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## Safety Recommendations

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Safety Recommendations

Installation
The services and facilities to be provided by the customer should be installed according to local regulations.

Ground connections
The ground connection of the booth should be checked each time the equipment is put into operation. The ground must be connected by the customer to the base of the booth, Multicyclone, and filter housing(s). Also make sure that the workpieces, and all other systems are properly grounded.

Inspection
Before switching on the booth, check the following points *(where applicable)*:
- there are no foreign objects in the intake channel of the Multicyclone
- the Multicyclone is connected, the toggle catches are locked in
- the powder hopper is in place, the toggle catches are engaged and locked in, the pneumatic, and powder hoses connected to the powder pumps
- the After Filter is connected, the sealing frames are properly sealed, the pneumatic hoses are connected
- the Filter plate doors are closed, the waste powder trolley is in place

Entering the booth
In order to protect personnel when entered the booth for inspection and cleaning purposes, the Button - S5 (Booth cleaning) or the corresponding function on other types of control panels, must be actuated. This button (or command) starts the ventilation, however, the electrostatic control units, and other systems are interlocked and cannot be started.

When entering the booth make sure not to step on powder covering the floor.

⚠️ CAUTION  Danger of Slipping !

Repairs
Repairs and cleaning inside the booth (coating area) may only be performed *after* the Button - S5 (Booth cleaning) or the corresponding function on other types of control panels, has been actuated.

*Repairs should only be performed by trained personnel.*
Technical Data - MRS Booth
(subject to change)

Power requirements:
Voltage: 3 x 380 V / 50 Hz
Other voltages, and frequencies on request

Compressed air connection:
Inlet pressure: min. 6 bar / max. 10 bar
Recommended inlet pressure: 7 bar
Water vapour content: max. 1.3 g/m³
Max. oil content: max. 0.1 mg/kg (oil/air)
Squeegee Unit for MRS Multi-Recovery System

Field of application

Squeegee Unit

The squeegee unit pushes oversprayed powder along the floor of the booth into the fluidizing channel where it is returned to the powder hopper to be reused (see description of PTS Powder Transport System). Operation is automatic, but the operating interval can be preset to the customers requirements, etc.

Booth versions (option)

MRS booths are built to a modular system and are designed to match customer specifications, that is, according to the customers production requirements.

Booths can be completely equipped for automatic operation.

There are two versions of MRS powder coating booths available. One version is fitted with a squeegee unit and the other version is not. The version without a squeegee unit can also be fitted with a fluidizing channel to remove the powder from the inside of the booth, but it is not absolutely necessary. In this case of the oversprayed powder is removed (or pushed into the fluidizing channel) manually.

Booths fitted with a squeegee unit are highly recommended for single colour operation.

Booths without a squeegee unit are more suitable for short production runs with multiple colours where colour changes are frequent.

Fluidizing channel

A fluidizing channel can be fitted almost anywhere along the length of the interior of a powder coating booth.

The fluidizing channel is almost the same width as the squeegee beam.

The floor on the channel slopes towards the suction point where oversprayed powder is evacuated to the powder hopper.

The actual floor of the fluidizing channel is made of a porous plastic material which allows air to pass through it. The space underneath the floor plate is divided into three separate chambers, each supplied with compressed air by a small diameter hose. Fluidizing air is fed to the chambers when the booth is switched on.

Any powder, which has been pushed into the channel, manually or by a squeegee, is loosened up by the compressed air escaping from below and becomes fluid-like.

The powder starts to flow down towards the lower end of the channel where it is sucked away by the powder pump.

The fluidizing air is on all the time the squeegee is switched on.

The setting controls for the air required for fluidizing and suction are found on the pneumatic control panel next to the orange booth corner elements.
Description of the squeegee unit

The reciprocating squeegee unit (Fig. 1, below) consists of a mechanical scraper fitted with a transverse rubber blade on a carrier bar. The actual width of the bar is slightly smaller than the working width of the booth floor. When the squeegee unit is switched off the bar finishes its cleaning cycle and parks at one end of the booth.

The following description is of a booth with a fluidizing channel (C - Fig. 2, page 3) when the conveyor travels from left to right (seen from the operating position). The actual position of the components described can differ due to customer configuration requirements, but in principle all functions are the same.

The squeegee unit is activated by a signal from the control panel and operates at preset intervals during the coating operation, until switched off. The squeegee bar (8 - Fig. 2, page 3) slides along the booth (longitudinally) on flat, self-cleaning rails, driven by an electrically operated cable system. There is one cable loop (9 - Fig. 1) on each side of the bar running along the length of the booth.

The cables are wound a number of times around grooved drums (1 - Fig. 1) at each end of a transverse shaft (2 - Fig. 1), driven by a single, centrally located electric worm drive motor (4 - Fig. 1) under the booth. The worm drive is fitted with an adjustable slipping clutch (at the other end of the shaft holding the sprocket - 3, Fig. 1) for safety to protect the electric motor from damage if the bar or the cables are blocked and so that the plastic coated cables cannot cause damage to the booth or personnel. Each of the plastic coated cables pass over a pair of pulleys fitted one at each end of the booth. One pulley of the pair (10 - Fig. 1) has a screw fitting to tension the cable. The other pulley (11 - Fig. 1) of the pair is not adjustable.

The cables are cleaned by compressed air when they pass through special sleeves (12 - Fig. 1) at each end of the booth as they leave the inside of the booth. This prevents powder building up on the cables, which could cause them to slip in the grooves of the drums, and also that one colour powder does not contaminate another colour powder after a colour change. The speed of the squeegee unit is constant.
One complete cycle of the squeegee bar consists of a forward, and a return stroke, whereby oversprayed powder is pushed along the floor of the booth until it falls into the fluidizing channel (C - Fig. 2, below) to be returned to the powder hopper for reuse. The squeegee bar is lifted automatically when it reaches the fluidizing channel. On the stroke towards the fluidizing channel the bar should always be in the lowered position. When the blade is moving away from the fluidizing channel (C - Fig. 2), in either direction, the lifting dogs (2 - Fig. 2) raise the squeegee bar (8 - Fig. 2). The blade has enough clearance over the powder so that it is not transported to either end of the booth. The rubber blade of the squeegee slides along the booth floor in the lowered position so that a maximum amount of powder is returned to the fluidizing channel at each stroke.

**Description of a squeegee cycle**

Assuming that the cycle starts with the bar at rest on the far left-hand side of the booth:

The squeegee unit is started up. The bar starts to move to the right. The blade is set in the lowered position and the powder on the floor is moved towards the fluidizing channel (C - Fig. 2). As the blade reaches the fluidizing channel it is lifted to the raised position by the double dogs (2 - Fig. 2) mounted on the side walls of the booth and no powder is moved with the blade. The bar (8 - Fig. 2) travels almost to the other end of the booth where it is tripped to the lowered position by another pair of single dogs (1 - Fig. 2) mounted on each side wall of the booth. The direction of travel of the bar is reversed by proximity switches (B - Fig. 2) fitted at each end of the booth. The bar starts the return journey (to the left) towards the fluidizing channel, carrying excess powder with it.

The powder in the fluidizing channel (C - Fig. 2) is continuously being evacuated to the powder hopper. When the bar reaches the fluidizing channel again it is lifted clear of the fluidizing channel by the double dogs (2 - Fig. 2) mounted on each side wall of the booth. When the bar reaches the end of its stroke the blade is automatically tripped to the lowered position by the other single dogs (1 - Fig. 2) ready to start a new cycle (to the right) again. Fluidizing air chambers, below the fluidizing channel, are constantly supplied with compressed air to fluidize the powder which is pushed into the channel. The fluidized powder is continuously sucked into the opening at the lower end of the fluidizing channel (C - Fig. 2) by a powder pump where it is fed back to the powder hopper by the PTS Powder Transport System for reuse.

![Diagram of a squeegee cycle](image-url)
ICS Control unit

Operator controls on the switch cabinet

The number, and positioning of the elements on the switch cabinet or even the control unit type can vary, according to the plant specifications. For the relative operating instructions etc, see the corresponding documentation supplied with the equipment.

S0  Emergency stop (Mushroom type - not shown)
S0.1  Key switch: control voltage - ON/OFF
S1  Plant - OFF
S2  Plant - ON
S5  Booth cleaning
S6  Lighting
S7  Alarm - OFF
S10  Squeegee - Manual
S19  Fresh powder - Automatic/OFF
Q0  Main switch (not shown)
H0  Control voltage - ON (white)
H1  Plant - ON (green)
H2  Booth cleaning
H6  Powder hopper - Empty
H7  Alarm - OFF
H8  Motor fault
H20  Alarm signal
H32  Squeegee fault
H38  Too much exhaust air (Fan 1)
H39  Too little exhaust air (Fan 1)
MRS Booth with squeegee, and fluidizing channel

Start Up Sequence

When the squeegee is started up or switched off the cable rinsing is switched on or off respectively.
The squeegee movement sequence is as follows:
Start up takes place through a set time function. The start interval can be set from approximately 30-90 seconds.
The squeegee is driven by a three-phase AC motor.

The forward and backward movement of the squeegee has cycle time monitoring of 60-120 seconds. The signal to stop the squeegee comes from a proximity switch in the booth.
There is a delay and then the reversing movement starts. The cycle time monitoring is through a time function with a time range of between 30-90 seconds.
When the squeegee reaches the other end of the booth it stops and waits for a new start signal from a time function.

Powder cleared away through a powder pump

The conveying air is controlled by a level sensor in the powder hopper.
The conveying air is switched off during the prefluidization of the powder hopper with time functions for switching to the next suction position or through the alarm signal.
The switching on of the fluidizing air is controlled by powder conveying or the squeegee operation. There is no prefluidization.

Powder clearing with a built-on powder hopper

The switched on of the fluidizing air is controlled by the level sensor in the powder hopper.
There is no prefluidization. The prefluidization air is switched off during the fluidization in the powder hopper, and there are also no time functions.

Settings for the squeegee, fluidizing channel, cable cleaning, and powder pump

Setting values:
- Fluidizing channel air pressure: 1-4 bar*
- Cable rinsing pressure setting: 2 bar (Pressure gauge A2xx)**
- Fluidizing channel suction point: Maximum 3 bar (Pressure gauge A2xx)**

Electrical settings:
- Squeegee monitoring: In the control unit A71:
  Timer B11 set to 60-120 secs
- Fluidizing channel suction point: In the control unit A72:
  Timer B01 set to 8 secs - Coating operation
  Timer B23 set to 15 secs - Cleaning operation

* Must be set according to the type of powder used. The powder must flow.
** Pressure gauges are identified according to customer specified functions
## Maintenance Schedule

<table>
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<tr>
<th>Assembly /Function</th>
<th>Cause</th>
<th>Interval</th>
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<tr>
<td><strong>Squeegee - MRS</strong></td>
<td>- Check Functioning</td>
<td>Weekly</td>
</tr>
<tr>
<td>- Slipping clutch</td>
<td>- Check Functioning</td>
<td>Weekly</td>
</tr>
<tr>
<td>- Cable tensioning</td>
<td>- Check Functioning</td>
<td>Weekly</td>
</tr>
<tr>
<td>- Cable cleaning</td>
<td>- Check Seals</td>
<td>Weekly</td>
</tr>
<tr>
<td>- Drive</td>
<td>- Oil change (with single shift operation)</td>
<td>Every 3 years</td>
</tr>
<tr>
<td>- Stops suddenly</td>
<td>- Too much powder in the booth</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Slipping clutch set too loose</td>
<td></td>
</tr>
<tr>
<td>- Powder escapes from the cable sleeve</td>
<td>- Rinsing air not switched on</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Rinsing pressure too low</td>
<td></td>
</tr>
</tbody>
</table>

| **Fluidizing channel (Organic powder) MRS** | | |
| Fluidization | Check functioning | Daily |
| - Poor fluidization | - Check fluidizing air | |
| - Fluidizing channel clogged | - Check powder transport (Conveying pressure, Transport hose etc.) | |
| | - Dirt in the fluidizing channel | |

| **Fluidizing channel (Enamel powder) MRS** | | |
| Fluidization | Check functioning | Daily |
| Magnet separator | Clean | Daily |
| - Poor fluidization | - Check fluidizing air | |
| - Fluidizing channel clogged | - Check powder transport (Conveying pressure, Transport hose etc.) | |
| | - Dirt in the fluidizing channel | |

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**NOTICE**

Detailed information about individual assemblies are found in the corresponding Operating Instructions. It is recommended that the plant be inspected annually (after 2000 hours operation) by an ITW Gema specialist. Please contact your ITW Gema Representative.
Removing a squeegee drive cable

If both cables are to be replaced it is recommended to replace one cable at a time, as this will retain the approximate end stroke positions of the squeegee.

- The squeegee should be positioned approximately in the middle of the booth.
- Switch off the booth at the Mains.
- Remove the corresponding side panel from the base of the booth nearest to the drive unit (4 - Fig. 4, page 8).
- Remove the corresponding lower curved corner panels from each end of the booth.
- Release the tension on the cable (9 - Fig. 4, page 8) completely by unscrewing the tensioning screws of the adjustable pulley (10 - Fig. 4, page 8) at one end of the booth. After assembly the new cable can be tensioning to a maximum with the tensioning screws.
- Loosen the clamping bolt on the clutch (3 - Fig. 4, page 8) of the drive unit (4 - Fig. 4, page 8) just enough to be able to turn the cable drums by hand.

\[\text{CAUTION}\]

Do not place fingers between the cable and the drum!

- Unscrew the cable clamping screws on each side of the drum (1 - Fig. 4, page 8) and remove the ends of the cable from the V-shaped slots.
- Unwind the cable from the drum.
- Enter the booth. Take care not to have any loose powder on the floor.

\[\text{WARNING}\]

Danger of slipping !!!

- Unscrew the four bolts (15 - Fig. 5, page 8) holding the cable clamp plate (13 - Fig. 5, page 8) on squeegee shoe assembly (14 - Fig. 5, page 8).
- Lift off the cable clamp plate and pull the cable out of the groove.
- Pull both ends of the cable into the booth through the rinsing bushes (12 - Fig. 4, page 8) at each end of the booth.
- Roll up the cable and remove from the booth.

Fitting a new squeegee drive cable :

- Thread the ends of the new cable through the rinsing bushes at each end of the booth from inside the booth.
- Pass the cable over the pulleys at each end of the booth.
- Pull enough cable under the booth to be able to continue the winding operation.
- Strip off approximately 4 cm of the plastic covering (grounding) from the end of the cable to be wrapped around the outer groove of the drum.
- Fit the end of the cable into the V-shaped slot (4 - Fig. 6, page 9) on the side of the drum and tighten the clamping screw and washer. Make sure there is a good metal-to-metal contact between the screw, cable, and drum.
- First, wrap the cable approximately 1 1/2 times, clockwise, tightly around the drum with the long end of the cable towards the centre of the booth. The cable should leave the drum on the underside (see Fig 6, page 9).
- Lift the squeegee beam completely out of the vertical guideways and place away from the slides in the booth.

(continued on page 9)
The squeegee cable drive

Fitting a squeegee cable

Figure 4

Figure 5
Fitting a new squeegee drive cable (continued):

- Pull the fixed cable tight from inside of the booth. Make sure that the cable is in the groove of pulley.
- Turn the drum in a clockwise direction. The cable must be tight around the drum. When the cable driven squeegee shoe (14 - Fig. 5, page 8) has reached the end of the booth pull the loose end of the cable tight and fit it into the groove next to the cable already on the drum. Wrap the remaining cable onto the drum until it reaches the V-shaped slot (4 - Fig. 6) on the inside of the drum. Strip off enough of the plastic cover (grounding), like the other end of the cable, and fit the screw and washer. Cut off any surplus cable.
- Position both squeegee shoes so that the beam is at right-angles to the booth slides.
- Fit the squeegee beam in the guideways on the slide shoes (14 - Fig. 5, page 8).
- Strip off enough of the plastic cover from the cable, where it passes under the clamping plate (13 - Fig. 5, page 8), to allow it to fit tightly into the groove.
- Place the clamping plate (13 - Fig. 5, page 8) with the cable on the slide shoe (14 - Fig. 5, page 8).
- Tighten the four clamping plate bolts (15 - Fig. 5, page 8). Check that the cable has no slack.
- Tension the cable by tightening the tensioning screws of the adjustable pulley (10 - Fig. 4, page 7) until the cable is tensioned and cannot move out of the groove.
- Turning the cable drums (by hand) to test the squeegee stroke to both ends of the booth and to see if the cable is positioned correctly on the drum.
- Tighten the clamping bolt on the clutch (3 - Fig. 4, page 8) so that the clutch slips when a foot is used to stop the drums turning.

![CAUTION](image)

Do not place fingers between the cable and the drum!

- Switch on the booth power and test run the squeegee to check that it reverses automatically at both ends of the booth without problem.
- Re-tension the cable, if necessary.

Grooved cable drum

Figure 6 shows how the cable should be wrapped around the drum.

![Figure 6](image)