

FF-SD Series Safety Sensitive Edges

Application Sheet

FF-SD SERIES SAFETY SENSITIVE EDGES

Honeywell's FF-SD Series Safety Sensitive Edges comprise a pressure sensitive protective device designed in compliance with the requirements of the EN 1760 part 2 European Standard for protection of operators exposed to hazardous moving parts.

When the safety edge is actuated, the control unit de-energizes its safety output relays, stopping the hazard.

The complete system complies with Category 4 per EN 954-1 European Standard and therefore can be used in high-risk applications (Fig. 1).

FIGURE 1. FF-SD SERIES SAFETY SENSITIVE EDGE



POTENTIAL APPLICATIONS

Safety edges may be used on machines where hazardous moving parts could cause personal injury, such as:

- Machine guards, doors and hoods
- Machine centers
- Presses
- Welding machines
- Packaging machines
- Lifting decks, elevating platforms
- Material handling and feeding systems, robots
- Paternoster, theatre stages
- Automatic guided vehicles (AGV)
- Industrial washing machines

This application sheet provides potential application examples and extracts from the corresponding European Type C Machine Standards.

INJECTION MOLDING PRESS

An injection-molding press produces molded parts from plastics or rubber. The plastic material is injected through a nozzle into a mold in which the part is formed. Generally, a door prevents access to the mold area.

Safety requirements per Type C Standard EN 201

“Injection Molding Machines” (extract)

If the movement of power-operated guards can cause injury, then trip devices shall be fitted which will immediately either arrest or reverse the closing movement of the power operated guard. Reversing the movement shall not create further hazards.

Honeywell Solution

- Two FF-SD Type 4 safety edge systems, one on either side of the operated guard.

INDUSTRIAL LAUNDRY MACHINERY

Safety edges are particularly used on washing machines and washer extractors to prevent a hazard due to automatic door closing.

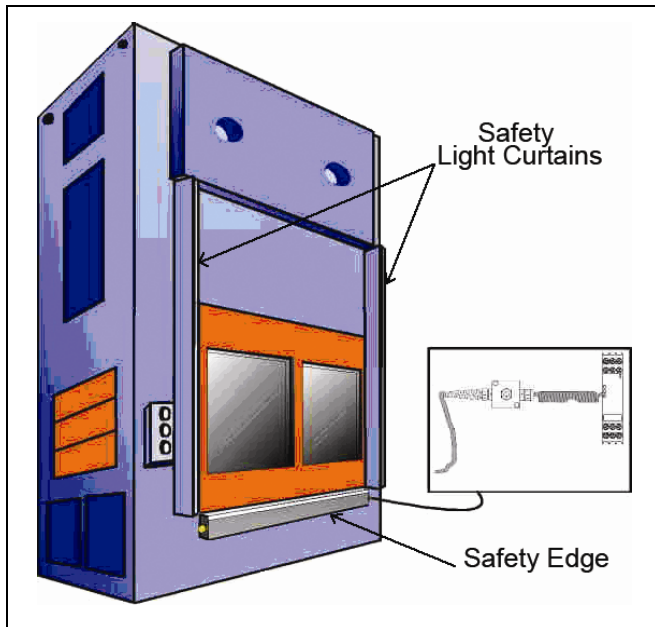
Safety devices that stop the door movement are effective only during the closing of the door. Trip bars take into account the stopping time.

MECHANICAL OR HYDRAULIC PRESS

A mechanical or hydraulic press uses large lifting or compressive forces to mold, force or a press work piece. In this example, the work piece is fed automatically on the side of the press (Fig. 2).

When setting operations or a problem occurs, the operator can access the hazardous area through the sliding door (equipped with safety switches and safety edges). The safety edge is mounted on the sliding door of the press.

FIGURE 2. MECHANICAL OR HYDRAULIC PRESS



Safety Requirements

The use of safety edges is neither specified in the Type C Machine Standard EN692 “Mechanical Presses” nor in EN693 “Hydraulic Presses”. However, many presses are protected by a safety door and Category 4 safety edges are used in addition to Type 4 safety light curtains.

Honeywell Solution

- One FF-SD Series Type 4 safety edge system
- One pair of FF-SYB Series Type 4 safety light curtains

MACHINING CENTER WITH TURNING PLATE

These types of machines usually have two main zones:

- A work piece loading/unloading zone
- A work piece machining zone

While the operator is clamping work piece A to the table in the loading zone, work piece B is being processed in the machining zone.

By the next cycle, the turning plate on which work piece A is clamped has turned 180°. Work piece A is then in the machining zone whereas work piece B is now in the unloading zone. The operator unloads the completed work piece B and then loads a new work piece.

Safety Requirements

The use of safety edges is not specified in safety standard EN12417 “Safety of machine tools – machining centers”; however, many machining centers with turning plates are equipped with safety edges.

The machining zone is isolated with a vertical sliding door equipped with a safety edge to prevent crushing hazards.

Safety light curtains control the turning plate’s dangerous movement. The safety category of the light curtain depends on the risk assessment of the turning plate. In this example, Type 2 safety light curtains are used.

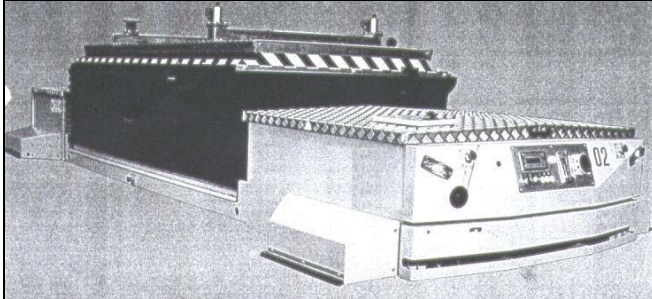
Honeywell Solution

- One FF-SD Series Type 4 safety edge system
- One pair of FF-SLD Series Type 2 safety light curtains

DRIVERLESS INDUSTRIAL TRUCK

A driverless industrial truck or Automatic Guided Vehicle (AGV) is a powered vehicle, including any trailers, designed to travel automatically in which the safety of operation does not depend on an operator. Remote controlled trucks are not considered to be driverless trucks (Fig. 3).

FIGURE 3. DRIVERLESS INDUSTRIAL TRUCK



Safety requirements per Type C standard EN1525

“Driverless Transport Systems” (extract)

EN1525 states that trucks shall be equipped with the means for the detection of persons in their travel path. The safety related parts of this personnel detection means shall be:

- Category 3 per EN954-1 for safety related parts of the personnel detection means are in the main directions of travel.
- Category 2 per EN954-1 for safety related parts of the personnel detection means are not in the main directions of travel (e.g. side protection for turns).

Whether or not safety edges are allowed for safeguarding AGVs depends on the risk assessment.

(The following text is taken from 5.9.5.)

Detection of persons in the traveling path.

(The following text is taken from 5.9.5.1.)

Trucks shall be equipped with means (e.g. bumpers, proximity sensors) for the detection of persons in their travel path. These personnel detection means shall fulfill the following requirements:

- a) they shall operate at least over the full width of the truck and load in every direction of travel;*
- b) they shall generate a signal enabling the truck to be stopped by the braking system ... under the specified floor conditions ... before contact between the rigid parts of the truck and/or load and a person;*
- c) they shall detect parts of a person's body as close as possible to the floor but at least the test pieces in 5.9.5.2 ... shall be detected;*
- d) the activation of such means shall not cause injury to persons. In addition, the static forces exerted by the means, measured in the climatic conditions in which the trucks are intended to operate, shall not exceed the amounts in 5.9.5.2;*
- e) reflective characteristics of test pieces for personnel detection means which work without physical contact shall be representative of human clothing.*

(The following text is taken from 5.9.5.2.)

The safety related parts of the personnel detection means in the main directions of travel shall be in accordance with EN 954-1 Category 3 ... the following test pieces shall be detected:

- a) A test piece with a diameter of 200 mm and a length of 600 mm lying at right angles to and anywhere on the path of the truck. The actuating force on this test piece shall not exceed 750 N;*
- b) a test piece with a diameter of 70 mm and a height of 400 mm set vertically anywhere fully within the path of the truck. The actuating force on this test piece shall not exceed 250 N. The force when the bumper is compressed to the position reached in a bumper stop from maximum speed and load shall not exceed 400 N.*

Honeywell Solution

- Four FF-SD Series Type 4 safety edge systems, one at each corner of the AGV.

THERMOFORM, FILL AND SEAL MACHINE

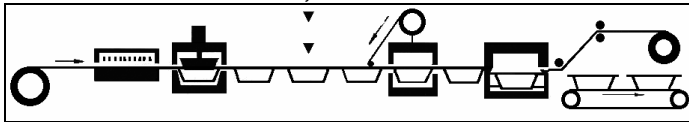
Safety edges are especially installed on the automatic guards of thermoform, fill and seal packaging machines.

(The following text is taken from Type C standard EN415-3 "Form, Fill and Seal Machines" 3.2.5.2.)

Thermoform, fill and seal machine: A deep draw form, fill and seal machine in which a web of thermoformable material is heated and formed with pressure and/or vacuum, before being filled vertically with product, sealed with a top film or magazine fed lid and finally cut to produce individual packs. Machines can produce one or more lanes of packs and may incorporate equipment to evacuate packages before they are sealed (Fig. 4). The characteristic features are:

- a reel unwind mechanism;
- a film heating mechanism;
- a forming die;
- a transport mechanism;
- a product loading area or automatic feeding device;
- a top lid dispensing mechanism or reel unwind mechanism;
- a lid sealing mechanism;
- a cutting mechanism;
- a discharge mechanism.

FIGURE 4. THERMOFORM, FILL AND SEAL MACHINE

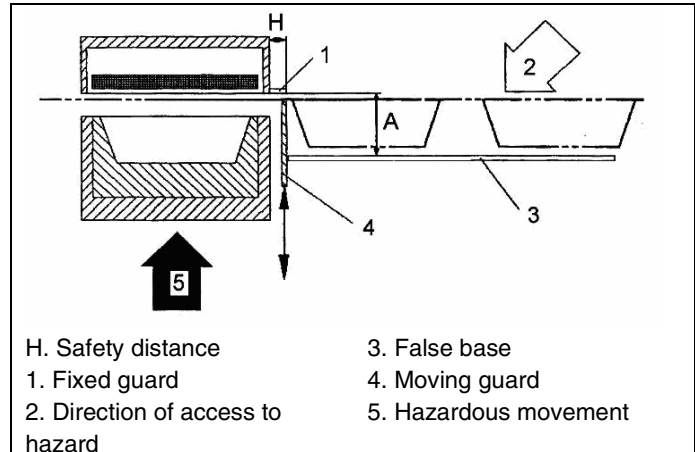


Automatic Guard

(The following text is taken from 5.7.5.8.)

This guard is powered independently of other movements on the machine, it moves into place after the transport cycle, and before the forming and sealing cycles. It shall be interlocked with the machine, to ensure that hazardous movements cannot start until the guard is in position. The guard shall be fitted with a pressure sensitive device (EN 1760-2) incorporated into a Category 1 circuit (EN 954-1) or move with a force less than 150 N, so that the guard does not, of itself, present a hazard. In this case, safety distance H ... may be used (Fig. 5).

FIGURE 5. AUTOMATIC GUARD

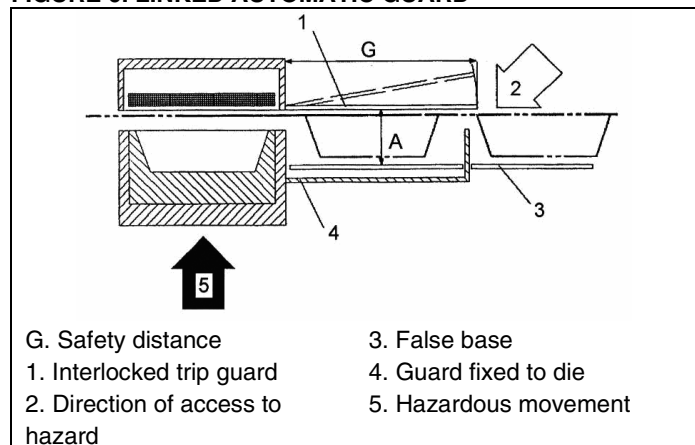


Linked Automatic Guard

(The following text is taken from 5.7.5.7.)

This comprises a guard which is attached to the forming or sealing die mechanism, and moves into place when the hazardous movements of the forming or sealing dies begin. The guard shall be interlocked with the machine to stop hazardous movements if the guard does not close in less than 0.5 s. The guard shall be fitted with a pressure sensitive device (see EN 1760-2) incorporated into a Category 2 circuit (see EN 954-1) or move with a force less than 150 N, so that the guard does not, of itself, present a hazard. In this case, safety distance G ... may be used (Fig. 6).

FIGURE 6. LINKED AUTOMATIC GUARD



TANNERY INDUSTRY MACHINES

Safety edges are used on tannery machines equipped with moving platens as seen in Figs. 7 through 10.

FIGURE 7. VACUUM DRYER WITH VERTICAL MOVEMENT

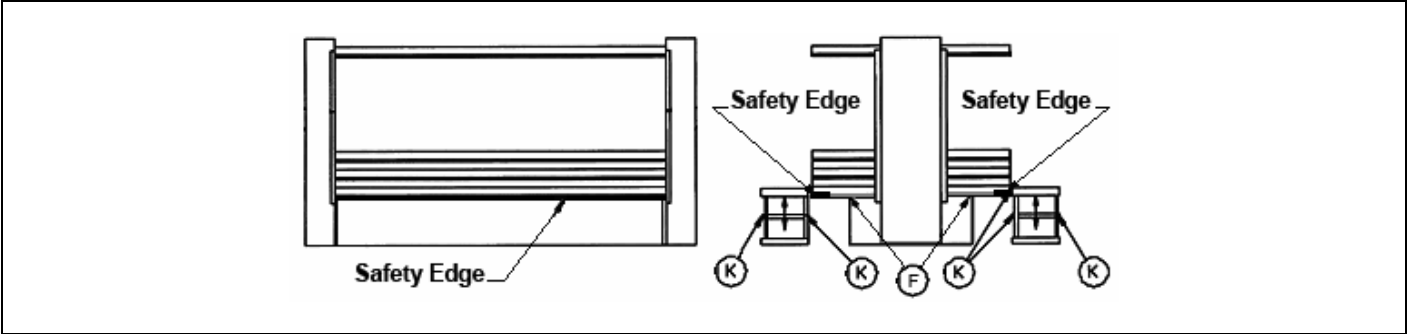


FIGURE 8. VACUUM DRYER WITH VERTICAL AND HORIZONTAL MOVEMENT

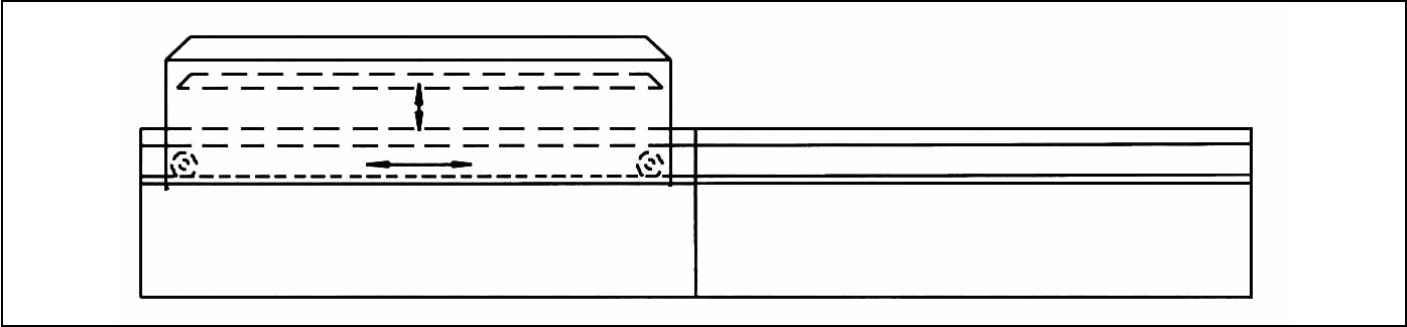


FIGURE 9. VACUUM STRETCHING MACHINE

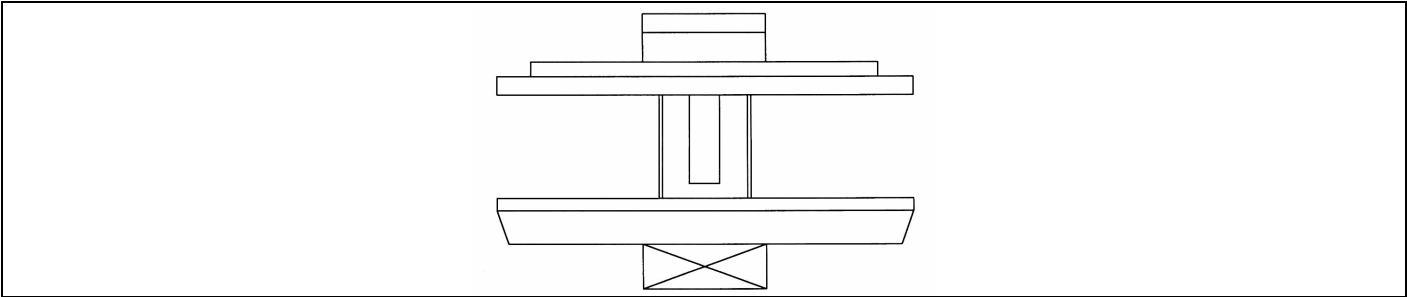
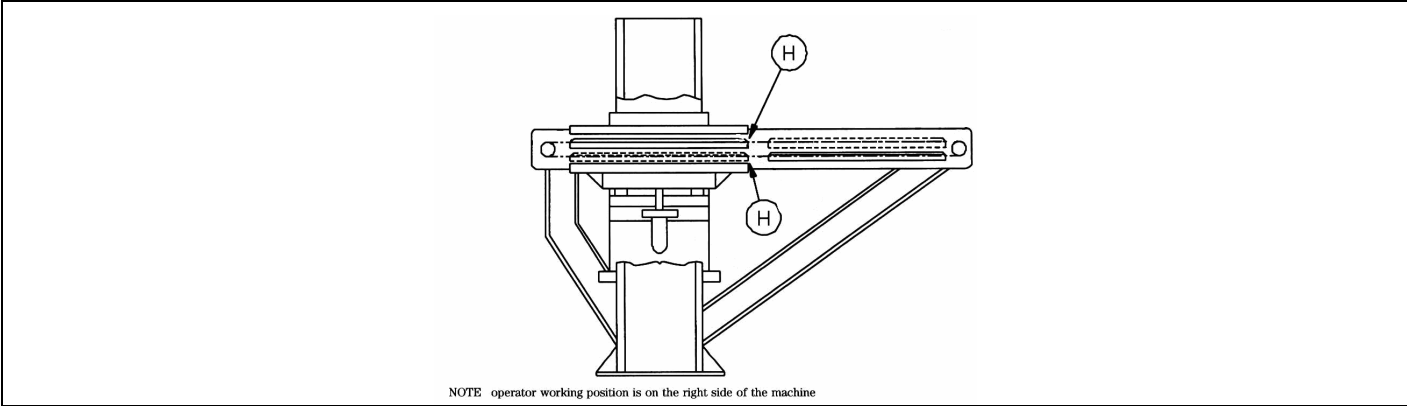


FIGURE 10. PLATEN IRONING AND EMBOSING MACHINE WITH HORIZONTAL AND VERTICAL MOVEMENT



Safety Requirements

Per Type C standard EN1035 “Tannery Machines with moving platens”.

Requirements Concerning Hazards in the Working Zone (The following text is taken from 5.3.1.1.)

For vacuum dryers with vertical movement (Fig. 7) and vacuum-stretching machines (Fig.9).

The pressure sensitive edge on each platen shall stop the movement of the platen before the distance between the two converging platens is less than the distance between the trip edge and the other approaching platen. The reverse movement, if actuated, shall not cause any hazard.

The control systems shall be at least equivalent to Category 2 per EN954-1.

Requirements for Hazards in the Accessible Zone (The following text is taken from 5.4.2.)

In platen ironing and embossing machines with horizontal and vertical movement (Fig. 10), the forward and backward movement of the mobile platens may cause crushing and shearing hazards (Fig. 10, position H).

(The following text is taken from 5.4.3.1.)

For vacuum dryers with vertical movement (Fig. 7).

The hazards indicated at zone F shall be safeguarded by a pressure sensitive edge. The pressure sensitive edge on the low edge of the platen shall stop the movement of the platen before the distance between the two converging platens is less than the distance between the adjacent fixed point or part. The reverse movement, if actuated, shall not cause any hazard.

The control systems shall be at least equivalent to Category 2 per EN954-1.

(The following text is taken from 5.4.4.)

In vacuum dryers with vertical movement (Fig. 7), if the platform moves vertically, there are crushing and shearing hazards as a result of possible operator foot access to the area (Fig. 7, position K).

Pressure sensitive edge, applied on the wide side of the platform, which shall stop the movement of the platform before the distance between the closing parts shall be less than the distance between the trip edge and the opposite closing part. The reverse movement, if actuated, shall not cause any hazard. The control systems shall be at least equivalent to Category 2 per EN954-1.

(The following text is taken from 5.4.5.1.)

For vacuum dryers with horizontal and vertical movement (Fig. 8) and platen ironing and embossing machines with horizontal and vertical movement (see Fig. 10), the machine parts which produce the horizontal platen movement may cause entanglement, shearing and impact hazards.

The pressure sensitive edge shall stop the movement of the suction head before the distance between the closing parts is less than the distance between the trip edge and the adjacent part. The reverse movement, if actuated, shall not cause any hazard.

The control systems shall be at least equivalent to Category 2 per EN954-1.

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- Complete installation, operation, and maintenance information is provided in the instructions supplied with each product.

Failure to comply with these instructions could result in death or serious injury.

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