



GLASS-LINED EQUIPMENT INSPECTION EGUIDE

***An overview of the procedures used to examine
glass-lined vessels***

Routine inspections are vital to sustaining the condition of your glass-lined steel process equipment. De Dietrich Process Systems offers a program designed to meet customers demands for preventative maintenance, including OSHA's Process Safety Management requirement for mechanical integrity of process equipment.

Benefits of this program are:

- an extensive documented inspection history for each vessel covered
- preventing possible severe damage before it occurs
- a periodic extensive inspection by an experienced and trained specialist

Each of these benefits aide in projecting and prolonging your equipment's life.



This eGuide is designed to provide a general overview of the procedures De Dietrich Process Systems uses to inspect glass-lined equipment, including the glass lining, agitation system, accessories and vessel exterior. Its contents should only be used as a guideline; specific instructions from the vessel supplier should always be followed. Only well-qualified technicians should carry out these inspections. Damage to the glass lining can occur during some inspection techniques if they are not done properly.

Inspection Frequency

To ensure the continued performance and well-being of your glass-lined steel equipment, regularly scheduled inspections should be conducted to examine the interior and exterior of the vessel as well as the associated components (e.g. agitators, baffles, etc.). This chart lists the recommended frequency of inspections* for each different type of equipment:

Type of Equipment	Inspection Frequency*
Storage Tanks	3-5 years
Vessels with agitators	Annually
Vessels without agitators	1-2 years
Repaired equipment: Plugs <1 inch	After 1 month, 6 months, then annually
Repaired equipment: Plugs >1 inch	After 1 month, 3 months, 6 months, then annually
Equipment that undergoes service changes	After each service until history is established then at normal frequency

**This information is general in nature. Recommended inspection frequency can vary greatly depending on a combination of factors such as process conditions and how the equipment is operated. If you are unsure it is best to consult with your equipment manufacturer for their recommendation based on your specific process information.*



Preparing for an Inspection

Prior to inspecting a vessel and its components it is important to obtain documentation from previous inspections and services. These documents will provide a necessary reference regarding repair locations, the condition of existing plugs and patches, as well as the identification of any other issues that were noted during the last examination. This data will help benchmark the condition of the equipment during the last inspection and identify the location of specific areas that need close analysis.

The vessel must also be thoroughly cleaned and dried to remove any product that could endanger the personnel entering the vessel or inhibit the testing procedures and results. Once you have taken care of these steps and you have secured a certified technician, you are ready to have your equipment inspected.



External Inspection

External inspection refers to the examination of all exterior parts of the vessel, including the shell, jacket, lifting lugs and supports. Once verifying the information on the vessel nameplate, the vessel should be checked to ensure it is properly leveled. The following areas should be closely looked at during this step in the inspection process to check for corrosion, erosion and mechanical damage:

Shell and Jacket

- Areas around welds and bolting
- Nozzles and crevices (e.g. between back-up flange and underside of nozzle stub)
- Nozzle sealing surfaces (gasket leakage can lead to corrosion)
- Gasketed joints
- Insulation and coating system
- Uninsulated areas

Inside Jacket

- Impingement plates of all jacket nozzles
- Steel surface (can be examined via inspection ports)
- Bottom jacket clean-out port (checking for accumulated sludge)

Support System

- Welds on legs, feed, side lugs

Additionally a jacket thickness test can be performed using an ultrasonic thickness gauge. It is important to measure in the same locations during each inspection in order to accurately note any changes to the metal thickness.



Internal Inspection

The activities included in an internal inspection include visual examination, glass thickness measurement, and spark testing. Visual examination usually consists of a technician entering a vessel, however, there are some instances when remote visual inspection via cameras is used. Here we've outlined the issues to look for during the following visual examination procedures:

Visual Examination

Inspection of Plugs and Patches

- Loosening and corrosion
- Spaces between the repair and the glass surface
- Embrittlement of tantalum
- Rust stains around edges

Mechanical Seal and Agitator Drive Inspection

(Note: Mechanical seal should be removed to enable full inspection. During inspection of drive gearing, oil should be changed)

- Leakage or damage
- Corrosion in mechanical seal area of the agitator and under split-ring flanges

Glass Thickness Measurement

This procedure measures the glass thickness using a magnetic coating thickness gauge to assess where "firepolish" is lost. Glass thickness measurements should always be taken at the same locations during each inspection in order to accurately evaluate if any erosion has taken place.

StatiFlux Testing

Additionally, Statiflux testing can be conducted if a vessel has undergone mechanical or thermal stress, which could cause cracks in the lining that can't be detected with visual inspection or spark testing. During this test, a special talc-based powder is electrically charged and sprayed onto the glass lining to reveal any cracks.



Spark Testing

During spark testing, the entire glass-lined surface is inspected and any chips, cracks, pinholes and other defects should be documented and marked. It is important to carefully inspect nozzles and other internal attachments, as these areas are extra susceptible to damage. There are two apparatuses available for spark testing:

- DC spark testers – preferred method, portable and less hazardous; requires vessel to be grounded
- AC spark testers – must be used when examining removable agitators and other equipment that are completely glassed and can't be grounded

Repaired areas should be avoided during this procedure as the voltage from the spark tester can damage the PTFE (instead, repair areas are inspected thoroughly during the visual examination). Due to the residual charges that build up during this procedure, spark testing should be the last test conducted before exiting a vessel.

Inspection of Peripherals

Once the body of the vessel has been inspected it's time to assess the auxilliary components including the agitation system, baffles, bolting, piping and various other accessories and parts.

Agitation System

- Inspection of drive/motor coupling alignment
- Check drive oil pressure (on PTE units)
- Document rotation
- Visual inspection for any corrosion or mechanical damage
- Check bolting for correct size, position & torque
- Document run-out
- Visual inspection of mechanical seal for leakage and performance
- Document seal design
- Visual inspection of lubricator oil level pressure (15 to 25 psi over max internal operating pressure)
- Visual inspection of all connections for leaks and damaged fittings
- Verify method and medium used to pressurize lubricating system
- Overall inspection of agitating system to assess general condition

Accessories

- Visual inspection of all gaskets to verify type, positioning and orientation of any shim and leakage
- Check bolting for correct size, position and torque
- Verify correct size and quantity clamps, condition, retaining cable in place and torque
- Visual inspection of manway assist for alignment, performance and corrosion
- Test operation of manway assist, check setting and verify type
- Check valve for leakage, proper bolting and verify type
- Inspect method of piping including location of expansion joints and if piping is adequately supported
- Document location and visual inspection of all accessories installed



Professional Inspections

While it's convenient to have knowledgeable maintenance personnel on hand who are familiar with glass-lined equipment, an alternative to self inspection is to hire an experienced service technician who can perform the inspection for you. One of the many benefits to hiring a professional is that they typically have a better idea of what to look and what to look for. Additionally, they can provide you with detailed documentation listing all the findings from their inspection. De Dietrich Process Systems' experienced field service technicians can perform inspections on your vessels and peripheral equipment onsite and provide you with the following documentation:

- Vessel Inspection Checklist
- Vessel Glass Thickness Inspection Report
- Vessel Exterior Inspection Sheet
- Agitation System Checklist
- Accessory Checklist

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