



Stabilized Magnesium Hydroxide Slurry Railcar Unloading Procedure

This document is based on the methods observed at Martin Marietta Magnesia Specialties' transload terminals to successfully unload Stabilized Magnesium Hydroxide Slurry bulk railcars to agitated storage. The same procedure may be used to unload any of Martin Marietta Magnesia Specialties' slurry products at customer sites. Follow all safety and regulatory requirements.

Railcars may be unloaded either by transfer pump or by pressurizing the railcar. Both processes are described below. Always sparge car before offloading, regardless of which process is used.

Railcars are designed to be completely unloaded into a suitable mixed storage tank upon receipt, and are not intended to be used for storage for an extended period of time, even if sparged regularly during that time.

Procedure:

1. Record the railcar number, quantity in the car, and product identity in each of the railcars available to unload.
2. Determine the storage tank(s) storing the same product, and having sufficient volume to unload the car.
3. Spot, brake, and block the wheels of the appropriate car at the unloading station.
4. Inspect railcar for damage and that it appears fit for intended use.
5. Assemble all tools and fittings and inspect to ensure that they are clean, in good condition, and that they appear fit for intended use.

Note: Always use safety precautions when ascending, descending, or atop the railcar - especially during inclement weather.

6. Do not start unloading until there is sufficient storage space to hold the entire car.
7. Vent the car using the $\frac{3}{4}$ " or 1" vent ball valve (located at the center of the car near the top man-way) to relieve any pressure buildup. Slowly open valve to preclude any slurry discharge.

Note: It may be necessary to remove wire seals from valves and man-way prior to opening. On some railcars, the valve handle may be separated from the body of the valve and stored in a sealed recess located near the valve.

8. Open man-way at top of car. Prop it open to allow air to escape during sparging.

Note: Do not break the plane of the man-way with body parts as this requires vessel entry procedures. Railcars are filled based on the weight-bearing capacity of the tank car and rail lines being used, not by volume. It is not unusual for the cars to appear partially filled. Prior to sparging, there may be a thin layer of

clear water above the white magnesia liquid; this is normal. Thicker water layers may indicate the need for more sparging time, up to 90 minutes.

Note: The magnesia is loaded warm; a cloud of water vapor on a humid or cold day may be present. In winter, the presence of ice or a liquid temperature less than 40 degrees F indicates that the heating coils** should be used prior to sparging.

9. Connect 50-70 psig air-source providing 50-150 ACFM, preferably 80-120 ACFM. Use the 2" sparger line and connection-adapters as required.

Note: Obey all plant safety requirements for handling compressed air.

The 2" sparger pipe may be observed to proceed from the valve on top of the car straight down through the surface of the liquid, when viewing through the man-way. Below the surface of the liquid, this connects to a series of air outlets evenly spaced along the length of the car, a few inches off the bottom. Other relief or vent lines may be present on top of the car for safety during transit, but these are not used for unloading. Wear safety glasses during sparging, since vigorous sparging sometimes splashes.

10. Initiate compressed air flow to properly vented car. Sparge the car 60-90 minutes (minimum) prior to the beginning of unloading (preferably upon arrival at customer or terminal). Thereafter, sparge for 30 minutes daily, or at least 60-90 minutes every 3-4 days.

Note: The railcar is not intended to be used for storage for an extended period of time, even if sparged regularly (see last step of this procedure).

Air should be observed to vigorously mix the liquid as it rises from the nozzles positioned along the length of the railcar. As the liquid mixes, the thin layer of water is dispersed. Failure to observe a series of sparging "air fountains" may indicate lack of sufficient air pressure or volume, incorrect valve position, connection to the wrong railcar fitting, excessive time since loading, liquid temperature less than 40 degrees F, or equipment damage.

11. **Maintain a minimum liquid temperature of 40 degrees F. If needed, use low-pressure steam (15 psig max) or hot water to external heating coils while sparging contents. The target slurry temperature after heating is 50 degrees F. A significant amount of energy will be needed to raise the slurry temperature past 50 degrees F and excessive heating and/or insufficient agitation while heating, may cause the product to bake on the internal walls of the tank car. Check stenciled markings on car for additional guidance on using steam coils.
12. Frozen slurry forms from the walls and grows to the center. The slurry in the center of the car will be warmer than along the walls. Agitating (or sparging) the cars will even the temperature. Agitating the cars while heating will avoid "cooking" the slurry by assuring even heat distribution, and will also avoid railcar lining damage.

**Railcar Heating Notes: Obey all plant safety requirements for handling steam. Do not steam/heat closed or sealed railcars; the manway hatch should be left open. Locations of the coil inlet and outlet are marked on each car. The coil does not directly contact the magnesia within the car, so there is no product dilution. The coil does not heat the car unless steam flows in and out, sometimes the steam will condense and condensate flows out. Direct hot condensate and blow-through steam, if any, safely away from personnel. Do not attempt to heat the railcar contents beyond 70-80 degrees F. Heating to 50 F is sufficient. Close steam valves prior to disconnecting steam and condensate fittings and hoses.

13. Continue to sparge while car is being unloaded.
14. Verify that the bottom unloading valve is closed. Then remove cap from male camlock fitting bottom of car bottom unloading line.
15. Connect 4" suction line with female camlock end to bottom of railcar male camlock.
16. Connect compressed air to blow-out valve in coupling. Use air-port to back-flush bottom unloading valve free of settled solids.

Pump Unloading

Note: Please contact the Application Center at (410) 761-8392 for transfer pump recommendations.

17. Prepare the pump and filter for use. Turn on the pump seal water. Connect hoses and verify proper seal. Set valve positions to pass through the filter, pump, and to the chosen tank (or trailer), verify that the filters and flush valves are closed and sealed. Record car and product to be unloaded, storage tank number (or trailer), tank start level.
18. Open unloading valve, back-flush with pressurized air, shut air valve, then open valve in unloading line to pump suction.
19. Turn on pump and pump railcar contents to the proper storage tank. Watch change in tank level by using the level indicator, and the railcar level by inspection. Use proper safety precautions when on the railcar, especially during inclement weather. Record ending tank level.
20. If slurry pumping ceases, stop pump, wait several minutes to recover flooded pump suction, and restart. Inspect via manhole. If car is empty, close unloading valve. Make note of cars that were not completely unloaded or that left large heels.
21. Blow out unloading line through pump and to tank.
22. Turn off air compressor and prepare for next use.
23. Disconnect hoses connected to the sparge line. Close top valves. Return chained valve handles to receptacles. Seal man-way.
24. Disconnect unloading hose and fittings on bottom of the car.
25. Reconnect female dust cap to railcar male unloading camlock fitting.
26. Reconnect male plug to female unloading hose, to prevent internal drying.
27. Flush out filter basket, filter, pump and fittings as required.
28. Shut off seal water to pump and prepare pump and filter for next use.
29. Promptly re-consign empty railcar to plant where railcar originated or as directed.
30. Record the unloading date, railcar, operator, material, storage tank, and other information as directed. Submit records to the office for processing.
31. Report railcars that require maintenance, railcars that were not completely unloaded, or cars that had trouble unloading.
32. Railcars are designed to be completely unloaded into a suitable mixed storage tank upon receipt, and are not intended to be used for storage in extended period of time, even if sparged during that time.

Compressed Air Unloading

Note: Railcars are equipped with pressure relief valves or rupture discs that will limit the maximum pressure inside the vessel. Maximum allowed pressure is posted on the railcar. Martin Marietta Magnesia Specialties does not recommend pressurizing railcars beyond 50 PSI.

17. With air to the sparging pipe on, close vent and manway to begin to pressurize the railcar. It is recommended to use a regulator which will limit pressure to 50 PSI.
18. Verify that the receiving tank is vented
19. Open unloading valve at the bottom of the railcar. Open the valve on the fill line of the receiving tank. Watch change in tank level by using the level indicator. Record ending tank level.
20. When car is empty, close unloading valve. Make note of cars that were not completely unloaded or that left large heels.
21. Blow out unloading line to the tank.
22. Turn off air compressor and prepare for next use.
23. Slowly open the vent to depressurize railcar. This may take several minutes to fully dissipate the air pressure or vacuum that may have built up. It is preferred that you open the top manway hatch again to verify the car is not released under pressure or vacuum. Note that there may be a lot of pressure on the hatch and care should be taken not to be in the way of the lid as it is opened.
24. Disconnect hoses connected to the sparge line. Close top valves. Return chained valve handles to receptacles. Seal man-way.
25. Disconnect unloading hose and fittings on bottom of the car.
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Note: A schematic diagram of a typical railcar is available at www.magnesiumspecialties.com or call the Glen Burnie, MD Application Center at (410) 761-8392.

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