, filling speed and terminal pin length can easily be set. A great effort has been made to achieve a simple and clear man-machine interface.

The two conventional motors are replaced by servo-motors in order to get exact positioning of the waggons in each sequence of the filling operation.

New!

The control system of KOF-125, as well as that of KOF-25 and KOF-24B, has been converted to the PLC-type. While keeping the advantages of the previous computer-type systems, in particular its user-friendly interface, going over to standardized PLC-systems assures excellent reliability and service.

(It is GRANLUND Machinery's opinion that using standardized PLC-systems, a technology developing rapidly, improves reliability and facilitates service in all parts of the world.)

B) Filling system

In order to achieve a higher filling speed, the conventional two-tube system with its conventional labyrinth, is replaced by a three-tube system. The three-tube system comprises one inner tube, one outer tube and one valve tube. The valve tube opens and closes the flow of MgO.

This information, which may be subject to change, is offered solely for your consideration, and should not be taken as a warranty or representation for which we assume any legal responsibility.

Sales Catalogue

Construction

The KOF-24B comprises the following main items:

1. New filling set (three-tube system)
2. Two new motors (stepping motors)
3. Completely new electrical control system
4. Device for making existing vibrator to move upwards during filling
5. New bottom waggon for clamping the tubes
6. Control cabinet with computer
7. Small control box to be used by the operator
8. Loading fixture
9. Two stands for empty tubes and filled elements

Note: This conversion kit includes everything required to make your old KOF-24 into a modern PLC-controlled high speed filling machine, comparable with a KOF-125.

Technical description

A. Motors

The conventional AC-motors are replaced by servo motors. The gear boxes are changed to worm gears, which are maintenance-free.

B. Refilling device

The conventional hand operated device is replaced by a pneumatic device operated by the programmed automatic cycle.

C. MgO valve

The valve tube in the new three-tube system is pneumatically operated. The device is put on the existing upper beam (waggon 1). The control programme controls the function of the refilling device, like every other function.

D. Travelling vibrator

In order to get as much efficiency as possible from the vibrator, it is of the travelling type. The vibrator is suspended in four bars fastened in waggon 1, which means that the distance to the nozzles remains constant throughout the entire filling operation.

E. Waggon No 2

This waggon has been redesigned to allow quick changes in element tube length and also to allow loading by means of a rack.

The tube support, which also pressed the bottom plug into the tube, is attached to waggon No 2, therefore, it will always have the correct position irrespective of programmed tube length.

This information, which may be subject to change, is offered solely for your consideration, and should not be taken as a warranty or representation for which we assume any legal responsibility.

Sales Catalogue

The clamping bar has a double movement to allow front loading by means of the rack. The rack is used mainly for shorter lengths, i e up to 1,5 m.

F. Valves

All air valves are assembled in a box mounted on the frame. Totally, there are five valves, all controlled by the set programme.

G. Operating

As soon as programming is made, the machine is operated by the small box with buttons, placed on the frame close to the operator. All necessary sequences in order to run the machine, are controlled through this box.

H. Cables

An entirely new set of cables is supplied with the conversion kit. This is to ensure a reliable function.

I. Control cabinet

The most important control functions are placed in the free-standing control cabinet, in order to protect them from the vibrations in the machine stand. The functions are motor control, transformer and PLC.

In the top of the cabinet, you will find the keyboard from which the communication with the PLC programme is made. A great effort has been made to get a simple and logical programming of basic data.

Technical data

See KOF-125

Element tube diameter	max	12 mm (KOF-24B)
		16 mm (KOF-18B)
		24 mm (KOF-12B)

Productivity

See KOF-125

Filling tests

See KOF-125

This information, which may be subject to change, is offered solely for your consideration, and should not be taken as a warranty or representation for which we assume any legal responsibility.

Sales Catalogue

GRANLUND KSO Automatic Sealing Machine

When unloading the filled elements from the filling machine, it is convenient to seal the elements before feeding them into the reducing rolling mill. Thanks to the KSO, specially designed to automatically seal the upper ends with a plastic plug, the time to seal has been drastically reduced.

As the machine is loaded and unloaded with a rack, it can only work together with KOF-25, KOF-125, or KOF-24B.

Construction

The machine comprises the following main parts:

- support with locking device to hold the tubes in position
- automatic plug feeding system with step-by-step device
- device for sensing the presence of a plug
- device for levelling the MgO, leaving room enough for the plastic plug in the element end.

Function

The elements are put into the machine with the fixture, supplied with our filling machines, and locked in this position.

Technical data

Dimensions	1100 x 800 x 2200 (height) mm
	for element lengths above 1600 mm, the machine has to be fixed at the side of a pit measuring 1100 x 800 x 1200 mm
Element length	min 200 mm
	max 2500 mm
Element diameter	min 6 mm
	max 10 mm
Cycle time	one set of elements is sealed off in about 18-20 seconds

In order to change element dimensions, it is necessary to replace:

- vibrator cup with plug selecting device
- plug feeding channel
- jaws for inserting the plug
- adjustment of jaw closure (when changing tube diameter)

This information, which may be subject to change, is offered solely for your consideration, and should not be taken as a warranty or representation for which we assume any legal responsibility.

Sales Catalogue

Note: This machine is not suitable for rubber plugs (too high friction), but for polyethylene or PVC plastic. It is important that the quality of the plugs is high, and consistent (dimensions, lack of burrs...).

This information, which may be subject to change, is offered solely for your consideration, and should not be taken as a warranty or representation for which we assume any legal responsibility.

2/7/2006