

# INSTRUCTIONS FOR MANUAL SCREENING OF MECS<sup>®</sup> CATALYST FOR SULFURIC ACID

## GENERAL

Screening the converter catalyst will be necessary from time to time due to increased pressure drop from dust and scale. In spent acid regeneration and metallurgical plants, impurities not removed in the gas cleaning system will deposit on the catalyst. In sulfur burning plants, impurities from the incoming sulfur will accumulate in the catalyst and cause pluggage. The increased pressure drop limits plant capacity and increases the cost of production.

Catalyst movement inside product packages during transport will create fine dust. Keep unnecessary personnel away from the work area when emptying catalyst packages or when working with the catalyst. If enclosed handling cannot be guaranteed, ventilation, protective clothing, and other personal protective equipment (PPE) must be used.

Avoid catalyst contact with skin and eyes. Skin irritation occurs on contact with wet or moist skin. Avoid inhalation of dust. Catalyst dust is toxic due to its vanadium salt content. Crystalline silica (quartz and cristobalite) may be present in both new and used catalyst. Respirable crystalline silica (that can lodge deep in the lungs) is classified as a known or probable human carcinogen by various international authorities.

Observe good personal hygiene measures after handling this material such as removing contaminated clothing and PPE and washing before eating, drinking and/or smoking.

## SUGGESTED PROCEDURE FOR MANUAL SCREENING OF MECS<sup>®</sup> CATALYST

1. If permanent platforms do not exist at converter manhole(s) prior to shutting down, erect temporary platforms at the converter manholes(s) from which catalyst will be removed. Provide safe access to the platform(s).
2. The screening operation should not be conducted while it is raining because the rain or high humidity may damage the catalyst. Catalyst that is exposed to high moisture may have reduced structural integrity and a loss of conversion performance. Polyethylene sheeting and rope or wire should be on hand to cover the manholes during rainfall and whenever screening work is not taking place.
3. Cool the converter by blowing dried air through it until the temperature is low enough for people to work safely. Once the dry blow is complete and the converter is opened up, it will cool rapidly to the point where it can be worked in comfortably. General safety for confined space entry should be followed, such as checking the atmospheric conditions before entering the space.
4. The bed thermocouples and wells should be removed before removing the catalyst to prevent thermocouple damage.
5. Prior to removing catalyst and support media (quartz rock or ceramic balls), draw a line with chalk or permanent marker around the converter shell at the support media level. When the converter bed is empty, draw another line 2 inches (50 mm) below the original one. These will serve as guides for reloading to the proper height. If used sparingly, a can of spray paint can simplify marking the levels.
6. The screened support media and catalyst should be collected in dry, closed waterproof bags or drums and stored on pallets until ready to return to the converter. Catalyst should be stored indoors (recommended) or covered and protected from weather outdoors. The drums or bags should be clearly labeled with the catalyst pass number and the catalyst location in the bed (top, middle, or bottom).
7. It is recommended to screen the catalyst in layers. The top quartz rock or ceramic balls are scalped off first. Then typically the catalyst is divided into three layers (top, middle, and bottom). The bottom quartz rock or ceramic balls is the final layer.

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If a mechanical screen is used, the catalyst screen should be a two-stage motor-driven unit, Rotex or equal. The upper screen should have openings small enough to retain quartz pebbles or ceramic balls, but large enough to pass the catalyst. The lower screen should have openings large enough to pass dust and chips to the bottom deck for disposal. In some instances, it is desirable to separate pellet catalyst from ring catalyst, so that the ring catalyst can later be reinstalled on top to maximize dust penetration which minimizes pressure drop build-up.

Table 1 shows the recommended screen sizes to achieve good separation of support media and MECS<sup>®</sup> Catalyst, while keeping screening losses to a minimum and retaining acceptable size catalyst for reuse. The screen should be located in an open, accessible area near the converter.

Careful manual handling of catalyst will minimize screening losses. A pulley arrangement installed on top of the converter will facilitate lowering and raising buckets of catalyst.

If catalyst is transferred to ground level through a hose, precautions should be taken to minimize how far the catalyst drops. The hose should be kept full of catalyst by using a slide gate at the bottom of the hose to control the flow of catalyst to the screen.

Twenty to twenty-five liter buckets, with handles, will probably prove to be most convenient for maneuvering within the converter and for moving into and out of the manways. Catalyst should be put into the buckets with short handled scoops, such as those used in grocery and hardware stores for handling bulk materials.

The buckets of catalyst should be screened as soon as they are removed from the converter.

8. Observe the conditions of the grid slots and clean them out if they are plugged with bits of rock and catalyst. Normally these grid slots will not require cleaning, but occasionally small pieces of rock become lodged in the slots causing added pressure drop.

In carbon steel converters, it is recommended to inspect the caulking between the grids and the converter shell and the spacing between the grids to check that there are no openings large enough to allow rock and catalyst to fall through the grids. Some division plates are covered with insulating brick. This insulating brick should be inspected and repaired, if necessary.

9. When reinstalling catalyst, be sure a level, 2 inch (50 mm) layer of quartz rock or ceramic balls is installed on the grids first. Use wide boards or panels of plywood as a working platform inside of the converter. In no case should workers be permitted to walk directly on the support media or catalyst, as this will create an uneven layer of support media and will break the catalyst.
10. Install the bottom thermocouple(s) on top of the bottom layer of quartz rock or ceramic balls. Thermocouples should always be located at the rock/catalyst interface. Approximately 6 inches (150 mm) of the tip end of the thermocouple should rest on a single layer of rock with another layer of rock above it.
11. Screened, original catalyst should be installed in the lower portion of the bed first, layer by layer. The screened catalyst from the bottom layer of the bed will be placed at the bottom of the bed again. The middle screened layer is added next, and then the top screened layer is replaced. New, fresh catalyst is then installed on top of the older catalyst. This approach should be used for all passes of the converter. After the specified amount of catalyst has been placed in a converter pass, the layer should be carefully leveled to ensure uniform thickness in the catalyst bed.

Install the top thermocouples(s) on top of the catalyst. Thermocouples should always be located at the rock/catalyst interface. Approximately 6 inches (150 mm) of the tip end of the thermocouple should rest on a single layer of rock with another layer of rock above it.

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12. A minimum 2-inch (50 mm) deep layer of quartz pebbles or ceramic balls is placed on top of the catalyst in each converter pass. This top hold-down layer should be carefully leveled also.
13. Before sealing on the manway covers, inspect the converter to ensure that all equipment has been removed, all catalyst beds are level, and that all parts of the converter are clean. Remove any dust that may have fallen through the grids onto the division plates while installing the catalyst to prevent unnecessary pressure drop in downstream equipment or catalyst beds. The use of a vacuum cleaner is desirable, but brushing with a soft brush is also acceptable.
14. The manways should be closed and the converter sealed off from all access by water or wet air until the plant is restarted.

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Table 1: Recommended Screen Sizes for MECS<sup>®</sup> Catalysts

To Separate Support Media from Catalysts, Use:

Screen Sizes	Comments
5/8" x 5/8" (15.7 mm x 15.7 mm) Square	Retains Support Media
9/16" x 1.0" (14 mm x 25 mm) Slotted	Retains Support Media
9/16" x 1-1/2" (14 mm x 38 mm) Slotted	Retains Support Media

To Separate GR-330, GR-310, XLP-110, XLP-220, XCs-120, SCX-2000, LP-120, and Cs-120 from Other Rings, Pellets or Fines, Use:

Screen Sizes	Comments
3/8" x 3/8" (9.4 mm x 9.4 mm) Square	Retains Essentially Whole Rings
3/8" x 2" (9.4 mm x 50 mm) Slotted	Retains Essentially Whole Rings

To Separate GR-330, GR-310, XLP-110, XLP-220, XCs-120, SCX-2000, LP-110, LP-120, LP-220, Cs-110, and Cs-120 from Pellets or Fines, Use:

Screen Sizes	Comments
9/32" x 2" (7 mm x 50 mm) Slotted	Retains Whole Rings
5/32" x 2" (3.9 mm x 50 mm) Slotted	Retains Whole Rings, Plus Acceptable Chips
1/4" x 2" (6.3 mm x 50 mm) Slotted	Retains Whole Rings, Plus Acceptable Chips
7/32" x 2" (5.5 mm x 50 mm) Slotted	Retains Whole Rings, Plus Acceptable Chips
3/16" x 2" (4.7 mm x 50 mm) Slotted	Retains Whole Rings, Plus Acceptable Chips

To Separate T-11, T-210, and Cs-210 Pellets from Fines, Use:

Screen Sizes	Comments
5/32" x 5/32" (3.9 mm x 3.9 mm) Square	Retains Pellets, screen size determines how many fines are purged
3/16" x 3/16" (4.7 mm x 4.7 mm) Square	Retains Pellets, screen size determines how many fines are purged
1/4" x 1/4" (6.3 mm x 6.3 mm) Square	Retains Pellets, screen size determines how many fines are purged

**NOTE:** Screening losses are normally made up by adding fresh, whole ring catalyst on top of the screened material. Chipped ring catalyst, mixed with whole ring catalyst, can be reinstalled in all converter beds, with no measurable increase in "clean" plant pressure drop. The rate of subsequent pressure drop increase is proportional to the size and quantity of the broken pieces. This can be controlled by occasional screening with a larger screen size opening.