



**Specification for the  
Application of Automatic  
Operator-Interface  
Safety Doors**

**SD-1038**

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REVISED

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## **1 Scope**

- 1.1 This specification was developed as a “how to” document in support of the Nexteer Automotive Design-In Health and Safety Specification (SD-012) and Specification for Safety Circuits (SD-011). The specification’s intent is to provide our plants with safe, well-designed, and reliable Automatic Operator-Interface Door (referred to in the rest of the document as door) safety circuits for industrial machinery and equipment.









The “Hierarchy of Health and Safety Controls” found in Nexteer Automotives Design-In Health and Safety Specification shall be followed to eliminate exposure to hazards.









- 1.2 The use of the word “shall” indicates requirements and the use of the word “should” indicates recommendations. The use of the word “may” indicates permission or allowance and the use of the word “can” indicates a possibility.

## **2. Safeguard Selection**

- 2.1 Care shall be taken to ensure that the safest and most cost effective solution is selected for the application and the risks involved.
- 2.2 Where the safeguarding method is a door that is magnetically coupled to the cylinder (break away), and the door is installed per this specification, the addition of a secondary electrical safeguarding device such as a light curtain, pressure sensitive bump strip or two hand control is discouraged unless their use can be justified by shortening the machine cycle times. **Note(1)** - Refer to table 1 and 2
- 2.3 Doors shall be controlled using one of the following approved circuit designs. In tables 1 and 2 the column at the far right is the relative cost factor with the Tolomatic being the most cost effective solution given a value of 1. As an example, the standard cylinder with the light curtain will cost 2.3 times more than the Tolomatic.



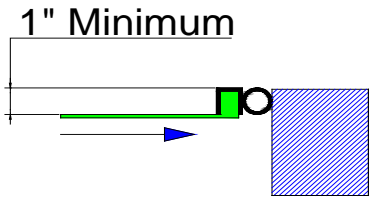
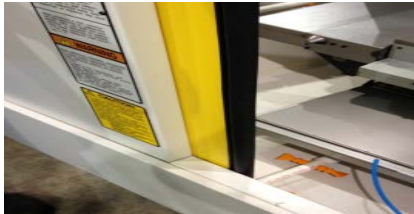
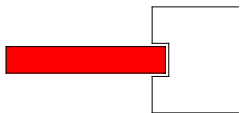
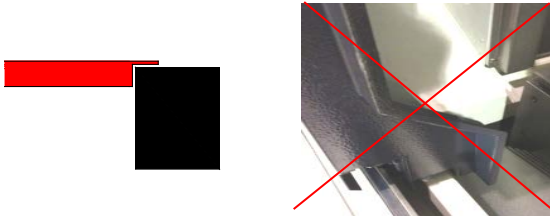
| <b>Table 1</b><br><b>Pneumatic – Horizontal Door</b> |   |  |  |   |                      |
|--|---|--|--|---|----------------------|
| Category Level – Ref. To Risk Assessment             | Circuit type  | Electrical safe guarding type  | Safety Valve   | Cylinder Type   | Relative cost factor |
| Cat 3  | Tolomatic   | <br>Note(1) | na   |  | 1                    |
| Cat 3/4  | Standard cylinder with pressure sensitive safety edge |             |  |  | 1.3                  |
| Cat 3/4  | Standard cylinder with light curtain                  |             |  |  | 2.3                  |

| <b>Table 2</b><br><b>Pneumatic – Vertical Door</b> |   |  |  |   |                      |
|--|---|--|--|---|----------------------|
| Category Level – Ref. To Risk Assessment           | Circuit type  | Electrical safe guarding type  | Safety Valve   | Cylinder Type   | Relative cost factor |
| Cat 1  | <b>Downward acting</b><br>Standard cylinder<br>Door follows cylinder downward while closing<br>Not physically coupled         | <br>Note(1)   | na   |  | 1                    |
| Cat 1  | <b>Upward acting</b><br>Standard cylinder<br>Cylinder drives door upward to close. Gap at top required.<br>Physically coupled | <br>Note(1)   | na   |  | 1                    |
| Cat 3/4  | <b>Upward/Downward acting</b><br>Standard cylinder that does not meet the (2) requirements above                              | <br>Or<br> |  |  | 2.3                  |

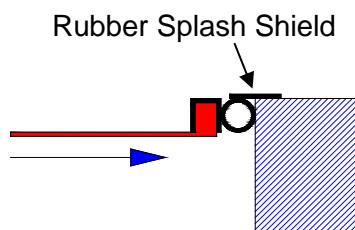
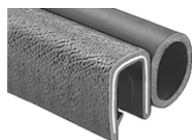


### 3. Door Design Mechanical

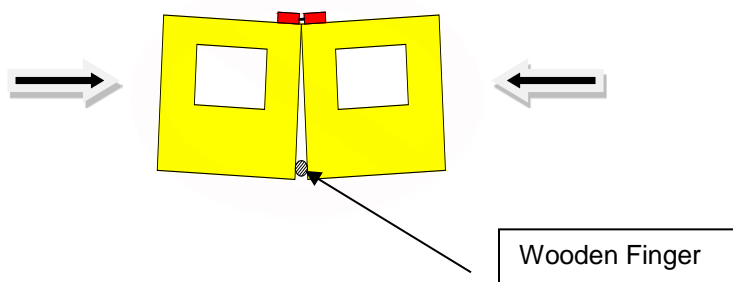
#### 3.1 Door Edge Design – The contact edge or surface of the moving door shall:

| Be a minimum of 1" wide, Include a rubber cushion, contact a flat surface                                   |   |
|---|---|
|  <p>1" Minimum</p>         |   |
| <p>Not enter a pocket</p>  | <p>Not contain hard or inflexible shear points</p>  |

An example of a rubber cushion that may be used is the McMaster Carr Edge Grip Rubber seal, part number 1120A35, 1120A47 or similar. In addition, a flexible flap may be required to contain high pressure process fluids and metal particles. (Basically replacing an existing metal edge with one made of flexible material to eliminate the shearing action.) All material used shall be rated for the process fluids and operating conditions of the equipment.



#### 3.2 Door Guidance and alignment – Door(s) shall be properly guided and aligned (both top and bottom) to limit actual closing force to less than 9 lbs while simulating actual production door speeds of not greater than 8"/second. This shall be verified using a pull gage with the door decoupled from the cylinder. The door shall not be allowed to cantilever or pivot when obstructed where the door switch could still be activated and the cycle started.



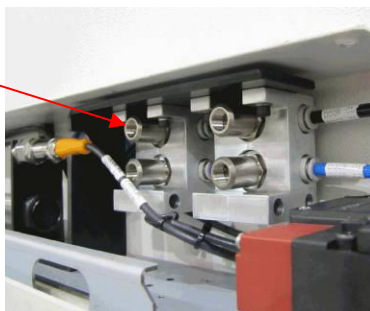


- 3.3 **Cylinder Mounting location and guidance system protection** – The cylinder shall be mounted at the top of the door, preferably on the outside away from process contaminants. If this cannot be accomplished and the cylinders are mounted on the inside, or on the bottom of the door, guarding or shielding shall be used to minimize or eliminate process contaminants from contacting the cylinder.

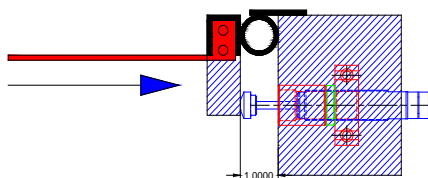
The lower door guide rod, track, bearing or channel shall also be protected from process contaminants through guarding or shielding and shall not contain pockets that can collect or retain process contaminants.

#### 4. Door Control

- 4.1 **Maximum Force** – The maximum force permitted on the door closing surface is 89N or 20lbs. This force shall be measured during the machine runoff and periodically during operation using a Hoggan ergoFET Push & Pull Gauge HGN104 or equivalent. Testing shall be done by placing the gauge in hand and contacting the moving door while it closes at the mid-point of its travel
- 4.2 **Maximum Speed** – The door closing velocity shall not exceed 8"/second. Fixed orifices or Meter-in and meter-out flow controls in series are required. The meter-in flow controls are used for speed while the meter-out is used for braking. After adjustment flow controls shall be fixed with Epoxy or pinned to prevent adjustment.



- 4.3 **Deceleration Control** – The moving doors deceleration shall be controlled for the last .5 inch to 1 inch of travel, (both open and close) by a hydraulic shock absorber such as an ACE MA225 or MC 150 H2. If adjustable, the setting of the shock, 0-9 shall be documented on the pneumatic diagrams and on a tag located next to the device on the equipment.



Cushion  
Setting = 3



- 4.4 **Door motion overtime** – The equipment shall include a door motion overtime timer that shall be set 2 seconds greater than the normal door close time. If the door does not close before the timer times out the machine shall:

- Drop out of cycle
- Display a fault on the operator HMI
- Remove the energy closing the door.

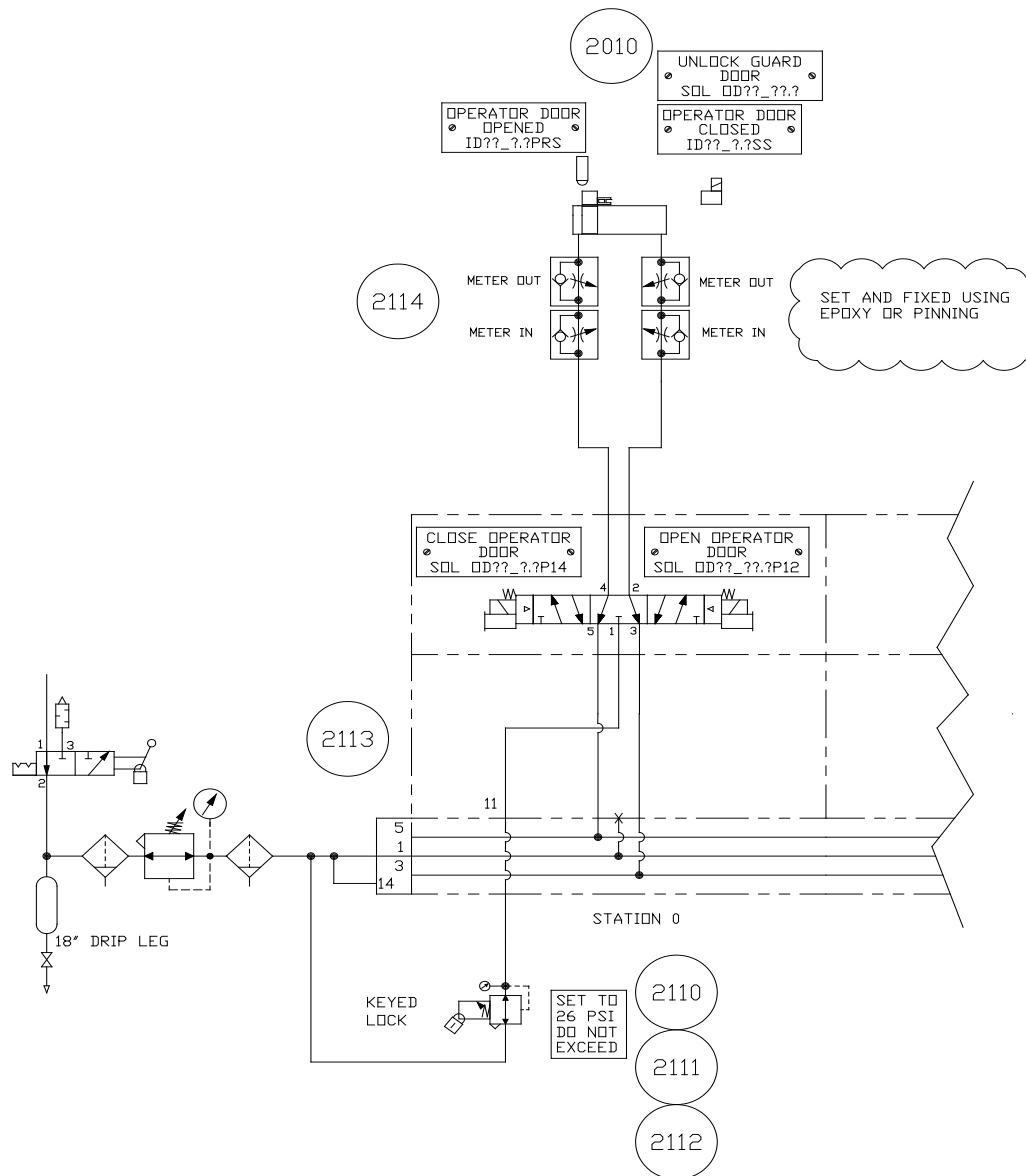
Example: Normal door closing time = 4 seconds, Door closing overtime timer set to 6 seconds.

- 4.5 **Solenoid locking safety gate electrical interlock device** – Solenoid locking switches shall be used to prevent the door from being opened while the machine is in cycle where the hazard cannot be stopped before personal would come in contact with it.



## 5. Pneumatic Circuit Design – Horizontal Door

### 5.1 Tolomatic Cylinder – Magnetic Break Away

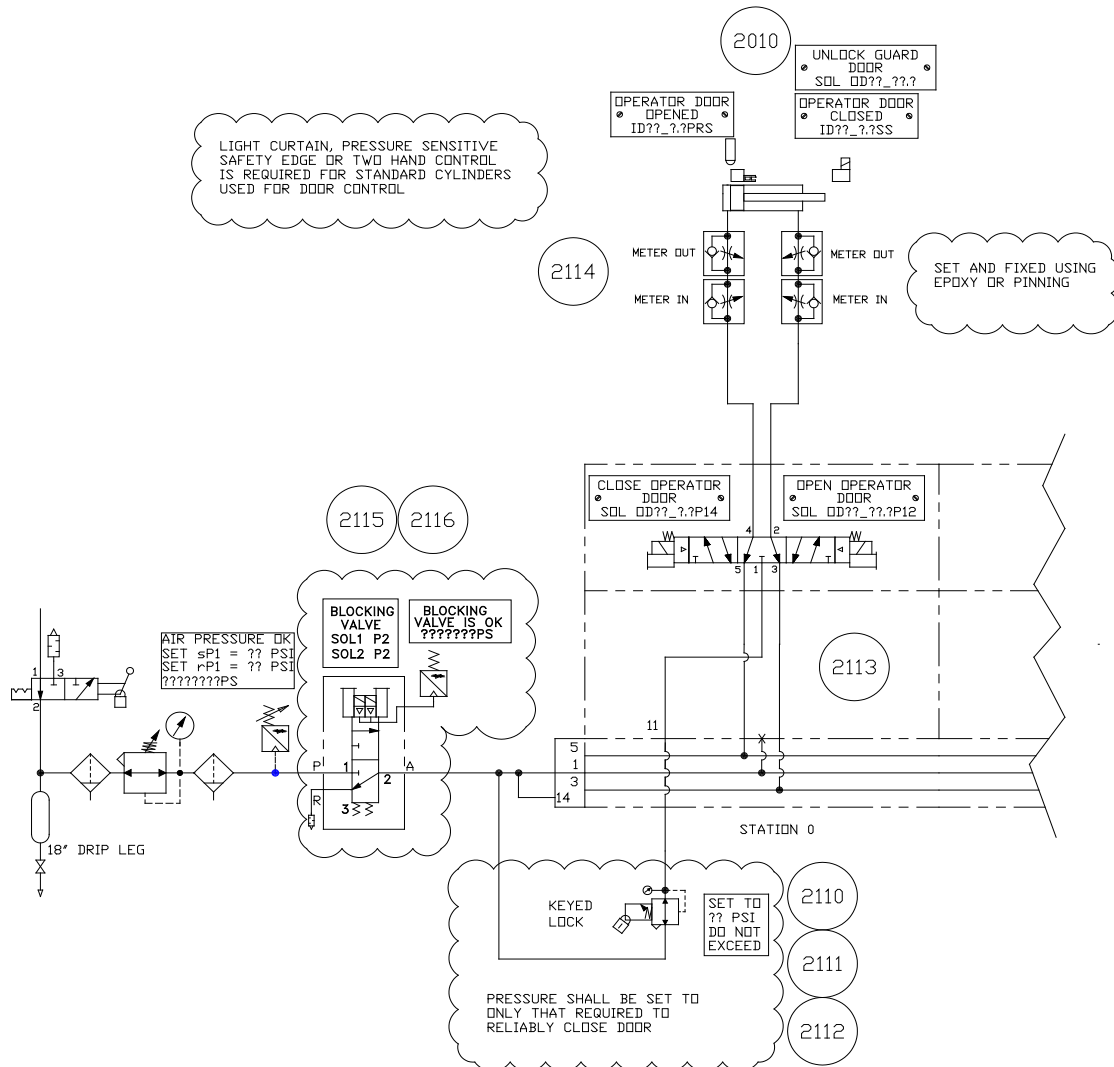


| Detail | Description                 | Manufacturer, Model   |
|--------|-----------------------------|---|
| 2010   | Cylinder                    | Tolomatic, 24100222SK--.--FLFM2,<br>(--.-- Represents cylinder stroke length in inches) |
| 2110   | Regulator                   | Festo, LR-3/4-D-7-MIDI (162587)   |
| 2111   | Regulator<br>Locking Cover  | Festo, LRVS-D-MIDI (193782)   |
| 2112   | Regulator Lock              | Festo, LRVS-D (193786)  |
| 2113   | Vertical Isolation<br>Plate | Festo, VABF-S4-1-P1A3-G14, (540171)   |
| 2114   | Flow Control                | SMC, AS2001F-06T  |



5.2 **Standard Cylinder – Non Breakaway**

- 5.3 The use of a standard cylinder for door control is strongly discouraged. Written approval from the purchasing Manufacturing Engineer's staff and CSE staff supervisor is required. In addition to the requirements of the Tolomatic circuit shown above a Herion safety valve or monitored dump valve is required as determined by the risk assessment.

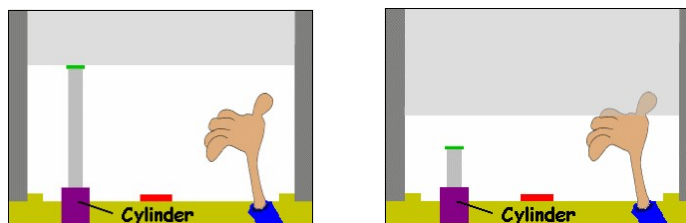
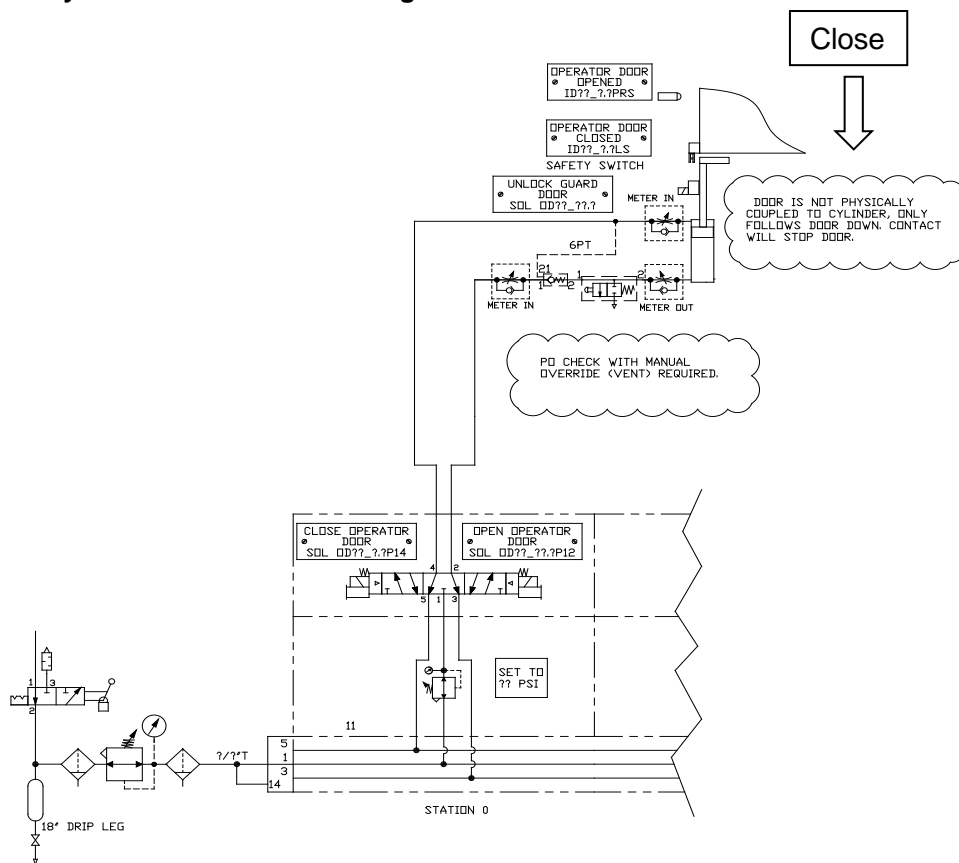


| Detail | Description              | Manufacturer, Model   |
|--------|--------------------------|---|
| 2010   | Cylinder                 | Standard rod or rod less. Shall be limited to smallest bore size possible |
| 2110   | Regulator                | Festo, LR-3/4-D-7-MIDI (162587)   |
| 2111   | Regulator Locking Cover  | Festo, LRVS-D-MIDI (193782)   |
| 2112   | Regulator Lock           | Festo, LRVSD (193786)   |
| 2113   | Vertical Isolation Plate | Festo, VABF-S4-1-P1A3-G14, (540171  |
| 2114   | Flow Control             | SMC, AS2001F-06T  |
| 2115   | Safety Valve             | Herion, 249***.****.024.00  |
| 2116   | Fault Indicator          | Herion, PSV, 1028063  |



## 6. Pneumatic Circuit Design – Vertical Door

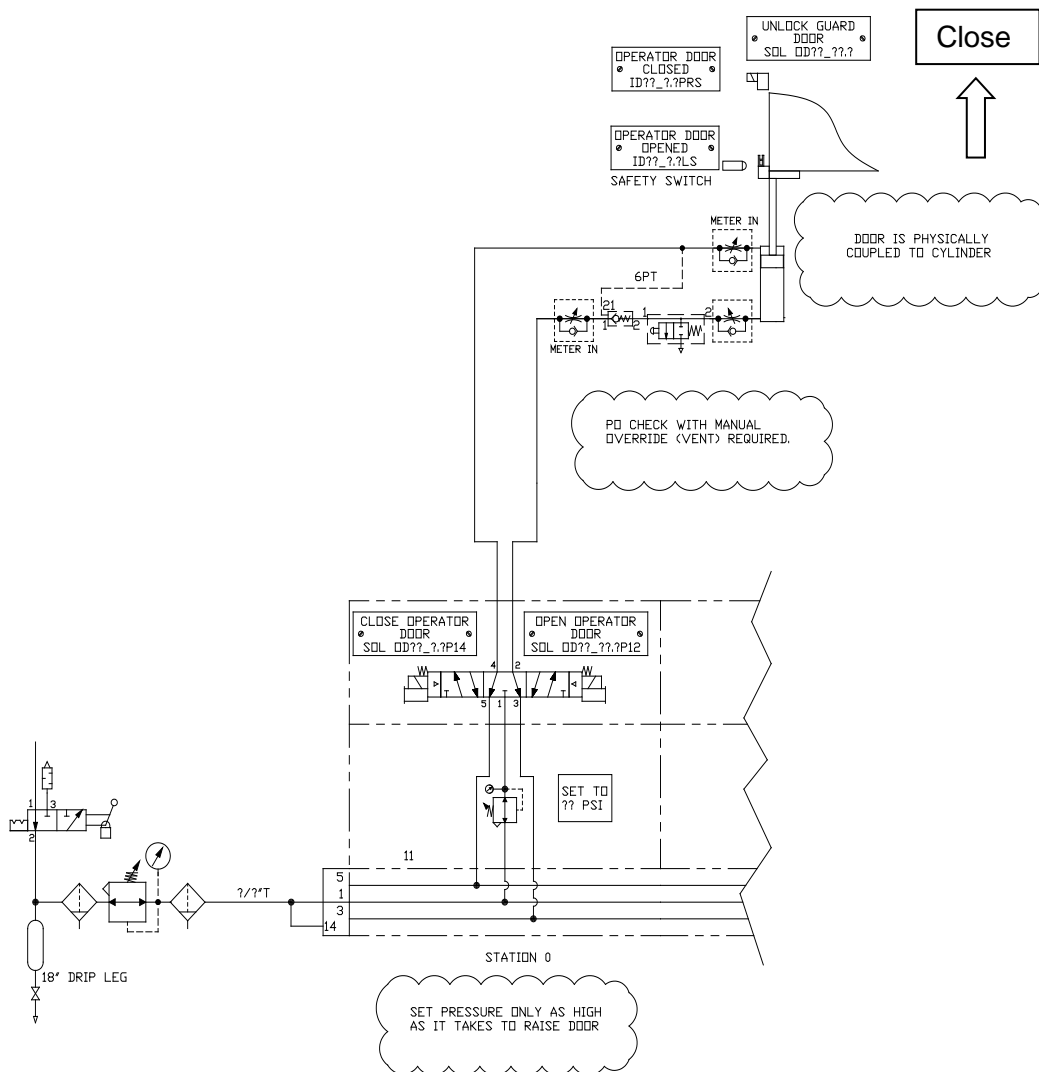
### 6.1 Standard Cylinder – Downward closing door



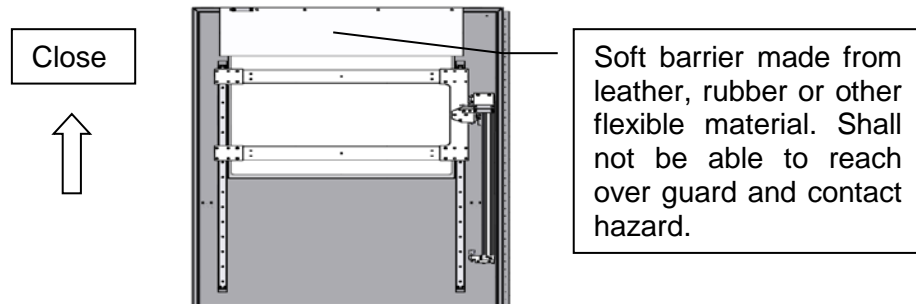
- Standard pneumatic components may be used. The door closed switch shall be safety rated for the category as determined by the risk assessment.
- Cannot have any hazards in the raise direction.
- Door is not physically coupled to cylinder and will stop if contact occurs.
- Rubber cushion required on door closing edge with 1" gap at bottom. Must not be able to reach hazards through gap.
- Door weigh cannot exceed 35lbs.
- Door must be properly guided using rails and bearings to eliminate binding or sticking.
- Light curtain, pressure sensitive safety edge or two hand control is not required.



## 6.2 Standard Cylinder – Upward closing door



- Cannot have any hazards in the Raise or lower direction.
- Door is physically coupled to cylinder
- Upward force cannot exceed 35 lbs.
- Door must be properly guided using rails and bearings to eliminate binding or sticking.
- Light curtain, pressure sensitive safety edge or two hand control is not required.
- 





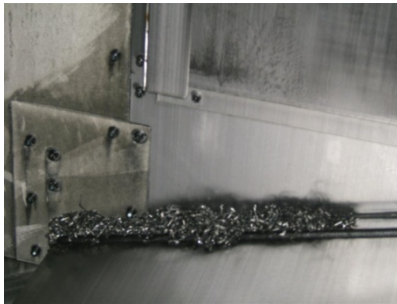
## 7. Maintenance

- 7.1 Daily maintenance and cleaning of the door guidance components is critical to the doors reliability and closing force repeatability. The operator doors shall include a laminated placard showing the critical areas that require cleaning. This placard shall be attached to the door or machine frame adjacent to the door.

### OKK Mill SD-\_\_\_\_\_

Daily door cleaning procedure

Clean and remove contamination in the following areas



If you are having problems with the door closing reliably contact your supervisor for assistance. Pressure regulator, flow control and cushion adjustment  
**by authorized personal only!**



## RECORD OF REVISIONS

| Revision # | Date   | Section | Description     |
|------------|--------|---------|-----------------|
| 001        | 31MR13 | ALL     | Initial release |
| 002        |        |         |                 |
| 003        |        |         |                 |
| 004        |        |         |                 |
| 005        |        |         |                 |
| 006        |        |         |                 |
| 007        |        |         |                 |
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