



MECHANICAL INTEGRITY

1.0 Purpose

This element identifies Petsec's Mechanical Integrity (MI) program as required by its Safety and Environmental Management System (SEMS) Program and applies to all Petsec operations. Petsec is responsible for the development and implementation of written procedures that provide instructions to ensure the mechanical integrity and safe operation of equipment through inspection, testing and quality assurance. Petsec monitors its equipment and systems during their entire life stage: design, procurement, fabrication, installation, calibration and maintenance. Petsec requires contractors to have a similar process in place to address their equipment and systems.

2.0 Process

The Petsec Mechanical Integrity program intends to assure that all Petsec facility equipment and systems are fit for service in a safe and environmentally-friendly manner. This program encompasses all equipment and systems "used to prevent or mitigate uncontrolled releases of hydrocarbons, toxic substances and other material that may cause environmental or safety consequences", and was developed with the human factors in mind. The basis for any mechanical program and its quality assurance is the effective and efficient process through which Petsec or its designees design, fabricate and install the equipment and systems placed on the facility. The operating and maintenance manuals, operating procedures and training of personnel after the facility is commissioned provide the basis for the continuation of that quality assurance process. Petsec regards the following list of equipment and systems as "critical" to the integrity and quality of our production operations and our SEMS Program:

- Wells/Wellhead Valves
- Production Safety System Devices
- Sump/Overboard Valves
- Vent/Flare Scrubber/Valves
- Containment
- Interlocks
- Pipeline Pumps/Valves
- Compressors
- Generators and Cranes
- Fire Protection Equipment
- Alarms (all)

The Wellhead Valves include the SCSSV, SSV and Master Valve; the Pipeline Valves include the SDV and block valve; and the Sump has an LSH.

2.1 Design, Procurement, Fabrication and Installation

Petsec Management has procedures in place to ensure that the facility equipment and systems are designed, fabricated and installed for new or modified facilities in accordance with the vendors' and manufacturers' specifications. A Construction Consultant may be hired to manage the fabrication and installation of new facilities or major renovations. Petsec uses existing company-approved procedures to:

- 2.1.1 Contract a drilling company to safely, efficiently and effectively drill wells and have a mechanical integrity process of equipment used to place suitable well heads and surface and subsurface safety valves on/in the wells drilled.
- 2.1.2 Procure an engineering firm to:
 - 2.1.2.1 review and consider historical information (from previous facility designs, fabrications, installations and operations).
 - 2.1.2.2 design the production process, interconnecting piping, pumps, valves, containment, other components and structure and facility layouts for the wells to be or already drilled according to current industry codes, guides, standards and generally-accepted engineering practices. A complete set of documents and related drawings is given to Petsec and becomes part of the *Safety and Environmental Information* element.
 - 2.1.2.3 procure the appropriate compressors, generators, cranes, fire protection systems, alarm systems and other equipment and systems for the wells drilled.
- 2.1.3 Procure the equipment and systems and a fabrication company to:
 - 2.1.3.1 If necessary, evaluate suppliers of critical equipment to assure quality during the procurement process.
 - 2.1.3.2 obtain input from experienced production personnel throughout the procurement, fabrication and installation process.
 - 2.1.3.3 fabricate the equipment and systems according to the engineering design documents and drawings and current industry codes, guides and standards.
 - 2.1.3.4 install the equipment and systems in a safe, efficient and effective manner, according to the engineering design documents and layouts.

NOTE	The quality of critical equipment and systems is initially checked during the Pre-Startup Review. This information may be used in the selection of suppliers and fabrication companies in the future.
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2.2 Calibration (and Pre-Commissioning)

After the equipment and systems have been installed, some of the equipment and systems must be calibrated or made operational prior to the commissioning process.

This usually includes generators, compressors, cranes, fire protection equipment, alarm systems and critical process components. Construction and/or production personnel are involved during calibration and pre-commissioning activities. If any of the equipment is not functional, it is repaired, replaced or recalibrated prior to commissioning the facility.

2.3 Operating (Monitoring) and Maintaining (Calibrating)

After the facility is commissioned, production personnel are trained on the operation (monitoring) and maintenance (calibration) of the equipment and systems before they are allowed to take over the operation of the new or modified facility.

2.3.1 Petsec assures that the operators are trained on the operation (monitoring) and maintenance (calibration) of the equipment: generators, compressors, fire protection equipment, alarms and other equipment and/or systems.

2.3.2 Vendors and manufacturers provide operating and maintenance manuals for key and major equipment to the operators for every facility.

2.4 Maintenance Materials, Spare Parts and Equipment

Replacement equipment and parts are purchased, received and installed by competent operations and maintenance personnel, properly trained in safe and effective removal and replacement techniques.

2.4.1 Vendors are pre-approved by Petsec through the generation of Master Service Agreements (MSA).

2.4.2 A Material Supply Request (MSR) procedure and form is used to purchase equipment and system materials, parts and equipment.

2.4.3 The Management Of Change (MOC) process determines if the purchase is a Change in Facilities or a Replacement-In-Kind (see *Management Of Change* element).

2.4.4 When the material, part or equipment is received in the field, it is checked against the existing equipment or system material or part before installation, to assure its operation will be safe.

2.5 Procedure

Petsec Operations utilizes testing and inspecting to assure the mechanical integrity of its equipment and systems. Operations personnel are trained in the operation, monitoring, maintenance and calibration of the equipment and systems; vendors and manufacturer representatives are part of the testing and inspecting process for some of the equipment and systems. Refer to **Attachment A: Testing and Inspecting Checklist**.

NOTE	The design and manufacture of critical equipment and systems is checked during the Pre-Startup Review.
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Critical equipment and systems tested and/or inspected are documented on the *Checklist*; a description and frequency of the test and/or inspection to be conducted, include:

- **Well and Wellhead Valves:** SCSSV, SDV, FSV and Master Valve – Monthly BOEMRE test to determine if valves are functioning properly and holding within tolerances.
- **Production Vessels and Oil Storage Tanks:** Production Safety Systems – Monthly BOEMRE test to determine if devices are functioning properly and within tolerances.
- **Interconnecting Piping and Valves** – Non-destructive test every three years for corrosion on the Piping and monthly function test on the Valves.
- **Overboard Valve:** Sump – Monthly function test on the Valve.
- **Flare/Vent Scrubber Pumps and Valves** – Monthly function test of the Valves and monthly visual inspection of the Pumps.
- **Containment:** Pans, Solid Decking – Monthly inspection for corrosion and leaks.
- **Interlocks:** Monthly BOEMRE test to determine if devices are functioning properly.
- **Pipeline Pumps and Valves** – monthly visual inspection of the Pumps and monthly function test of the Valves.
- **Generators:** daily generator checks (with reports) to assure proper operating parameters; monthly and quarterly servicing schemes.
- **Compressors:** daily compressor checks (with reports) to assure proper operating parameters; monthly and quarterly servicing schemes.
- **Cranes:** monthly, quarterly, semi-annual, annual maintenance servicing schemes.
- **Fire Protection Equipment:** Deluge System – weekly operation of the fire pump; Fire Extinguishers – monthly visual inspection.
- **Alarms:** Emergency Evacuation and Fire Alarms – monthly functional activation.

NOTE	Contractors must have (and provide evidence of) their own mechanical integrity programs for critical equipment used on Petsec facilities.
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2.5.1 Complete the *Checklist* Header section: enter your name and signature, the facility location, your position and the date.

2.5.2 Refer to one piece of critical equipment or system at a time: find all test and inspection documents (reports) used in your field and review them.

2.5.2.1 If you find evidence that the equipment or system was tested and/or inspected during the last month according to the frequency on the Checklist, the requirement has been met and you can check the “Yes” box for that item.

For example, select Generators. Find the Generator inspection and testing report for your facility and verify the proper inspections have been conducted every day for the entire month, the reports have the necessary information required (see step 2.5.2.3.) and the reports have been properly filed and/or electronically uploaded.

2.5.2.2 If you cannot find evidence the equipment or system was tested and/or inspected during the last month according to the frequency on the Checklist, check the “No” box and describe the discrepancy in the box provided.

2.5.2.3 Verify the test or inspection document at the facility has the following required information:

- Name of person testing and/or inspecting the equipment or system, with position and signature.
- Date of the test and/or inspection.
- Result of the test and/or inspection.
- Frequency of the test and/or inspection.

If the document does not, add the missing entries to the document (report), but generate a new form as soon as possible.

2.5.2.4 Repeat these steps until the testing and inspecting is verified for all of the critical equipment and systems for your facility.

2.5.3 Discrepancies found during the monthly check of inspecting and testing documents must be corrected before any further use of the equipment or system is allowed (equipment or system must be tested, inspected or serviced).

2.5.4 If there were any modifications to this critical equipment or system during the last month, describe what it was in the box provided.

NOTE	Management of Change may be necessary as a result of the testing and inspecting of equipment and systems.
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2.5.5 This inspecting, testing and monitoring procedure is audited when the facility is audited every three (3) years.

If any new critical equipment or systems were installed during the previous month, add the new critical equipment or system to the *Testing and Inspecting Checklist* (edit this element) and verify the equipment or system testing and inspecting document is in compliance.

NOTE	Maintenance activities continue from the operational through the abandonment phases of the facilities.
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2.6 Quality Assurance

Quality assurance of the Mechanical Integrity program begins with the procurement of reputable engineering firms that design the facility and its layout and selection of fabrication/installation contractors that construct and assemble the equipment and systems on the structure. It continues when vendors, manufacturers and/or production personnel calibrate and commission the facility. The mechanical integrity program:

2.6.1 requires conformance to specifications and requirements developed at the beginning of the project and is part of the overall project execution plan and maintenance program.

2.6.2 carries over into operating procedures and the management of change process.

2.6.3 includes the procurement of critical equipment to verify equipment compliance with applicable design and material specifications.

2.6.4 includes quality control procedures and specifications for critical equipment developed and implemented to confirm materials and construction are in accordance with the design specifications.

2.6.5 includes the following provisions:

- Procedures and work practices to maintain the mechanical integrity of equipment.
- Training of maintenance personnel in the application of the procedures, relevant hazards and safe work practices.
- Quality control procedures to verify maintenance materials and spare equipment and parts meet design specifications.
- Procedures to review all changes in facilities in accordance with the MOC process.

2.6.6 includes a management plan to document the technologies utilized and measurement systems used for compliance with testing, inspecting, calibrating and monitoring programs for critical equipment.

The essence of quality assurance depends on the training of the production personnel in the operation and maintenance of the equipment and systems. The quality assurance of the mechanical integrity program for Petsec lies in its training. If personnel are not properly trained to operate (monitor) and maintain (calibrate) the equipment and systems, the systems are likely to fail or malfunction. Petsec production employees and contract production personnel are properly trained:

2.6.7 on the SEMS Program before they are allowed to operate critical equipment and systems on the facility.

2.6.8 in the operation and monitoring of the critical equipment and systems on its facilities.

2.6.9 in the maintenance and calibration of the critical equipment and systems on its facilities.

2.6.10 to test and inspect the equipment and systems according to the Petsec maintenance program and the manufacturers' and vendors' specifications.

3.0 Training

3.1 Train all production operations' employees and contract personnel every five (5) years on the contents of this element; refer to the Training element.

3.2 Train all newly-hired production operations employees and contract personnel within 30 days of arrival at the facility on the contents of this element; refer to the Training element.

3.3 Train or inform affected employees of any changes to this element within 30 days after the element changes have been approved and completed.

4.0 Recordkeeping

4.1 Copies of the Testing and Inspecting Checklist are placed in the SEMS files by the Facility PIC within 30 days after completion and retained for six (6) years.

5.0 Attachments

6.1 Attachment A: *Testing and Inspecting Checklist*

Attachment A

Testing and Inspecting Checklist

Facility Location:	Date:
Person Completing Checklist:	Job Title:

Locate the document that verifies the test and/or inspection of the Critical Equipment; write in the date of the test or inspection (mm/dd/yy) or write in NA if the test or inspection is not due. Verify the document has the name, position and signature of the person conducting the test and/or inspection, the date, the frequency, a description of the test or inspection performed and the results of the test and/or inspection. If it does not, add the information to the test or inspection form. Correct all discrepancies found before further use of the equipment or system.

Critical Equipment	Frequency	Test	Inspect
Well and Wellhead Valves: SCSSV, SSSCV, SDV, FSV and Master Valve.	Monthly BOEMRE test to determine if valves are holding within tolerances.		
Production Vessels and Oil Storage Tanks: Production Safety Systems.	Monthly BOEMRE test to determine if safety devices are functioning properly and within tolerances.		
Interconnecting Piping and Valves	Non-destructive test every three years for corrosion on the Piping and monthly function test on the Valves.		
Overboard Valve: Sump	Monthly function test on the Valve, Pump.		
Flare/Vent Pumps and Valves	Monthly function test on the Valves, Pumps.		
Containment: Pans, Solid Decking	Daily inspection for corrosion, leaks and standing water.		
Interlocks:	Monthly BOEMRE test to determine if safety devices are functioning properly.		
Pipeline Pumps and Valves	Monthly visual inspection of the Pumps and monthly function test on the Valves.		
Generators	Daily generator checks (with reports) to assure proper operating parameters; monthly and quarterly servicing scheme.		
Compressors	Daily compressor checks (with reports) to assure proper operating parameters; monthly and quarterly servicing scheme.		
Cranes	Monthly, quarterly, semi-annual, annual maintenance servicing schemes.		
Fire Protection Equipment	Deluge System - Weekly operation of the fire pump; Fire Extinguishers – Monthly visual inspection.		
Alarms	Emergency Evacuation and Fire – Monthly functional activation test.		

Describe discrepancy in detail of every test or inspection checked "No":

Describe any modifications to existing critical equipment/systems during the last month.

Name:	Signature:	Date:
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