1. Principle of the Fluid Bed Dryer

The air stream, induced by the fan (2) in the upper part of the cabinet, passes through the air heater (7) and the pre-filter (9). After the heating has been completed, the purified, hot air passes through the product container (43) from bottom to top, by which means the product is brought to the fluidised state. The Nylon filter set (39) which follows in sequence prevents any carry-over of the product. When drying products with a relatively high content of water (above 20%), the air is almost completely saturated with water steam after having passed the product once. This air is blown into the atmosphere by means of an outgoing air channel. When drying products with a low content of water, the outgoing air may be re-added to the fresh air by installing a recirculating air flap.

2. Connection of the Fluid Bed Dryer

a) General

It is essential that the building floor on which the dryer shall be placed, is level; it is not necessary to provide for a floor fastening. However, it is recommended to lay a plate of 5-10 mm thickness underneath the dryer in order to avoid that the rubber sealing fixed to the lower part of the door pushes the dust lying on the floor into the cabinet when closing the door. The inlet and outlet air ducts should be led into the open air on the shortest way possible and the bends be reduced to a minimum. In order to avoid too big air resistances, it is advisable to increase the cross section of the duct by 1,2 to 1,5 times of the socket of the cabinet. If several drying units are placed side by side, the inlet and outlet air ducts have to be fixed separately for each drying unit.

It is very important to check the direction of rotation of the fan motor by comparing it with the direction arrow fixed on the motor. The air volume will decrease by at least 40 to 50% if the direction of rotation is not correct. The dryer must be grounded at some point.

If the fan blade, which is balanced electro-dynamically, is supplied in unfixed condition, it is important that this blade is protected against shocks. It has to be fitted carefully.

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onto the motor shaft by means of turning a screw into the provided thread.

For mending small colour damages, perhaps occurring during transport, a small quantity of paint is attached to each dryer.

For the dryer model ST 200 the rubber sealing (24) supplied with the dryer has to be jammed in between the flanges (66). The rods (52) are to be fixed to the lever (105) by means of a bolt (38) and the rods (45) to the lever (106).

b) Connection of steam
The control valve (34) has to be installed outside the dryer into the steam feed line (32) at a place easily accessible. If space is too small between the backwall of the dryer and the building wall, this valve may also be fitted at the side wall of the dryer as per Fig. 5. The control valve is protected against dirt by means of an easily accessible dirt collector (33). A hand release valve (31) has to be installed in the steam duct before the control valve. It is recommended to shut this valve when interrupting drying for a longer time.

c) Electrical connection
The inlet cables leading from the network to the electrical switch box are to be connected with the terminals RST O and E according to Fig. 16 for the electrically heated apparatus and according to Fig. 17 for the steam heated dryer. RST are the three outer conductors. O is the central conductor and E the earth wire. If the switch box is fitted outside the working room, the following connections from the apparatus to the switch box have to be effected:

In case of direct starting (ST 15) a four pole cable from the terminals UVW at the fan motor contactor and O or E at the terminal board to the corresponding terminals at the fan motor according to the local prescriptions. In case of a star-delta starter (ST 30, ST 60, ST 100, ST 200) a seven pole cable from the terminals UVW ZXY at the fan contactor and O or E at the terminal board to the corresponding terminals at the fan motor.

In case of a steam heated dryer the magnet steam valve (34) has to be connected to the terminals a and c. In case of electrically heated dryers connections have to be effected from the terminals U1 V1 W1 U2 V2 W2... etc. (according to the number of the heating contactors) at the heating contactors to the accordingly marked terminals in the terminal box mounted on the top of the dryer. There must also lead an earth wire from the terminal box to the earth wire terminal in the switch box. When having an automatic shaker the shaker motor has to be connected with a four pole cable to the contactor with the terminal mark UaVaWa and to the terminal board O or E.

The signal (26) must be connected to the terminals a and d too. Finally one end of the safety control line (103) has to be inserted in the plug (104) on the top of the dryer and the other end in the socket of the switch box.

**Attention:** The self-safe control line has to be laid separately, i.e. with a distance of at least 20 cm, on account of inductive effects by the remaining lines.

The corresponding actuating tension is always 220 volts and has to be protected externally to 6A. The feeding wires have to be connected to the terminals a b in the electrical switch box as per Fig. 16 or 17. In case of a star-delta starter (ST 30, ST 60, ST 100, ST 200) a seven pole cable from the terminals UVW ZXY at the fan motor according to the local recommendations. In case of a star-delta starter (ST 30, ST 60, ST 100, ST 200) a seven pole cable from the terminals UVW ZXY at the fan motor according to the local recommendations.

The power input of the single magnet coils is as follows:

- **a)** Motor starters:
  - Typ DSL 10 = 65 VA
  - Typ DSL 310 = 130 VA
  - Typ DSL 350 = 220 VA
  - Typ DSL 380 = 400 VA
  - Typ DSL 359 = 840 VA

- **b)** Heating contactors:
  - Typ DSL 30 = 180 VA

3. **Operation:**

a) **Before the drying process**

1. Filling in of the product into the product container (43). The filled in material shall immediately be dried and shall not remain in the dryer in undried condition.
2. Pushing in of the container into the dryer cabinet.
3. Fastening of the container by means of turning the lever (44).
4. In case of dryers with earthing basket the plug (41) of the earthing cable (40) has to be connected to the plug coupling (37).
5. Setting of the temperature at the potentiometer (29).
6. Setting of the drying time at the timer (25).
7. Setting of the recirculating air flap (5) by means of the handle (16). (The recirculating air flap is not standard and is installed at special request only. When drying products with a low moisture contents, a larger volume of recirculating air may be added to the fresh air, whereas in case of products with a high degree of moisture, a smaller volume of recirculating air may be added). When drying products containing alcohol or solvents, it is under no circumstances permitted to add recirculating air to the fresh air.
8. Press the starter button (22).
9. Slowly open the air control flap (3) by turning the lever (15) until the product fluidises. Should the product not fluidise, the air flap has to be opened and closed quickly a few times.
10. After the time set at the timer has expired, the fan switches off automatically.

b) **After the drying**

1. Shake off the filter set (39). In case of an automatic shaker, press the button (48) and switch off the shaker motor by pressing button (49) after about 10 seconds.
2. Lower the product container by turning the lever (44).
3. Drive out and discharge container (43).

4. **Protection against explosions**

(see Fig. 20)

a) Explosion panels in the back- or side wall of the dryer

All our dryers are equipped with explosion panels (71) as additional safety devices which serve the purpose to have the explosion pressure escape in case an explosion should arise. The panels consist of a sheet steel frame, one or several easily movable polyester flaps, complete rubber sealing and various hinges. Owing to the low-pressure in the dryer the flaps are pressed against the rubber sealing during the drying process. They open instantly in a time of about 0.1 sec. when the slightest over-pressure occurs. It has to be observed that the dryer is possibly placed towards an outer wall and that a channel (20), possibly without bends and leading into the atmosphere, is fixed to the frame.

b) **Device for eliminating electrostatic charges**

The earthing baskets (42 and 76) installed in the material container serve the purpose to eliminate electrostatic charges. The elimination of the charges in the filter set is effected via the wire rope (24) to the mass of the cabinet.

c) **Earthing control device**

The earthing control device (75) allows the setting to work of the dryer only then when a conductive connection is effected between the grounding basket (42) and the mass of the cabinet. The electronic ex control block (94) does therefore not only serve for the self safety but also as earthing control device.
All electrical operating instruments that no inflammable sparks can arise. The control elements, contactors and starters in the electrical switch box (28) are non-explosion-proof. If the dryer is installed in a working room where all electrical parts are explosion proof, this switch box has to be mounted outside this working room.

5. Mounting and dismounting of the Nylon filter set

a) Common multi sleeved type filter

The single filter sleeves (39) are first hung up in the loops of the ring (6) and then fastened to the filter bag frame (4) by means of a stretch band (80); see Fig. 4. The shaking off of the filter set is effected by moving the lever (17) a few times. The dismounting of the filter is effected in reverse sequence.

b) Ex-filter (see Fig. 20)

The Nylon filter bag (39) is put over the grounding matrix (76) outside the dryer (see Fig. 14), whereupon the two nuts (50) are to be tightened (see Fig. 13). Then, the lower part of the bag is turned up by about 20 cm and fastened to the corresponding loops (56). The complete set is then placed on the filter bag frame (4) and inserted in the plug coupling (85) (see Fig. 16). Now the loops are loosened again and the lower part of the filter let down. The fixation of the filter in the plug coupling is then effected by inserting the bolt (84) (see Fig. 17). After the filter has been fixed, it is lifted by pulling down the handle (86) and clamped automatically in the catching device (87) (see Fig. 16). Finally, the cylindrical part of the filter is fixed to the filter bag frame (4) by means of the steel band (80) (see Fig. 19). The stretching of the filter is effected by pulling out the clamping bolt (88).

When dismounting the filter, the shaker lever (17) has to be pulled down and the clamping bolt (88) inserted. Then, the toggle lock of the steel band of the filter is loosened and the lower part of the filter turned up again and fastened to the loops. Hereupon, the handle (78) has to be pulled down with one hand, whereas the other hand has to hold the whole filter set at the handle (86) at the same time. It is important to hold the filter set, otherwise it may fall down on the container. Now the complete set may slowly be let down on the filter bag frame. The clamping bolt (84) is pulled out and the filter can be removed from the plug coupling.

6. Description of the electrical installation

The electrical installation consists of:

a) Instrument panel (57) having the following instruments installed:

- 1 timer (25) for setting the drying time
- 1 Potentiometer (29) for setting the drying temperature
- 2 push buttons On-Off (22 and 23) for actuating the motor
- 1 thermometer (13) for indicating the inlet air temperature
- 1 thermometer (14) for indicating the outgoing air temperature

b) 1 AC motor (1) for driving the blower fan

c) Electrical heating: a number of heating elements

Steam heating: a control valve (34) for steam injection

d) Additional switching elements: temperature feeler (21) (measuring of resistance by means of nickel spiral), 2 excess temperature fuses (bi-metal switch item 12), 1 excess temperature safety fuse (8 - for increased safety air heater only)

e) Switch box (28) with:

1 star-delta starter for actuating the fan motor (dryer model ST 15 for direct starting). The specification of the models of the contactors, the size of fuses and the setting value of the over current relais are to be taken of the diagrams Fig. 16 and 17.

1 to 18 heating contactors for switching on and off the heating elements of the electrical air heater. The number of the heating contactors and the size of the corresponding fuses may be seen out of the diagram Fig. 16.

Various safety elements (92). Number and size according to capacity.

1 assistant contactor for the switching on of the heating contactors (only necessary for the electrically heated dryer)

1 electronic temperature control block (93) for temperature control

1 electronic ex control block (94) for effecting the self-safety

1 electronic ex control block (95) for effecting the self-safety (installed only when automatic shaker fitted)

1 electronic modulator (74) for eliminating the control-accuracy affected by the heating capacity of the air heater (for steam or hot water heating only).

Functioning of the electrical installation:

The drying time, determined by tests, is set for each individual product at the timer (25) on the instrument panel (57). Thus, the self-safe control circuit is closed and the installation ready for operation, i.e. by actuating the push-button (22) the dryer is set to work. After the drying time set has expired, the control circuit
A quickly acting resistance thermometer has to be fitted beside the air heater. The adjusting is done electrically.

b) Inferior setting of temperature

In cases where the thermal inertia of the air heater owing to strong temperature increases above the set value is perceptible (in cases of steam-heating only), the air heater has to be fed intermittently with energy during the heating-up period. The effect of this feeding is guaranteed in intervals by the temperature control block (93). A so-called electronic modulator serves to remove the control inaccuracy caused by the heating capacity of the air heater.

Setting of the modulator

The modulator is in the supplier’s workshop on account of values gathered by experience. Owing to the variety of the heating systems being applied, it may perhaps be necessary to adjust the modulator especially when during operation too big a temperature fluctuation is being registered. The adjusting is done as follows:

a) Higher setting of temperature above the nominal value:

The screw slit (79) of the trim-potentiometer (82) has to be turned in counter-clockwise direction. If this is of no use, the screw slit (83) of the trim-potentiometer (81) has to be turned in clockwise direction.

b) Inferior setting of temperature below the nominal value:

The screw slit (79) has to be turned in clockwise direction, and the screw (85) in counter-clockwise direction respectively. A quickly acting resistance thermometer has to be fitted beside the temperature feeler (21) for the temperature control. For your guidance, the trim-potentiometer (82) influences the injection time, the trim-potentiometer (83) the intervals.

The excess temperature safety fuse

This fuse is formed by the bi-metal switches (8 and 12) which are arranged in the air stream before and after the air heater and on the electrical heating elements respectively (for increased safety air heaters only). These bi-metal switches are an additional safety for excess of temperature in case any action of the control elements should fail; in such case they interrupt the self-safe control circuit. When the temperature falls below the admissible temperature, the control circuit will be closed automatically again and by pressing the button «on» (22) reset in operation.

Explanation to the electrical wiring diagrams

The electrical switch box may be affixed to the dryer only when the entire electrical installation of the working room is not of explosion-proof nature; otherwise this box must be flushed through with compressed air or be fixed outside the working room. If the dryer is not equipped with an earthing control device, the terminals 1 and 2 of the instrument panel are to be bridged over.

a) to Fig. 16

This drawing shows the current running plan of an electrically heated dryer. For the dryer model STe-15 the connexions X, Y and Z are omitted, because the fan motor is started directly. If no automatic shaker mechanism is installed, the starter (96), the electronic control block (95) and the instrument panel (27) are omitted as well as the signal lamp. The number of the heating contactors (91) depends on the heating capacity as well as on the working tension (1 to 19 pieces).

b) to Fig. 17

This drawing shows the current running plan of a steam-heated dryer. For the dryer model STd-15 the connexions X, Y and Z are omitted, because the fan motor is started directly. If no automatic shaker mechanism is installed, the starter (96), the electronic control block (95) and the instrument panel (27) are omitted.

Any breakdowns that may arise

Under normal conditions, the heating contactors and the starter do not require special maintenance. When operating properly, the switching on and off is audible as a slight stroke. If the contactors rattle considerably, either the actuating voltage deviates too much from the voltage of the bobbins (deviations of ± 10% admissible), or the movable elements at the contactors are hindered from working properly. It is also possible that accumulation of dust may cause this chattering. In case of a breakdown of the electrical unit first of all it must be checked whether the heat bundle of the starter (red button) has an electrical passage (terminals 95 and 96) and whether the grounding basket (42) is by means of the cable provided with a protective nature; otherwise this box may be affixed to the dryer only when the entire electrical installation of the working room is not of explosion-proof nature; otherwise this box must be flushed through with compressed air or be fixed outside the working room. If the dryer is not equipped with an earthing control device, the terminals 1 and 2 of the instrument panel are to be bridged over.

7. Automatic shaker mechanism

(see Fig. 23)

With the dryer model ST 200 the shaking off of the filter bags is effected automatically. The automatic shaker may also be incorporated in the dryer models ST 30 through 100.

The shaker arm (53) is actuated by the eccentric (54), resting on the shaft of the gear motor (67), and is pulled up resp. back by the spring (61). The eccentric (54) runs on the friction roll (63) in the direction of rotation indicated by the arrow.
When the shaker arm (53) recoils, the friction roll (63) shall not stroke onto the eccentric (54), but the shaker arm (53) onto the specially provided rubber buffer (64). The rubber buffer may be put in the proper position by adjusting the fastening angle (65). If the single tubes of the filter set (39) should not stretch sufficiently or cannot be inserted or taken out easily, the height of the bag ring (6) may be adjusted by means of the threaded rod (68). If the shaker arm (53) is not pulled upwards sufficiently high enough, the spring (61) may be stretched more strongly by turning the clamping device (62).

8. Maintenance of the dryer
The inlet air filter (9) should be spray-washed by water approximately every two or three months depending on the amount of dirt and should be replaced after about one year. If constantly the same granular material is being dried, the filter sets (39) are to be washed approximately every two weeks (temperature max. 60° C). The retaining screen of the material container (43) shall be cleaned periodically. — For the maintenance of the motor, please use the general operating instructions of the motor suppliers. According to the content of lime in the steam the magnet valve has to be decalcified by dipping in Brindizin about every year. In order to keep the rubber gaskets flexible at the doors, explosion panels, divider panels and frames, it is recommended to smear the same periodically with glycerin. The bolts of the hinges of the explosion panels should always be well lubricated. It is essential to check periodically the proper function of the explosion panels by lifting the panels away from the framing.
Technical data

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Dimensions

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