CHAPTER 27

HIGH-ALTITUDE ELECTROMAGNETIC PULSE (HEMP) PROTECTION SYSTEMS

27-1. Minimum maintenance activities for HEMP protection systems

Preventive maintenance is a periodic checking and testing (surveillance) of equipment. In HEMP hardened facilities, this is commonly referred to as hardness maintenance (HM) and testing as hardened surveillance (HS). Maintenance actions included in this chapter are summarized in table 27-1.

a. HM testing. HM defines the requirements, approaches, and procedures for maintaining HEMP hardness elements, including the role of technical manuals, periodic inspections, repair activities, and repair verification.

b. HS testing. HS defines the techniques and procedures for conducting a HEMP hardness surveillance program, including grounds and bonds, shields, electrical filters, surge arresters, and other hardness elements. HS should include auditing past performance, testing current conditions, and analyzing test data.

27-2. Preventive maintenance

Because HEMP protective systems are passive, their effectiveness must be proven during hardness surveillance testing. Maintenance of HEMP protective systems is essential for the system to be effective. Technical manuals provided with HEMP protection system equipment should be consulted for specific procedures concerning maintenance, inspection repair or replacement, and testing. The following table indicates the minimum preventive maintenance tasks, including surveillance and the frequency of these tasks. Inspection frequencies may be increased as required based on observations and experience. Personnel should also review past maintenance records to find repair patterns. These records may point to certain components that should be closely inspected during performance of preventive maintenance.

a. Doors. Inspect and test HEMP hardened doors in accordance with the following.

(1) Clean and inspect door and window finger stock to ensure integrity.

(2) Verify that doors fit snug and are plumb.

(3) Verify doors operate smoothly.

(4) Close all doors.

(5) Test doors using continuous wave radiated field method.

b. Honeycomb vents. Inspect and test honeycomb vents in accordance with the following.

(1) Clean dust and other foreign debris from vents.

(2) Inspect mounting seams and welds to ensure integrity.

(3) Test vents using continuous wave radiated field method.

c. Wave guide-below-cutoff devices. Inspect and test wave guide-below-cutoff devices in accordance with the following.

(1) Clean dust and other foreign debris from devices.

(2) Inspect mounting seams and welds to ensure integrity.

(3) Test devices using continuous wave radiated field method.

d. Gasketed seams. Inspect and test gasketed seams in accordance with the following.

(1) Inspect seams and gaskets for damage, openings, and corrosion. Repair and paint as required.

(2) Clean foreign debris from seams.

(3) Test gasketed seams using continuous wave radiated field method.

e. Bolted seams. Inspect and test bolted seams in accordance with the following.

(1) Inspect bolted seams for missing bolts, damage, openings, and corrosion. Repair and repaint as required.

(2) Clean foreign debris from seams.

(3) Test bolted seams with shielded enclosure leak detection method.

f. Welded seams. Inspect and test welded seams in accordance with the following.

(1) Inspect welded seams for damage, openings, and corrosion. Repair and repaint as required.

(2) Clean foreign debris from seams.

(3) Test welded seams with shielded enclosure leak detection method.

g. Threaded conduits. Inspect and test threaded conduits in accordance with the following.

(1) Inspect conduits for loose couplings, damage, openings, and corrosion. Repair and repaint as required.

(2) Clean foreign debris from couplings.

(3) Test threaded conduits with shielded enclosure leak detection method.

h. Welded conduits. Inspect and test welded conduits in accordance with the following.

(1) Inspect welded conduits for damage, openings, and corrosion. Repair and repaint as required.

(2) Clean foreign debris from seams.

(3) Test welded conduits with shielded enclosure leak detection method.

i. Grounding bonds. Test and inspect grounding bonds in accordance with the following.

(1) Inspect connections and conductors for degradation and loose connections.

(2) All electrical connections should be torqued to the proper design value.

(3) Test grounding bonds with four-point bonding method.

j. Test shielded areas. Perform a shielding effectiveness test of shielded room(s), areas, buildings, etc., using the test methods described in Institute of Electrical and Electronic Engineers (IEEE) 299, Standard Method for Measuring the Effectiveness of Electromagnetic Shielding Enclosures.

k. Electrical filters. Inspect and test electrical filters in accordance with the following.

(1) Inspect to ensure that warning signs exist. Replace as required.

(2) Inspect enclosure for damage, openings, and corrosion of metallic objects. Repair and paint as required.

(3) Inspect air passages and remove any blockage.

(4) Inspect, investigate, and solve conditions for unusual odors.

(5) As equipment is operated and tested, listen, investigate, and solve conditions for unusual noises.

(6) Inspect electrical connections for degradation. Repair as required.

(7) Inspect electrical insulation for discoloration and degradation. Repair as required.

(8) Inspect equipment grounding system such as conductors and connections. Repair as required.

(9) Inspect insulators for damage. Replace as required.

(10) Inspect physical condition of inductors and capacitors looking for abnormalities. Capacitors should be checked for leaks.

(11) Remove debris, dirt, and other foreign deposits from all filter components, cabinets, and areas within filter cabinets.

(12) All electrical connections should be torqued to the proper design value.

(13) Test all main current carrying equipment for hot spots with an infrared temperature indicating device.

(14) Fuses, especially fuses protecting capacitors, should be checked for continuity.

(15) Verify that all access openings are tightly sealed.

(16) Test filters as described in MIL-STD-220B, Method of Insertion Loss Measurement.

l. Electrical surge arresters/protectors. Inspect and test electrical surge arresters/protectors in accordance with the following.

(1) Inspect for damage and discoloration. Replace as required.

(2) Inspect arrester air gap if applicable.

(3) Listen for unusual noises as equipment is operated or tested.

(4) Inspect, investigate, and solve conditions for unusual odors.

(5) Inspect electrical connections for discoloration and tightness.

(6) Inspect surge arrester/protector grounding system such as conductors and connections.

(7) Remove debris and dust from surge arresters and protectors.

(8) All electrical connections should be torqued to the proper design value.

(9) Test surge arresters/protectors using a high voltage transient test.

m. Electrical isolation devices. Inspect and test electrical isolation devices in accordance with the following.

(1) Inspect to ensure that warning signs exist. Replace as required.

(2) Inspect enclosure for damage, openings, and corrosion of metallic objects. Repair and paint as required.

(3) Inspect air passages and remove any blockage.

(4) Inspect, investigate, and solve conditions for unusual odors.

(5) As equipment is operated and tested, listen, investigate, and solve conditions for unusual noises.

(6) Inspect electrical connections for discoloration. Repair as required.

(7) Inspect electrical insulation for discoloration and degradation. Repair as required.

(8) Inspect equipment grounding system such as conductors and connections. Repair as required.

(9) Inspect insulators for damage. Replace as required.

(10) Inspect physical condition of inductors and capacitors looking for abnormalities. Capacitors should be checked for leaks.

(11) Remove debris, dirt, and other foreign deposits from all components and cabinet areas.

(12) All electrical connections should be torqued to the proper design value.

(13) Test all main current carrying equipment for hot spots with an infrared temperature indicating device.

(14) Fuses should be checked for continuity.

(15) Surveillance testing is done to confirm equipment operation not otherwise detectable by preventive maintenance inspections.

Table 27-1. HEMP system components

HEMP System Components	
Action	***Frequency***
WARNING! MAINTENANCE PERSONNEL SHALL LOCKOUT/TAG EQUIPMENT TO INSURE DE-ENERGIZATION DURING MAINTENANCE PROCEDURES.	
Doors	
Clean and inspect door and window finger stock to ensure integrity.	mo
Verify that doors fit snug and are plumb.	mo
Verify doors operate smoothly.	mo
Close all doors.	mo
Test doors using continuous wave radiated field method.	mo
Honeycomb Vents	
Clean dust and other foreign debris from vents.	3 mos
Inspect mounting seams and welds to ensure integrity.	3 mos
Test vents using continuous wave radiated field method.	3 mos
Wave Guide-Below-Cutoff Devices	
Clean dust and other foreign debris from devices.	6 mos
Inspect mounting seams and welds to ensure integrity.	6 mos
Test devices using continuous wave radiated field method.	6 mos
Seams	
Inspect and test gasketed seams for the following.	
Inspect seams and gaskets for damage, openings, and corrosion. Repair and paint as required.	3 mos
Clean foreign debris from seams.	3 mos
Test gasketed seams using continuous wave radiated field method.	3 mos
Inspect and test bolted seams for the following.	
Inspect bolted seams for missing bolts, damage, openings, and corrosion. Repair and repaint as required.	6 mos
Clean foreign debris from seams.	6 mos
Test bolted seams with shielded enclosure leak detection method.	6 mos

Table 27-1. HEMP system components (continued)

HEMP System Components	
Action	***Frequency***
Inspect & test welded seams for the following.	
Inspect welded seams for damage, openings, and corrosion. Repair and repaint as required.	2 yrs
Clean foreign debris from seams.	2 yrs
Test welded seams with shielded enclosure leak detection method.	2 yrs
Conduits	
Inspect and test threaded conduits for the following.	
Inspect conduits for loose couplings, damage, openings, and corrosion. Repair and repaint as required.	yr
Clean foreign debris from couplings.	yr
Test threaded conduits with shielded enclosure leak detection method.	yr
Inspect and test welded conduits for the following.	
Inspect welded conduits for damage, openings, and corrosion. Repair and repaint as required.	2 yrs
Clean foreign debris from seams.	2 yrs
Test welded conduits with shielded enclosure leak detection method.	2 yrs
Grounding Bonds	
Inspect connections and conductors for degradation and loose connections.	yr
All electrical connections should be torqued to the proper design value.	yr
Test grounding bonds with four-point bonding method.	yr
Shielded Areas	
Perform a shielding effectiveness test of shielded rooms, areas, and buildings. (Reference 27-2*j*)	yr
Electrical Filters	
Inspect to ensure that warning signs exist. Replace as required.	yr
Inspect enclosure for damage, openings, and corrosion of metallic objects. Repair and paint as required.	yr
Inspect air passages and remove any blockage.	yr
Inspect, investigate, and solve conditions for unusual odors.	yr

Table 27-1. HEMP system components (continued)

HEMP System Components	
Action	***Frequency***
As equipment is operated and tested, listen, investigate, and solve conditions for unusual noises.	yr
Inspect electrical connections for degradation. Repair as required.	yr
Inspect electrical insulation for discoloration and degradation. Repair as required.	yr
Inspect equipment grounding system such as conductors and connections. Repair as required.	yr
Inspect insulators for damage. Replace as required.	yr
Inspect physical condition of inductors and capacitors looking for abnormalities. Capacitors should be checked for leaks.	yr
Remove debris, dirt, and other foreign deposits from all filter components, cabinets, and areas within filter cabinets.	yr
All electrical connections should be torqued to the proper design value.	yr
Test all main current carrying equipment for hot spots with an infrared temperature indicating device.	yr
Fuses, especially fuses protecting capacitors, should be checked for continuity.	yr
Verify that all access openings are tightly sealed.	yr
Test filters per MIL-STD-220B test. [Reference 27-2*k(16)*]	yr
Electrical Surge Arresters	
Inspect for damage and discoloration. Replace as required.	yr
Inspect arrester air gap if applicable.	yr
Listen for unusual noises as equipment is operated or tested.	yr
Inspect, investigate, and solve conditions for unusual odors.	yr
Inspect electrical connections for discoloration and tightness.	yr
Inspect surge arrester/protector grounding system such as conductors and connections.	yr
Remove debris and dust from surge arresters and protectors.	yr
All electrical connections should be torqued to the proper design value.	yr
Test surge arresters/protectors using a high voltage transient test.	yr
Electrical Isolation Devices	
Inspect to ensure that warning signs exist. Replace as required.	yr
Inspect enclosure for damage, openings, and corrosion of metallic objects. Repair and paint as required.	yr

Table 27-1. HEMP system components (continued)

HEMP System Components	
Action	***Frequency***
Inspect air passages and remove any blockage.	yr
Inspect, investigate, and solve conditions for unusual odors.	yr
As equipment is operated and tested, listen, investigate, and solve conditions for unusual noises.	yr
Inspect electrical connections for discoloration. Repair as required.	yr
Inspect electrical insulation for discoloration and degradation. Repair as required.	yr
Inspect equipment grounding system such as conductors and connections. Repair as required.	yr
Inspect insulators for damage. Replace as required.	yr
Inspect physical condition of inductors and capacitors looking for abnormalities. Capacitors should be checked for leaks.	yr
Remove debris, dirt, and other foreign deposits from all components and cabinet areas.	yr
All electrical connections should be torqued to the proper design value.	yr
Test all main current carrying equipment for hot spots with an infrared temperature indicating device.	yr
Fuses should be checked for continuity.	yr
Surveillance testing is done to confirm equipment operation not otherwise detectable by preventive maintenance inspection.	yr