NAVAL WEAPONS STATION EARLE
COLTS NECK, NJ 07722

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NWS EARLE INSTRUCTION 11010.2

From: Commanding Officer

Subj: INSPECTION AND TESTING OF LIGHTNING PROTECTION AND GROUNDING SYSTEMS FOR ORDNANCE STORAGE AND OPERATING FACILITIES

Ref: (a) NAVSEA OP-5, VOL I, 6th Revision, Change Four (4)
(b) MIL-HDBK-1004/6 Military Handbook (30 May 88)
(c) NFPA-780 National Fire Protection Association, Lightning Protection Code (1992)
(d) 25Ta Biddle Earth Resistance Testing Manual, Fourth Addition (April 1981)
(e) National Electric Code (1999)
(f) Ordnance Structures Status - AOC Det Earle Storage Facilities (Latest Issue)

Encl: (1) Grounding Plan Test Philosophy
(2) Instruction for Visual Inspection of Grounding Systems for Ordnance Storage and Operating Facilities
(3) Instruction for Electrical Testing of Grounding Systems for Ordnance Storage and Operating Facilities
a. Section I - Conductive Floor Testing
b. Section II - Three Point Fall-of-Potential Earth Resistance Testing
c. Section III - Bonding Resistance Testing
(4) Documentation

1. Purpose: To issue and implement at Naval Weapons Station Earle (WPNSTA Earle) responsibilities, requirements, and test procedures for the inspection, testing, maintenance, and repairs of the Lightning Protection and Grounding Systems for Ordnance Facilities. This program is established in accordance with the requirements contained in references (a) through (f) and becomes effective 1 June 1994.

2. Scope: This instruction provides procedures for the visual inspection and electrically testing of grounding systems for all primary girdles, secondary girdles, ordnance grounds, static grounds, conductive floor, metal masses, electrical equipment, machinery, and all other devices that are part of the lightning protection system. All visual inspection and electrical testing will be in accordance with

this instruction and references (a) through (f). Enclosure (1) contains the design philosophy for the development of the Grounding Test Plan at WPNSTA Earle. Enclosure (2) contains specific procedures for performing visual inspections for lightning protection and grounding systems. Enclosure (3) contains specific procedures for testing the lightning protection and grounding systems including procedures for conductive floor testing, earth resistance testing and bonding resistance testing. Enclosure (4) contains back-up documentation for the grounding test plan philosophy.

3. Action:

a. Base Civil Engineer will:

(1) Have overall responsibility for ensuring that all lightning protection/grounding systems for explosive-operating structures including buildings, railroad yards, truck holding yards, magazines, barricades, and explosive piers are inspected, maintained, repaired, and tested to assure they meet the requirements of references (a) through (e).

b. The NWS Earle Base Civil Engineer will:

(1) Prepare, update and issue a grounding system test plan for the visual and electrical testing of primary and secondary ground systems components. The specific grounding test plan for an ordnance facility (operating buildings, railroad yards, truck holding yards, magazines, barricades and explosive piers) shall identify the ground system test locations along with a listing of items to be tested and the type to be conducted.

(2) Issue and maintain a test plan for each new facility requiring a lightning protection system. Plan shall include scale drawings of each facility to be included as part of the lightning protection and grounding system test program.

(3) Receive, review and analyze test data to determine that all referenced specifications are met.

(4) Be responsible for issuing test points for all explosive buildings, railroad yards, truck holding yards, magazine groups, barricades and piers.

(5) Ensure that all drawings for new explosive ordnance structures, new additions, and replacement of equipment includes all necessary bonding, grounding, and lightning protection requirements per references (a) through (e).

(6) Assist other organizations with technical advice.

c. PWC Philadelphia Detachment Earle - Customer Service will:

(1) Provide a lightning protection and ordnance grounding manager who shall manage the inspection and test program for each lightning protection and grounding system. Throughout this document the Lightning Protection and Ordnance Grounding Project Manager shall be referenced as LPOG Project Manager.

(2) Will be responsible for collection and review of all inspection and test data. Take action to correct discrepancies. Maintain test data for five (5) years.

d. PWC Philadelphia Detachment Earle - Maintenance and Utilities will:

(1) Visually inspect all primary and secondary grounding systems (ordnance grounds, static grounds, electrical grounds, structural grounds, conductive floors, metal masses, surge arrestors, etc.) every six (6) months.

(2) Perform an electrical test on all conductive floors and mats. Perform electrical continuity tests on all ground reels and portable ground cables. These tests shall be conducted every twenty-four (24) months.

(3) Perform electrical tests on all primary lightning protection systems, secondary grounding systems including ordnance grounds, static grounds, instrumentation grounds, electrical grounds, metal masses, grab bars, gates, etc. every 24 months.

(4) Document all test results on ground system test plan and forward one copy to the LPOG, Engineering and EOSP Code 27A, AOCYDETEARLE, Code 27E.

(5) Record and repair immediately all minor discrepancies found during inspection. Record and report all discrepancies which cannot be corrected.

(6) Spot check electrical equipment and installations when performing visual inspection. Report all discrepancies to the LPOG and Site Civil Engineering if necessary.

(7) Clearly mark the ordnance, instrumentation, conductive matting, test points and static grounds to preclude the mis-identification of each.

(8) Provide personnel required to perform visual inspections and electrical testing of lightning protection and ground systems with a grounding system inspection plan for each ordnance facility. The inspection plan must identify all inspection points and shall be signed by an individual performing the inspection.

(9) Notify Base Civil Engineer, EOSP Code 27A, AOCYDETEARLE, Code 27E and the LPOG immediately when a lightning protection system is found defective and cannot be repaired by test personnel.

(10) Report any damage of a lightning protection system, which may be attributable to a lightning strike. A photocopy of such damage shall immediately be made and reported to NAVSEASYCOM (SEA 665) via EOSP Code 27A, AOCYDETEARLE, Code 27E, Site Civil Engineering and the LPOG.

e. Resident Officer in Charge of Construction (ROICC) Office will:

(1) Monitor contract work closely to make sure that grounding systems are not painted over,

dismantled, or damaged by Contractors.

(2) Ensure that when new metal doors, door frames, metallic masses (400 square inches or larger), gutters, downspouts, etc. are replaced, the contractor installs or replaces grounding as required.

(3) Ensure new facilities have proper grounding systems per reference (a) through (f) and notify the LPOG to place facilities in the ground test schedule.

(4) Ensure no excavation work is performed in the vicinity of ordnance facilities (building/magazines, etc.) before identifying the location of the primary and secondary girdles.

f. AOCYDETEARLE will:

(1) Notify the LPOG, in writing, of any new facility or equipment to be installed or modified in ordnance facilities that require grounding/bonding.

(2) Ensure that all explosive-operating and storage facilities installed with lightning protection, electrical and electrostatic grounding systems, are made available to PWC Philadelphia Detachment Earle -Maintenance and Utilities for inspection, maintenance, repair and testing.

(3) Ensure that any explosive-operating and storage facility not available at the scheduled time of testing, be made available in five (5) working days.

(4) Ensure that all explosive-operating and storage facilities which have been observed with grounding system problems, are immediately documented and brought to the attention of the LPOG and with grounding system before resuming operations.

(5) Contact PWD if any repairs are made to lightning protection systems, grounding systems, or if any soil is disturbed, to verify system is intact.

(6) Post in conspicuous location any notification of test failure and curtail operations as appropriate.

g. Production Building Supervisors will:

(1) Conduct the LPOG in the event of damage to or questionable operation of the lightning protection and grounding system.

(2) Make available, during each six (6) month testing cycle, all portable grounding straps and cables.

(3) Be available during inspections and testing to assist the inspection/testing team.

(4) Provide oversight and define any new requirements for grounding or bonding to the LPOG and other departments and tenants as soon as requirements are made available.

GROUNDING TEST PLAN PHILOSOPHY

Purpose:

The purpose of this document is to update the existing Station Instruction for the Inspection and Testing of Lightning Protection and Grounding Systems for Ordnance Storage and Operating Facilities to Ref. (a) Standards. As part of this upgrade, a comprehensive visual and electrical test plan has been created for the testing of all required structures and areas.

STRUCTURE AND AREA LISTINGS

Testing Required:

The chart below is a listing of all structures and areas that are required to be tested for earth and bonding resistance. The determination for the testing of these structures and areas are based on the following criteria:

a) Structure or area has a primary lightning protection system (i.e., lightning masts).

b) Structure or area is presently used for ordnance storage or operations.

c) Specific requirement by facility personnel and Ref. (a).

d) Future considerations.

LISTINGS	
STRUCTURE OR AREA	TITLE
OPERATION BUILDINGS	D-2, D-4, D-5, E-13, E-14, GB-1, HA-1, MA-1, MA-3, Bldg. 566, Bldg. 557 and Bldg. 589
MAGAZINES	F-Group, G-Group, H-Group, I-Group, J-Group, K-Group, L-Group, M-Group, and N-Group
BARRICADES	Army Barricades (AA-Group) and Navy Barricades (A&B-Group)
RAILROAD YARDS	Classification Yard #1 and Receiving Yard
PIERS	Piers #1, #3 and #4
TRUCK HOLDING YARDS	Truck Holding Yards No. 1 & 2

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Exceptions:

Buildings D-3, and MAB-544 do have lightning protection systems but are no longer used and/or certified for ordnance operations. As a result these buildings will not be included as part of the test plan. (See Enclosure (4) for back-up documentation.)

The helicopter landing area is no longer used for ordnance operations, therefore, will not be included as part of the test plan. (See Enclosure (4) for back-up documentation.)

Remaining Structures and Areas:

All remaining structures and areas that possess neither a lightning protection system nor are they associated with ordnance functions will not be included as part of the test plan.

PHILOSOPHY

The main philosophy was to create a comprehensive and "Easy to Use" grounding test plan. One main goal was to eliminate as many questions and/or "gray" areas as possible in terms of the following:

a) Interpretation of Ref(a) and,

b) Tailoring the test plan for specific use at Naval Weapons Station Earle.

The above criteria has been incorporated in the revised Station Instruction and the newly created Ground Test Plan Drawings.

The major portion of this test plan centered around not only the test procedures but the actual location of all earth resistance and bonding resistance test points. By locating and documenting all test points, two (2) problems were eliminated:

1. What are the required bonding resistance test points per Ref. (a)?

2. For the Earth Resistance Testing, where should the P2 and C2 test probes be located so they are out the influences created by the "Electrode Under Test" and C-2 test probe?

For the Earth Resistance C2 and P2 probe locations, extensive testing was conducted. (See "Blue Volumes" for back-up test data.) If a building or area had a lighting protection system without test pockets the "Electrode Under Test" was taken from a lightning mast. If a building or area had a lighting protection with test pockets, the "electrode under test" was taken from the associated test pocket ground rod. In areas where there was no lightning protection system, the lowest metal point to earth was selected (i.e., door strap, hand rail, ground wire, etc.). Once this point was selected, testing was conducted to locate the probes' required positions. All probe locations are shown on the Ground Test Plan Drawing.

When the final Earth Resistance point was established, all bonding resistance testing was sequenced back to this point verifying complete continuity.

For bonding resistance all test points were located based on the straight forward criteria set forth in Ref. (a). Again, these points are shown on the Ground Test Plan Drawing.

DEPARTURES FROM REF.(a)

Buildings D-2, D-4, D-5, E-13, E-14, MA-1, MA-3, HA-1, 566 and 589; Railroad Classification Yard and Reciving Yard; Magazines F-54, F-63 thru F-68; Truck Holding Yards No. 1 and 2.

Due to the large ground grid systems, for the above areas, it was impossible to place the "C2" probe at the distance required by the 3-point fall-of-potential method as required by Ref. (a). The problem arises from physical constraints posed by the surrounding terrain (i.e. other structures, dense woods, swamps, brooks and rough terrain). As a result, the idea to disconnect one ground rod from the grid system, and test that ground rod for earth resistance was used.

This idea was past on to and accepted by the E.O.D. Technical Center in Indian Head, Maryland on 26Jun98 (see enclosure (4) "Documentation" for copy of telecom).

Buildings GB-1 and 557:

These buildings were tested for earth resistance using a derivative of the 3-point fall-of-potential method called the simplified fall-of-potential method. Due to the large ground grid systems of the above areas, it was impossible to place the "C2" probe at the distance required by the 3-point fall-of-potential method. The problem arises from physical constraints posed by the surrounding terrain (i.e., other structures, dense woods, railroad tracks, swamps, brooks and rough terrain). As a result the simplified fall-of-potential method had to be used to establish the earth resistance probe locations.

In realizing that this method is a deviation from Ref. (a), a "concurrence" was applied for, from the E.O.D. Technical Center in Indian Head, Maryland on 17 Dec 93 (see Enclosure (4) "Documentation" for copy of letter). As of the writing (07 Apr 94) an answer has not been received. Efforts will continue for this application.

Building MA-3, Conductive Floor:

The conductive floor, located in the Electro-Explosive Device (EED) Room, is very small (8'x7'). Inside the room there are two (2) steel work benches. Due to the room's small size, it is not possible to perform a conductive floor test per the requirements of Ref. (a).

A conductive floor test will be performed however, using the appropriate test equipment, in four (4) locations (see Ground Test Plan Drawings - Building MA-3, Sheet 4). Two (2) electrode-to-electrode and two (2) electrode-to-ground tests will be conducted as close as possible to the parameters required by Ref. (a). The readings will be documented and used to establish a trend (5 years minimum) in an attempt to monitor the conductive floor's condition.

CONCLUSION:

This document and associated Ground Test Plan Drawings was designed to be as complete and accurate as possible. The objective was to create a comprehensive guide that would allow testing personnel to perform all required testing to meet the requirements as set forth in Ref. (a). It should be known as of this writing (01 March 94), Weapons Station Earle is undergoing major upgrades to the primary and secondary grounding systems in many buildings and areas. This document was created to suit all the existing conditions, but at the same time to accommodate these future upgrades. By doing so, this will minimize

the amount of future modifications that must be made to this document, to meet the ever present progress of Naval Weapons Station Earle.

New Note: All upgrades as mentioned above have been incorporated with the upgraded test plan (Revised 31Aug98).

INSTRUCTION FOR THE VISUAL INSPECTION OF GROUNDING SYSTEMS FOR ORDNANCE AND OPERATING FACILITIES

Purpose:

This document provides detailed procedures to be used in the visual inspections of grounding systems for ordnance storage and operating facilities. The intent of the inspection is to identify obvious points of non-compliance with the requirements of Ref.(a).

Inspection Interval:

Visual inspections are required every six (6) months.

Inspection Team Membership:

The visual inspections shall be conducted by a team made up of representatives from the following organizations:

a. Lightning Protection and Ordnance Grounding Project Manager (LPOG Project Manager)
b. Facility Supervisor(s)
c. PWC Philadelphia Detachment Earle - Maintenance and Utilities Personnel
   1. Team Leader
   2. Testing Personnel

Responsibility:

This section delegates the responsibility of the various team members.

The LPOG Project Manager is responsible for:

a. Providing inspection team members with a data package on the facility including any grounding system waivers or items grandfathered, a copy of the grounding system sketches of each of the facilities from the grounding test plan drawings, and a copy of the most recent electrical test data for each facility.

b. Collection of inspection data from all team members and documentation of the visual inspection.

The Facility Supervisor(s) is responsible for:

a. Ensuring that the facility is available for the inspection team.

b. Ensuring that the facility is free of any exposed explosives, explosive dusts, or exposed electro-explosive devices (EED's).

c. Removing any sources of flammable or combustible vapors (as practical) and briefing the visual inspection personnel on the location and type of hazardous (classified) locations remaining in the facility.

d. Briefing the visual inspection team on any explosives hazards that may exist in the facility at the time of inspection.

The PWC Philadelphia Detachment Earle - Maintenance and Utilities Personnel Team Leader conducting

the visual inspections is responsible for:

a. Conducting the visual inspection as ordered by the LPOG Project Manager.

b. Conducting visual inspection using Figure (1) checklist.

c. Organizing visual data and turning original sheets over to the LPOG Project Manager for documentation.

d. Scheduling of the visual inspections with the building/magazine supervisor(s) and other team members.

e. Leading the team members on the visual inspection.

Protective Equipment:

The following protective equipment is required for personnel working in magazine or explosives operating buildings:

a. Safety glasses
b. Safety shoes (non-conductive)
c. Cotton coveralls

Visual Inspection Procedures:

Figure (1) provides a checklist of the items to be inspected during the visual inspections. Both visual and physical (where practical) inspections of bonding connections shall be conducted. Inspections shall be conducted both inside and outside of each facility. In addition, all bonding connection points shall be visually inspected for potential isolation due to paint or corrosion. Any evidence of paint or corrosion shall be noted in Figure (1), "Visual Inspection Checklist" comment column. The team leader shall provide a statement on the Visual Inspection Checklist as to the need for an electrical bonding test to confirm that the corrosion or paint does not influence the effectiveness of the bonding connection. Any necessary bonding tests shall be conducted by the team leader, in accordance with the requirements of the Standard Operating Procedure for Electrical Testing of Grounding Systems for Ordnance Storage and Operating Facilities - Section III - "Bonding Resistance Testing".

Any modifications to the structure made within the last 24 months shall be reviewed in detail to ensure they were made in accordance with the above requirements. Any bonding or grounding point test results (from the last electrical test) which differed greatly from other test data gathered during the same test period shall also be examined in detail.

Post-Inspection Procedures:

The PWC Philadelphia Detachment Earle - Maintenance and Utilities Supervisor shall:

a. Deliver one (1) copy of the Visual Inspection Check List to Facility Supervisor(s), one (1) copy to Base Civil Engineering, and one (1) copy to EOSP Code 27A, WSFYDETEARLE, Code 27E.

b. Ensure that Facility Supervisor(s) are aware of any deficiencies.

The PWC Philadelphia Detachment Earle - Maintenance and Utilities Personnel Team Leader shall:

a. Document and report any deficiencies and take immediate corrective action. If a problem is major in nature, turn over to Base Civil Engineering for review.

b. Log all Visual Inspection Check List data in Computer data base file.

VISUAL INSPECTION CHECKLIST

DATE: _____ BUILDING: _____

INSPECTOR(S): _____

1. LIGHTNING PROTECTION SYSTEM	ACCEPTABLE (Y/N)	COMMENTS
A. Are all large metal masses, 400 square inches or larger, within six (6) feet of a lightning mast connected at their lowest point to the primary ground girdle stub at the lightning mast?		
B. Are masts, overhead wires and air terminals, properly supported?		
C. Is any part of the structure obviously outside of zone-of-protection?		
D. Inspect lightning mast cables. Are they in good condition? At least #$^{1}/_{0}$ or larger? Made of bare copper? Repair, replace or install new cables as needed.		
E. Are down conductors continuous? Less than 1/3 of strands broken? No sharp bends or kinks? Symmetrically located?		

FIGURE (1) - VISUAL INSPECTION CHECKLIST
Sheet 1 of 16 (Building)

VISUAL INSPECTION CHECKLIST

DATE: _____ BUILDING: _____

INSPECTOR(S): _____

1. LIGHTNING PROTECTION SYSTEM	ACCEPTABLE (Y/N)	COMMENTS
F. Are down conductors attached firmly and correctly to masts? 180° apart?		
G. Are all grounding connections, located in each test pit, tight and secure?		
H. Are all rail head bonds connected and in good condition on all railroad track joint bars located within the zone-of-protection of a lightning protection system?		
I. Are lightning masts secure and in good condition?		
J. Are overhead catenary wires and mast mounted air terminals in good condition?		

FIGURE (1) - VISUAL INSPECTION CHECKLIST

VISUAL INSPECTION CHECKLIST

DATE: _____ BUILDING: _____

INSPECTOR(S): _____

1. LIGHTNING PROTECTION SYSTEM	ACCEPTABLE (Y/N)	COMMENTS
K. For all visible portions of the primary, are all bends greater than 90 degrees and have minimum of eight (8) inch radius?		
L. For railroad track ground tie connections, are all cables #$^{1}/_{0}$ stranded copper? In good condition? Are welds to tracks present and secure?		
M. For railroad track earth ground connections,are all cables #$^{1}/_{0}$ stranded copper? In good condition? Are welds to track present and secure?		
N. Are all fences visually bonded to the lightning protection system if the fence passes within the zone-of -protection?		
O. Have previous test records been reviewed to insure that fences are bonded from gate post to gate post, gate post to gates, to secondary girdle if within the zone-of-protection?		

FIGURE (1) - VISUAL INSPECTION CHECKLIST

VISUAL INSPECTION CHECKLIST

DATE: _____ BUILDING: _____

INSPECTOR(S): _____

1. LIGHTNING PROTECTION SYSTEM	ACCEPTABLE (Y/N)	COMMENTS

CAUTION

ANY INDICATION OF DAMAGE TO A LIGHTNING PROTECTION SYSTEM SHALL BE IMMEDIATELY REPORTED TO THE TEAM LEADER. PHOTOGRAPHIC RECORDS OF THE DAMAGE SUSPECTED TO HAVE RESULTED FROM A LIGHTNING STRIKE SHALL BE OBTAINED PRIOR TO REPAIR. NAVSEASYSCOM MUST BE INFORMED OF ANY LIGHTNING STRIKE MADE ON THE AREA AND THE DAMAGE SUSTAINED.

FIGURE (1) - VISUAL INSPECTION CHECKLIST

VISUAL INSPECTION CHECKLIST

DATE: _____ BUILDING: _____

INSPECTOR(S): _____

2. POWER SERVICE GROUNDING	ACCEPTABLE (Y/N)	COMMENTS
A. Are all utility lines coming into the building buried the last 50 feet?		
B. Are surge suppressors installed on all power, communication, data and process control conductors entering the facility? Do the surge suppressors appear in good condition?		
C. Is the electrical service to the building arranged so it can be shut off by switches located at one or more control points outside, but immediately adjacent to the explosive work area?		
D. For the service disconnect or panel, is the ground attachment point free of corrosion? Tightly connected?		

FIGURE (1) - VISUAL INSPECTION CHECKLIST

VISUAL INSPECTION CHECKLIST

DATE: _____ BUILDING: _____

INSPECTOR(S): _____

2. POWER SERVICE GROUNDING	ACCEPTABLE (Y/N)	COMMENTS
E. Are external service transformers and security fences properly grounded?		
F. All externally mounted service conduit properly secured to building? Continuously connected?		
G. All externally mounted 120 VAC single phase receptacles ground fault interrupter type?		
H. Are all metallic conductors, intrusion detection lines, water, steam, air conditioning lines, etc., run underground the last 50 feet to building?		
I. Inside building, are all distribution and lighting panels and receptacles interconnected by continuous conduit runs? Conduit in good condition?		

FIGURE (1) - VISUAL INSPECTION CHECKLIST

VISUAL INSPECTION CHECKLIST

DATE: _____ BUILDING: _____

INSPECTOR(S): _____

2. POWER SERVICE GROUNDING	ACCEPTABLE (Y/N)	COMMENTS
J. Are all electrical systems working properly?		

FIGURE (1) - VISUAL INSPECTION CHECKLIST

VISUAL INSPECTION CHECKLIST

DATE: _____ BUILDING: _____

INSPECTOR(S): _____

3. EQUIPMENT/STRUCTURE BONDING	ACCEPTABLE (Y/N)	COMMENTS
A. Are the bonding jumpers from door to door frame and door frame to ground installed? In good condition?		
B. Are grounding jumpers installed and in good condition for all metal window frames?		
C. Are all vents, vent covers, and stacks visually bonded? Are the connections in good condition?		
D. Are all machines, steel work tables, desks, shelves located in Ordnance Processing Areas bonded? Are connections in good condition?		
E. Are all ground cable connections to building steel secure and in good condition?		

FIGURE (1) - VISUAL INSPECTION CHECKLIST

VISUAL INSPECTION CHECKLIST

DATE: _____ BUILDING: _____

INSPECTOR(S): _____

3. EQUIPMENT/STRUCTURE BONDING	ACCEPTABLE (Y/N)	COMMENTS
F. Are all exposed ground conductors securely fastened? In good condition?		
G. Are the ground connections for all fire stand pipes installed and in good condition? Securely fastened?		
H. Are all ground jumpers for ductwork, piping, equipment, etc. installed and in good condition?		
I. Is there paint or corrosion on any grounding bond-point? If so, give pull test. Paint or corrosion sufficient to provide isolation? If so, conduct electrical bond resistance test to verify continuity.		
J. Are all metal masses 400 square inches or larger bonded to the grounding system? Are all connections in good condition and at their lowest point? (Use grounding plan dwgs. as a guide for metal mass locations.) Repair or add grounding as needed.		

FIGURE (1) - VISUAL INSPECTION CHECKLIST

VISUAL INSPECTION CHECKLIST

DATE: _____ BUILDING: _____

INSPECTOR(S): _____

3. EQUIPMENT/STRUCTURE BONDING	ACCEPTABLE (Y/N)	COMMENTS
K. Are any structural components isolated?		
L. Are only braided straps installed on equipment that vibrates?		
M. Is all equipment within sideflash distance of structure bonded?		
N. Are all structural bonding cables greater than or equal to #1/0? Connections in good condition? Are all equipment bonding cables greater than or equal to #6? Connections in good condition?		
O. In utility rooms, are boilers, compressors, piping, tanks, etc. bonded? Connections in good condition?		

FIGURE (1) - VISUAL INSPECTION CHECKLIST
Sheet 10 of 16 (Building)

VISUAL INSPECTION CHECKLIST

DATE: _____ BUILDING: _____

INSPECTOR(S): _____

3. EQUIPMENT/STRUCTURE BONDING	ACCEPTABLE (Y/N)	COMMENTS
P. Are all roll up door ground reels installed? Free of defects and in good operating condition?		

FIGURE (1) - VISUAL INSPECTION CHECKLIST

VISUAL INSPECTION CHECKLIST

DATE: _____ BUILDING: _____

INSPECTOR(S): _____

4. STATIC GROUNDING SYSTEM	ACCEPTABLE (Y/N)	COMMENTS
A. Are all static ground busses properly labeled? Are they securely fastened? Are the connection points free of paint, corrosion or any foreign material that may impair the efficiency of the system?		
B. Is Bonding/Grounding cabling continuous?		
C. Are all static ground interconnection joints/jumpers installed and in good condition? Securely fastened?		
D. Are the static ground busses securely fastened to the grounding system?		
E. Are all static ground reels free of defects and in good condition? Properly connected? Labeled as a static ground?		

FIGURE (1) - VISUAL INSPECTION CHECKLIST

VISUAL INSPECTION CHECKLIST

DATE: _____ BUILDING: _____

INSPECTOR(S): _____

4. STATIC GROUNDING SYSTEM	ACCEPTABLE (Y/N)	COMMENTS
F. Are connectors secure and properly attached to the static ground reel cables?		
G. Are all conductive chairs, carts, and work stations, connected to the static ground system and clearly labeled as conductive/anti static? Inspection date indicated?		
H. Are conductive floors/mats/table tops clean, relatively smooth, and free of cracks?		
I. Are grab bars securely supported, not painted? Installed just outside an entrance to area with a conductive floor?		
J. Are grounding bonds installed and in good condition for all grab bars?		

FIGURE (1) - VISUAL INSPECTION CHECKLIST

VISUAL INSPECTION CHECKLIST

DATE: _____ BUILDING: _____

INSPECTOR(S): _____

4. STATIC GROUNDING SYSTEM	ACCEPTABLE (Y/N)	COMMENTS
K. Are all portable ground cables/straps free of defects and in good condition?		
L. Are connectors secure and properly attached to the portable ground cables/straps?		
M. Are attachment point(s) free of paint?		
N. Have all portable ground cables/straps been electrically tested within the last 6 months?		

FIGURE (1) - VISUAL INSPECTION CHECKLIST

VISUAL INSPECTION CHECKLIST

DATE: _____ BUILDING: _____

INSPECTOR(S): _____

5. ORDNANCE GROUNDING SYSTEM	ACCEPTABLE (Y/N)	COMMENTS
A. Are all ordnance ground busses clearly labeled? Are they securely fastened? Are connection points free of paint, corrosion or any foreign material that may impair the efficiency of the system?		
B. Is all interconnecting cabling continuous, in good condition and isolated from any static grounds?		
C. Are all buss bar interconnection joints/jumpers installed and in good condition?		
D. Are all ordnance ground busses isolated from other grounding system? Isolated from building steel?		
E. Are there any ground loops in the ordnance ground system?		

FIGURE (1) - VISUAL INSPECTION CHECKLIST

VISUAL INSPECTION CHECKLIST

DATE: _____ BUILDING: _____

INSPECTOR(S): _____

5. ORDNANCE GROUNDING SYSTEM	ACCEPTABLE (Y/N)	COMMENTS
F. For each ordnance ground system there should only be one (1) connection point to the secondary ground girdle. Is this the case?		
G. Is each ordnance ground system capable of being isolated from the secondary ground girdle for testing?		
H. Are all ordnance ground reels free of defects and in good condition? Isolated from the structure? Labeled as ordnance ground? Securely fastened?		
I. Are connectors secure and properly attached to the ordnance ground reel cables?		

FIGURE (1) - VISUAL INSPECTION CHECKLIST

VISUAL INSPECTION CHECKLIST

DATE: _____ MAGAZINE: _____

INSPECTOR(S): _____

1. LIGHTNING PROTECTION SYSTEM (not applicable to all magazines)	ACCEPTABLE (Y/N)	COMMENTS
A. Are all large metal masses, 400 square inches or larger, within six feet of a lightning mast connected at their lowest point to the primary ground girdle stub at the lightning mast?		
B. Are masts and air terminals, properly supported? In good condition?		
C. Are lightning masts secure and in good condition?		
D. Inspect lightning mast and air terminal cables. Are they in good condition? At least #$^{1}/_{0}$ or larger? Made of bare copper? Repair, replace or install new cables as needed.		
E. Are down conductors continuous (two required)? Less than 1/3 of strands broken? No sharp bends or kinks? Symmetrically located?		

FIGURE (1) - VISUAL INSPECTION CHECKLIST

VISUAL INSPECTION CHECKLIST

DATE: _____ MAGAZINE: _____

INSPECTOR(S): _____

1. LIGHTNING PROTECTION SYSTEM (not applicable to all magazines)	ACCEPTABLE (Y/N)	COMMENTS
F. Are down conductors attached firmly and correctly to mast and air terminals?		
G. Are all rail-head bonds connected and in good condition on all railroad track joint bars located within the zone-of-protection of a lightning protection system?		
H. For all visible portions of the primary conductors, are all bends greater than 90 degrees and have minimum of eight (8) inches radius?		
I. For railroad track ground tie connections, are all cables #1/0 stranded copper? In good condition? Any welds to tracks present and secure?		
J. For railroad track earth ground connections, are all cables #1/0 stranded copper? In good condition? Any welds to tracks present and secure?		

FIGURE (1) - VISUAL INSPECTION CHECKLIST

VISUAL INSPECTION CHECKLIST

DATE: _____ MAGAZINE: _____

INSPECTOR(S): _____

2. POWER SERVICE GROUNDING (not applicable to all magazines)	ACCEPTABLE (Y/N)	COMMENTS
A. Are all utility lines coming into the magazine buried the last 50 feet?		
B. Are surge suppressors installed on all power lines? Do the surge suppressors appear in good condition?		
C. Is the electrical service to the magazine arranged so it can be cut off by a switch located outdoors?		
D. Inside service disconnect or panel, is the ground attachment point free of corrosion? Tightly connected?		
E. Are all externally mounted service conduit properly secured to magazine? Continuously connected?		

FIGURE (1) - VISUAL INSPECTION CHECKLIST
Sheet 3 of 7 (Magazine)

VISUAL INSPECTION CHECKLIST

DATE: _____ MAGAZINE: _____

INSPECTOR(S): _____

2. POWER SERVICE GROUNDING (not applicable to all magazines)	ACCEPTABLE (Y/N)	COMMENTS
F. Inside magazine, are all distribution panels, door motors and lighting interconnected by continuous conduit runs? Conduit in good condition?		
G. All electrical systems working properly?		

CAUTION

ANY INDICATION OF DAMAGE TO A LIGHTNING PROTECTION SYSTEM SHALL BE IMMEDIATELY REPORTED TO THE TEAM LEADER. PHOTOGRAPHIC RECORDS OF THE DAMAGE SUSPECTED TO HAVE RESULTED FROM A LIGHTNING STRIKE SHALL BE OBTAINED PRIOR TO REPAIR. NAVSEASYSCOM MUST BE INFORMED OF ANY LIGHTNING STRIKE MADE ON THE AREA AND THE DAMAGE SUSTAINED.

FIGURE (1) - VISUAL INSPECTION CHECKLIST

VISUAL INSPECTION CHECKLIST

DATE: _____ MAGAZINE: _____

INSPECTOR(S): _____

3. EQUIPMENT/STRUCTURE BONDING	ACCEPTABLE (Y/N)	COMMENTS
A. Are all bonding jumpers from door to door frame installed? In good condition?		
B. Are all vents visually bonded? Are the connections in good condition?		
C. Are ground cable connections to stainless steel security boxes secure and in good condition?		
D. Are all exposed ground conductors securely fastened? In good condition?		
E. Are all bonding jumpers for ductwork, piping, and ventilators installed and in good condition?		

FIGURE (1) - VISUAL INSPECTION CHECKLIST

VISUAL INSPECTION CHECKLIST

DATE: _____ MAGAZINE: _____

INSPECTOR(S): _____

3. EQUIPMENT/STRUCTURE BONDING	ACCEPTABLE (Y/N)	COMMENTS
F. Is there paint or corrosion on any grounding bond-point? If so, give pull test. Paint or corrosion sufficient to provide isolation? If so, conduct electrical bond resistance test to verify continuity.		
G. Are all metal masses 400 square inches or larger bonded to the grounding system? Are all connections in good condition and at their lowest point? (use Ground Test Plan Drawings as a guide for metal mass locations) Repair or add grounding as needed.		
H. Are all roll up door ground reels installed? Free of defects and in good operating condition?		

FIGURE (1) - VISUAL INSPECTION CHECKLIST
Sheet 6 of 7 (Magazine)

VISUAL INSPECTION CHECKLIST

DATE: _____ MAGAZINE: _____

INSPECTOR(S): _____

4. STATIC GROUNDING SYSTEM	ACCEPTABLE (Y/N)	COMMENTS
A. Are all static ground cables and/or busses properly labeled? Are they securely fastened? Are the connection points free of paint, corrosion or any foreign material that may impair the efficiency of the ground?		
B. Are all static ground interconnection joints/jumpers installed and in good condition? Securely fastened?		

FIGURE (1) - VISUAL INSPECTION CHECKLIST

VISUAL INSPECTION CHECKLIST

DATE: _____ RAILROAD CLASSIFICATION YARD: _____

INSPECTOR(S): _____

1. LIGHTNING PROTECTION SYSTEM	ACCEPTABLE (Y/N)	COMMENTS
A. Are all large metal masses 400 square inches or larger, within six (6) feet of a lightning mast connected at their lowest point to the primary ground girdle stub at the lightning mast?		
B. Are masts, overhead wires and air terminals, properly supported?		
C. Are lightning masts secure and in good condition?		
D. Are overhead catenary wires and mast mounted air terminals in good condition?		
E. Inspect lightning mast cables. Are they in good condition? At least #$^{1}/_{0}$ or larger? Made of bare copper? Repair, replace or install new cables as needed.		

FIGURE (1) - VISUAL INSPECTION CHECKLIST
Sheet 1 of 3 (Railroad Classification Yard)

VISUAL INSPECTION CHECKLIST

DATE: _____ RAILROAD CLASSIFICATION YARD: _____

INSPECTOR(S): _____

1. LIGHTNING PROTECTION SYSTEM	ACCEPTABLE (Y/N)	COMMENTS
F. Are down conductors continuous? Less than 1/3 of strands broken? No sharp bends or kinks? Symmetrically located?		
G. Are down conductors attached firmly and correctly to masts? 180° apart?		
H. Are all grounding connections located in each test pit, tight and secure?		
I. Are all rail-head bonds connected and in good condition on all railroad track joint bars located within the zone-of-protection of the lightning protection system?		
J. For all visible portions of the primary, are all bends greater than 90 degrees and have minimum of eight (8) inches radius?		

FIGURE (1) - VISUAL INSPECTION CHECKLIST
Sheet 2 of 3 (Railroad Classification Yard)

VISUAL INSPECTION CHECKLIST

DATE: _____ RAILROAD CLASSIFICATION YARD: _____

INSPECTOR(S): _____

1. LIGHTNING PROTECTION SYSTEM	ACCEPTABLE (Y/N)	COMMENTS
K. For railroad track ground tie connections, are all cables #1/0 stranded copper? In good condition? Are welds to tracks present and secure?		
L. For railroad track earth ground connections, are all cables #1/0 stranded copper? In good condition? Are welds to tracks present and secure?		
CAUTION **ANY INDICATION OF DAMAGE TO A LIGHTNING PROTECTION SYSTEM SHALL BE IMMEDIATELY REPORTED TO THE TEAM LEADER. PHOTOGRAPHIC RECORDS OF THE DAMAGE SUSPECTED TO HAVE RESULTED FROM A LIGHTNING STRIKE SHALL BE OBTAINED PRIOR TO REPAIR. NAVSEASYSCOM MUST BE INFORMED OF ANY LIGHTNING STRIKE MADE ON THE AREA AND THE DAMAGE SUSTAINED.**		

FIGURE (1) - VISUAL INSPECTION CHECKLIST
Sheet 3 of 3 (Railroad Classification Yard)

VISUAL INSPECTION CHECKLIST

DATE: _____ RAILROAD RECEIVING YARD: _____

INSPECTOR(S): _____

1. LIGHTNING PROTECTION SYSTEM	ACCEPTABLE (Y/N)	COMMENTS
A. Are all large metal masses 400 square inches or larger, within six (6) feet of a lightning mast connected at their lowest point to the primary ground girdle stub at the lightning mast?		
B. Are masts, overhead wires and air terminals, properly supported?		
C. Are lightning masts secure and in good condition?		
D. Are overhead catenary wires and mast mounted air terminals in good condition?		
E. Inspect lightning mast cables. Are they in good condition? At least #$^{1}/_{0}$ or larger? Made of bare copper? Repair, replace or install new cables as needed.		

FIGURE (1) - VISUAL INSPECTION CHECKLIST
Sheet 1 of 3 (Railroad Receiving Yard)

VISUAL INSPECTION CHECKLIST

DATE: _____ RAILROAD RECEIVING YARD: _____

INSPECTOR(S): _____

1. LIGHTNING PROTECTION SYSTEM	ACCEPTABLE (Y/N)	COMMENTS
F. Are down conductors continuous? Less than 1/3 of strands broken? No sharp bends or kinks? Symmetrically located?		
G. Are down conductors attached firmly and correctly to masts? 180° apart?		
H. Are all grounding connections located in each test pit, tight and secure?		
I. Are all rail-head bonds connected and in good condition on all railroad track joint bars located within the zone-of-protection of the lightning protection system?		
J. For all visible portions of the primary, are all bends greater than 90 degrees and have minimum of eight (8) inches radius?		

FIGURE (1) - VISUAL INSPECTION CHECKLIST
Sheet 2 of 3 (Railroad Receiving Yard)

VISUAL INSPECTION CHECKLIST

DATE: _____ RAILROAD RECEIVING YARD: _____

INSPECTOR(S): _____

1. LIGHTNING PROTECTION SYSTEM	ACCEPTABLE (Y/N)	COMMENTS
K. For railroad track ground tie connections, are all cables #$^1/_0$ stranded copper? In good condition? Are welds to tracks present and secure?		
L. For railroad track earth ground connections, are all cables #$^1/_0$ stranded copper? In good condition? Are welds to tracks present and secure?		

CAUTION

ANY INDICATION OF DAMAGE TO A LIGHTNING PROTECTION SYSTEM SHALL BE IMMEDIATELY REPORTED TO THE TEAM LEADER. PHOTOGRAPHIC RECORDS OF THE DAMAGE SUSPECTED TO HAVE RESULTED FROM A LIGHTNING STRIKE SHALL BE OBTAINED PRIOR TO REPAIR. NAVSEASYSCOM MUST BE INFORMED OF ANY LIGHTNING STRIKE MADE ON THE AREA AND THE DAMAGE SUSTAINED.

FIGURE (1) - VISUAL INSPECTION CHECKLIST
Sheet 3 of 3 (Railroad Receiving Yard)

VISUAL INSPECTION CHECKLIST

DATE: _____ TRUCK HOLDING YARD: _____

INSPECTOR(S): _____

1. LIGHTNING PROTECTION SYSTEM	ACCEPTABLE (Y/N)	COMMENTS
A. Are all large metal masses, 400 square inches or larger, within six (6) feet of a lightning mast connected at their lowest point to the primary ground girdle stub at the lightning mast?		
B. Are masts, overhead wires and air terminals, properly supported?		
C. Are lightning masts secure and in good condition?		
D. Are overhead catenary wires and mast mounted air terminals in good condition?		
E. Inspect lightning mast cables. Are they in good condition? At least # 1/0 or larger? Made of bare copper? Repair, replace or install new cables as needed.		

FIGURE (1) - VISUAL INSPECTION CHECKLIST
Sheet 1 of 4 (Truck Holding Yard)

VISUAL INSPECTION CHECKLIST

DATE: _____ TRUCK HOLDING YARD: _____

INSPECTOR(S): _____

1. LIGHTNING PROTECTION SYSTEM	ACCEPTABLE (Y/N)	COMMENTS
F. Are down conductors continuous? Less than 1/3 of strands broken? No sharp bends or kinks? Symmetrically located?		
G. Are down conductors attached firmly and correctly to masts? 180° apart?		
H. Are all grounding connections, located in each test pit, tight and secure?		

CAUTION

ANY INDICATION OF DAMAGE TO A LIGHTNING PROTECTION SYSTEM SHALL BE IMMEDIATELY REPORTED TO THE TEAM LEADER. PHOTOGRAPHIC RECORDS OF THE DAMAGE SUSPECTED TO HAVE RESULTED FROM A LIGHTNING STRIKE SHALL BE OBTAINED PRIOR RO REPAIR, NAVSEASYSCOM MUST BE INFORMED OF ANY LIGHTNING STRIKE MADE ON THE AREA AND THE DAMAGE SUSTAINED.

FIGURE (1) - VISUAL INSPECTION CHECKLIST

VISUAL INSPECTION CHECKLIST

DATE: _____ TRUCK HOLDING YARD: _____

INSPECTOR(S): _____

2. POWER SERVICE GROUNDING	ACCEPTABLE (Y/N)	COMMENTS
A. Are all utility lines coming into the Truck Holding Yard area buried the last 50 feet?		
B. Are surge suppressors installed on all power lines? Are they in good condition?		
C. Is the electrical service arranged so it can be cut off by a single switch?		
D. Inside service panel, is the ground attachment point free of corrosion? Tightly connected?		
E. Are all electrical systems working properly?		

FIGURE (1) - VISUAL INSPECTION CHECKLIST
Sheet 3 of 4 (Truck Holding Yard)

VISUAL INSPECTION CHECKLIST

DATE: _____ TRUCK HOLDING YARD: _____

INSPECTOR(S): _____

3. EQUIPMENT/STRUCTURE BONDING	ACCEPTABLE (Y/N)	COMMENTS
A. Are all exposed ground connections secure and in good condition?		
B. Are all fences properly grounded within the cone-of-influence of the lightning protection system?		
C. Are all bonding jumpers present on fence gates? Secure and in good condition.		
D. Are all metal masses, 400 square inches or larger, bonded to the grounding system? Are connections secure and in good condition?		

FIGURE (1) - VISUAL INSPECTION CHECKLIST
Sheet 4 of 4 (Truck Holding Yard)

VISUAL INSPECTION CHECKLIST

DATE: _____ BARRICADE: _____

INSPECTOR(S): _____

1. LIGHTNING PROTECTION SYSTEM (Not Applicable To All Barricades)	ACCEPTABLE (Y/N)	COMMENTS
A. Are all large metal masses 400 square inches or larger, within six (6) feet of a lightning mast connected at their lowest point to the primary ground girdle stub at the lightning mast?		
B. Are masts, overhead wires and air terminals, properly supported?		
C. Are lightning masts secure and in good condition?		
D. Are overhead catenary wires and mast mounted air terminals in good condition?		
E. Inspect lightning mast cables. Are they in good condition? At least #$^{1}/_{0}$ or larger? Made of bare copper? Repair, replace or install new cables as needed.		

FIGURE (1) - VISUAL INSPECTION CHECKLIST
Sheet 1 of 3 (Barricade)

VISUAL INSPECTION CHECKLIST

DATE: _____ BARRICADE: _____

INSPECTOR(S): _____

1. LIGHTNING PROTECTION SYSTEM	ACCEPTABLE (Y/N)	COMMENTS
F. Are down conductors continuous? Less than 1/3 of strands broken? No sharp bends or kinks? Symmetrically located?		
G. Are down conductors attached firmly and correctly to masts? 180° apart?		
H. Are all grounding connections located in each test pit, tight and secure?		
I. Are all rail-head bonds connected and in good condition on all railroad track joint bars located within the zone-of-protection of the lightning protection system?		
J. For all visible portions of the primary, are all bends greater than 90 degrees and have minimum of eight (8) inches radius?		

FIGURE (1) - VISUAL INSPECTION CHECKLIST

VISUAL INSPECTION CHECKLIST

DATE: _____ BARRICADE: _____

INSPECTOR(S): _____

1. LIGHTNING PROTECTION SYSTEM	ACCEPTABLE (Y/N)	COMMENTS
K. For railroad track ground tie connections, are all cables #1/0 stranded copper? In good condition? Are welds to tracks present and secure?		
L. For railroad track earth ground connections, are all cables #1/0 stranded copper? In good condition? Are welds to tracks present and secure?		
M. Are all exposed ground conductors securely fastened? In good condition?		

CAUTION

ANY INDICATION OF DAMAGE TO A LIGHTNING PROTECTION SYSTEM SHALL BE IMMEDIATELY REPORTED TO THE TEAM LEADER. PHOTOGRAPHIC RECORDS OF THE DAMAGE SUSPECTED TO HAVE RESULTED FROM A LIGHTNING STRIKE SHALL BE OBTAINED PRIOR TO REPAIR. NAVSEASYSCOM MUST BE INFORMED OF ANY LIGHTNING STRIKE MADE ON THE AREA AND THE DAMAGE SUSTAINED.

FIGURE (1) - VISUAL INSPECTION CHECKLIST

VISUAL INSPECTION CHECKLIST

DATE: _____ PIER: _____

INSPECTOR(S): _____

1. LIGHTNING PROTECTION SYSTEM	ACCEPTABLE (Y/N)	COMMENTS
A. Are all large metal masses 400 square inches or larger, within six (6) feet of a lightning mast connected at their lowest point to the primary ground girdle stub at the lightning mast?		
B. If applicable, are overhead wires and air terminals properly supported? Secure and in good condition?		
C. Are lightning masts secure and in good condition?		
D. Inspect lightning mast cables. Are they in good condition? At least #$^{1}/_{0}$ or larger? Made of bare copper? Repair, replace or install new cables as needed.		
E. Are down conductors continuous (two required)? Less than 1/3 of strands broken? No sharp bends or kinks?		

FIGURE (1) - VISUAL INSPECTION CHECKLIST
Sheet 1 of 3 (Pier)

VISUAL INSPECTION CHECKLIST

DATE: _____ PIER: _____

INSPECTOR(S): _____

1. LIGHTNING PROTECTION SYSTEM	ACCEPTABLE (Y/N)	COMMENTS
F. Are down conductors attached firmly and correctly to masts? 180° apart?		
G. Are any exposed ground conductors mechanically protected?		
H. Are any visual rail-head bonds connected and in good condition?		
I. Are all railings, tanks, metal frames, etc. within the lightning protected area, visually bonded?		
J. Is there paint or corrosion on any grounding bond-point? If so give pull test. Paint or corrosion sufficient to provide isolation? If so, conduct electrical bond resistance test to verify continuity.		

FIGURE (1) - VISUAL INSPECTION CHECKLIST
Sheet 2 of 3 (Pier)

VISUAL INSPECTION CHECKLIST

DATE: _____ PIER: _____

INSPECTOR(S): _____

1. LIGHTNING PROTECTION SYSTEM	ACCEPTABLE (Y/N)	COMMENTS
K. Are all exposed ground jumpers for piping and expansion joints installed and in good condition?		

CAUTION

ANY INDICATION OF DAMAGE TO A LIGHTNING PROTECTION SYSTEM SHALL BE IMMEDIATELY REPORTED TO THE TEAM LEADER. PHOTOGRAPHIC RECORDS OF THE DAMAGE SUSPECTED TO HAVE RESULTED FROM A LIGHTNING STRIKE SHALL BE OBTAINED PRIOR TO REPAIR. NAVSEASYSCOM MUST BE INFORMED OF ANY LIGHTNING STRIKE MADE ON THE AREA AND THE DAMAGE SUSTAINED.

FIGURE (1) - VISUAL INSPECTION CHECKLIST

INSTRUCTION FOR ELECTRICAL TESTING OF GROUNDING SYSTEMS FOR ORDNANCE STORAGE AND OPERATING FACILITIES

General:

Sections I, II and III below provide detailed procedures for the electrical testing of ordnance facilities grounding system. The following sections are also to be used in conjunction with the grounding test plan drawings and data recording forms. The intent of these sections is to identify obvious points of non-compliance with the requirements of Ref.(a).

SECTION I - CONDUCTIVE FLOOR TESTING

Purpose:

This document provides specific test procedures to be used in the performance of conductive floor testing in accordance with the requirements of Ref.(a).

Scheduling:

Conductive floor testing shall be conducted every six (6) months in accordance with the procedures described below.

Testing Team Membership:

The testing of conductive floors shall be conducted by a team of representatives from the following organizations:

a. LPOG Project Manager
b. Facility Supervisor
c. PWC Philadelphia Detachment - Maintenance and Utilities Personnel conducting electrical testing consisting of:
   1. Team Leader
   2. Test equipment operator

Responsibility:

This section delegates the responsibilities of the various team members.

The PWC Philadelphia Detachment - Maintenance and Utilities Supervisor is responsible for:

a. Ensuring that scheduling and testing procedures concur with OP-5 latest revision and WPNSTAEINST 11010.2.

b. Verifying that the personnel conducting electrical testing has provided the correct test equipment, all necessary testing tools, and is skilled in the operation of the test equipment.

c. Ensuring that the test equipment used in the testing is calibrated in accordance with the manufacturer's calibration procedures.

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d. Ensuring that the conductive floor testing is conducted in accordance with the requirements of this procedure and the test results are properly documented.

e. Ensuring that the Facility Supervisor is aware of any failed test.

f. Entering data in computer data base file.

The LPOG Project Manager is responsible for:

a. Analysis of test results.

b. Development and dissimilation of the test data.

c. Recommend corrective action if required.

Note: It is not necessary for the LPOG Project Manager to be present for the actual test.

The Facility Supervisor is responsible for:

a. Ensuring that the structure does not contain any explosive dusts, flammable vapors, or exposed electro-explosive devices (EED's).

b. Ensuring that the floor is clean and dry.

c. Briefing the test team on any explosive hazards that may exist in the building at the time of the test.

d. Providing any personnel necessary to handle explosives.

WARNING

1. Conductive floor testing shall be conducted only in areas where there are no explosive dusts, flammable vapors, or exposed electro-explosive devices (EED's).
2. Only authorized ordnance handlers shall handle any explosives material.
3. A minimum of two personnel shall be required to move explosives.

PWC Philadelphia Detachment - Maintenance and Utilities Team Leader is responsible for:

a. Coordination between facility supervisor and personnel conducting electrical testing.

b. Providing all test equipment, instruments, tools, etc. for proper conductive floor testing.

c. Conducting the actual test as ordered by the LPOG Project Manager.

d. Conducting the actual test in accordance with the procedure herein and as shown on the ground test plan drawings.

e. The accuracy of testing.

f. Reconnecting all ground straps, disconnected prior to testing, as recommended by the Facility Supervisor. Also, assure that all tools have been removed from test area.

g. Recording and organizing all test results. Provide LPOG with test result originals, one (1) copy to Base Civil Engineering and one (1) copy to EOSP Code 27A, WSFYDETEARL, Code 27E.

WARNING

Prior to the performance of any testing conducted as a part of these detailed test procedures, the test conductor shall ensure that all bonding is removed between the grounding system under test and any grounded ordnance items throughout the facility.

Test Hardware:

Conductive floor resistance shall be measured with a Biddle Insulation Resistance Tester (Model BM10), with the associated test equipment, or equal.

a. A total of two electrodes (conductive floor weights) weighing 5 pounds and having a dry, flat, circular contact area of 2.5 inches in diameter is required. The contact area shall have a surface of aluminum or tin foil of a minimum of 0.0005-inches thickness backed by a 1/4-inch thick layer of rubber. The surface of the electrode shall measure between 40-and 60-inch diameter hardness as determined by a Shore Type A Durometer in accordance with ASTM-2240-68.

b. Calibrated ohmmeter shall operate on a normal open circuit output of 500 volts DC and short circuit current of 5 milliamperes with an effective internal resistance of 100,000 ohms plus or minus 10 percent.

c. The test leads are to be made of #16 stranded wire, well insulated, and in good repair.

d. Hardened file.

e. Electrician knife.

WARNING

The Biddle Insulation Resistance Tester, Model BM10, is not approved for use in hazardous (classified) locations and shall not be used in any locations where there are explosives dusts, flammable and/or combustible vapors.

Specific Test Requirements:

Both electrode-to-electrode and electrode-to-ground measurements shall be made.

Electrode-to-electrode measurements shall be made at two (2) or more locations in each area or room. Each

measurement result shall be recorded on the test data sheet.

Electrode-to-ground measurements shall be taken at two (2) or more locations (using two (2) grounding system reference points). Each measurement result shall be recorded on the test data sheet.

All measurements shall be taken with the electrode(s) a minimum of 3 feet away from any ground connection or from a grounded object that is resting on the floor or as shown on the ground test plan drawings (See Enclosure (1), Departures from Ref.(a), Building MA-3, Conductive Floor, Page 3).

Specific Test Procedures:

The Test Equipment Operator shall select the electrode configuration and location from the ground test plan drawings.

The leads of the Biddle Insulation Resistance Tester shall be configured as specified below.

Electrode-to-Electrode Testing

Two electrodes shall be placed 3-feet apart at two (2) or more locations in each area or room. The electrodes are described under "Test Hardware". These electrodes must not be placed within 3 feet of a ground connection or from a grounded object that is resting on the floor except as shown on the ground test plan drawings.

The Test Equipment Operator shall connect the test lead's alligator clips to each electrode.

Electrode-to-Ground Testing

A conductive floor grounding point or structural steel member shall be used as a connection point for one of the electrodes. The other electrode shall be connected to the test equipment as described under "Test Hardware". The ground reference point shall be properly prepared before testing. This may consist of filing the surface or the shaving of paint and/or corrosion, using a knife.

The Test Equipment Operator shall connect one of the test lead's alligator clips to the electrode as described under "Test Hardware", the other shall be connected to the conductive floor ground reference point or structural steel member as shown on the ground test plan drawings.

Once the Test Equipment Operator has identified that the electrodes are properly connected, the test equipment operator shall make the resistance measurement. The test shall be conducted again at the same location by changing the leads at the tester. The averaged value of each test shall be the considered value at that location. The Test Equipment Operator shall enter this value on the data sheet.

If the resistance value changes appreciably with time during a measurement, the value observed after the voltage has been applied for 5 seconds shall be the value recorded on the data sheet.

The Test Equipment Operator shall record the test value on the data sheet.

The Test Equipment Operator shall vary the electrode location and configuration and repeat the above steps until all of the data points required by the ground test plan drawings have been measured.

Data Analysis:

The test results shall be collected by the LPOG Project Manager and reviewed with previous records to see if there has been any significant change in the conductive floor and/or mats.

No single value shall exceed 5 megohms.

Conductive mats shall not exceed 100,000 OHMS resistance.

The average electrode-to-electrode resistance shall be a minimum of 5,000 ohms for areas equipped with 110 volt service, 10,000 ohms for areas equipped with 220 volt service, and 20,000 ohms for areas equipped with 440 volt service.

All individual test points found to exhibit values of less than 20,000 ohms shall be reported to the LPOG Project Manager and EOSP Code 27A, WSFYDETEARLE, Code 27E, (those floors in structures equipped with only 110 volt service, this minimum number could be reduced to 5,000 ohms).

SECTION II - THREE POINT FALL-OF-POTENTIAL EARTH RESISTANCE TESTING

Purpose:

This document provides specific test procedures to be used in the performance of three point fall-of-potential and simplified fall-of-potential earth resistance testing in accordance with the requirements of Ref.(a).

Scheduling:

Earth resistance testing shall be conducted every 24 months in accordance with the requirements of NAVSEA OP-5, 6-8.3.4 using the methods specified below.

Testing Team Membership:

The earth resistance testing shall be conducted by a team of representatives from the following organizations:

a. LPOG Project Manager
b. Facility Supervisor
c. PWC Philadelphia Detachment - Maintenance and Utilities Personnel conducting electrical testing consisting of:
    1. A Team Leader
    2. Test equipment operator(s)

Responsibility:

This section delegates the responsibilities of the various team members.

The PWC Philadelphia Detachment - Maintenance and Utilities Supervisor is responsible for:

a. Verifying that the personnel conducting electrical testing has provided the correct test equipment, all necessary testing tools, and is skilled in the operation of the test equipment.

b. Ensuring that all test equipment to be used in the testing described in this document, is properly

calibrated and in good operating condition.

c. Scheduling of the 3 point fall-of-potential testing with the Facility Supervisor and personnel conducting the electrical testing.

d. Ensuring that the Facility Supervisor and EOSP Code 27A, WSFYDETEARLE, Code 27E are aware of any failed test.

e. Entering data in computer data base file.

The LPOG Project Manager is responsible for:

a. Analysis of test results.

b. Development and dissimilation of the test data.

c. Recommend corrective action if required.

Note: It is not necessary for the LPOG Project Manager to be present for the actual testing.

The Facility Supervisor is responsible for:

a. Ensuring that the Facility is available for the personnel conducting electrical testing.

b. Briefing the test team on any explosive hazards that may exist in the building at the time of the test.

WARNING

1. **Only authorized ordnance handlers shall handle any explosive materials.**
2. **A minimum of two personnel shall be required to move explosives.**

PWC Philadelphia Detachment - Maintenance and Utilities Team Leader is responsible for:

a. Coordination between facility supervisor and personnel conducting electrical testing.

b. Providing all test equipment, instruments, tools, etc. for proper three point fall-of-potential resistance testing.

c. Performing the actual test as ordered by the LPOG Project Manager.

d. Ensuring that the actual test is done in accordance with the procedure specified herein and as shown on the ground test plan drawings.

e. Ensuring that electrodes meeting the specifications detailed in the procedures are available.

f. The accuracy of testing.

g. Reconnect all ground straps, disconnected prior to testing, as recommended by the Facility Supervisor. Also, assure that all tools have been removed from test area.

h. Document and report any resistance-to-earth values greater than 25 ohms to Base Civil Engineering for further review.

i. Recording and organizing all test results. Provide LPOG with test result originals, one (1) copy to Base Civil Engineering and one (1) copy to EOSP Code 27A, WSFYDETEARL, Code 27E.

WARNING

Prior to the performance of any testing conducted as a part of these detailed test procedures, the test conductor shall ensure that all bonding is removed between the grounding system under test and any grounded ordnance items throughout the facility.

Test Hardware:

The following test hardware and equipment are required for the conduction of the testing described in this Instruction Manual.

a. A Biddle DET 2/2 digital ground resistance tester shall be used to conduct the earth resistance testing. The tester shall be configured as shown in figure (2).

b. Two reference electrodes of 1/2-inch diameter and minimum of 18-inches long of cooper or steel (galvanized or stainless) shall be used in the testing.

c. Three insulated test leads of sufficient length to meet the requirements of the "Specific Test Procedures" paragraph are required for the performance of the testing detailed in this procedure.

d. Cotton coveralls.

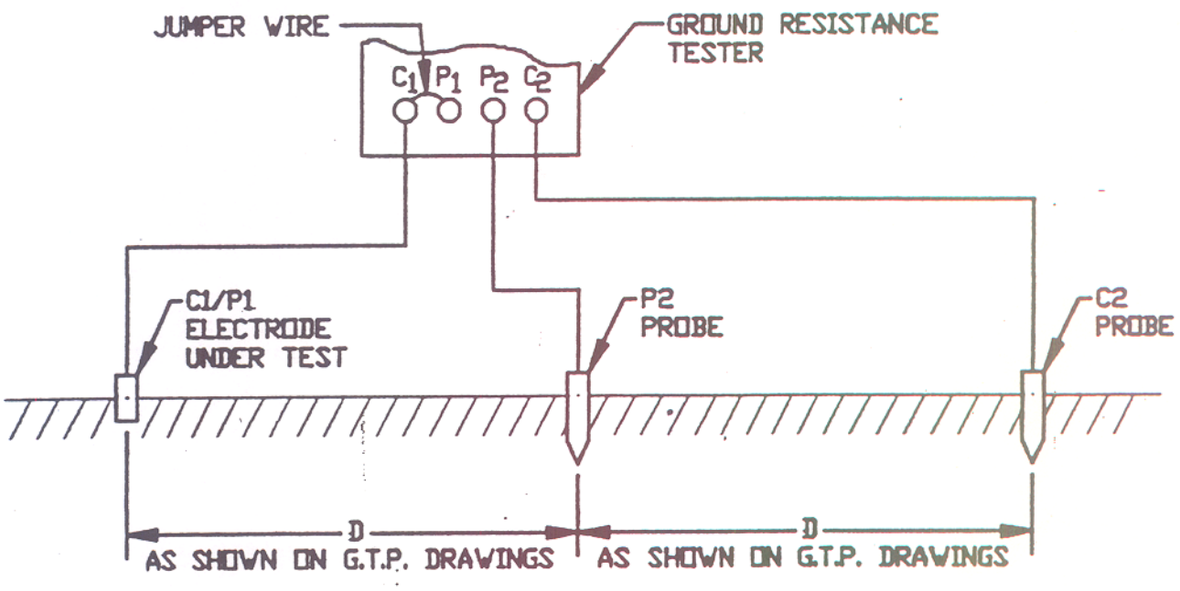

Figure (2) Earth Resistance Testing Equipment Configuration (G.T.P. = Ground Test Plan)

Selection of Test Points:

The selection of test points for the earth resistance testing have already been located under a separate testing phase in this S.O.P. The actual points are shown on both the ground test plan drawings and also are located in the field. Compass headings and dimensions are shown on the ground test plan drawings for exact probe locations. Back-up records for the selection of these test points can be found in the "Blue" volume of "Field Recorded Test Data"

Amended Test Procedure:

All structures with large ground grid systems have been installed with an Isolated Test Rod (ITR) test pocket in locations as shown on the test plan drawings. Due to the large sphere of influence and difficulty in placing the "P2" and "C2" probes at the distance required by the 3 point fall-of-potential test method, a unique testing procedure was devised and accepted for the earth resistance testing of these large ground grid systems. As a result, all earth resistance testing for the systems as shown on the test plan drawings shall be conducted from the ITR, which shall be considered the "electrode-under-test" as referred to in the Specific Test Procedures, which follows.

Specific Test Procedures:

a. The test equipment operator #1 shall ensure that Biddle DET 2/2 digital ground resistance tester is properly configured for three-point fall-of-potential testing as shown in Figure (2). He shall verify that the power to the tester is off and that the test lead for the C1/P1 electrode is disconnected from the tester.

b. The testing equipment operator #2 shall identify the "electrode-under-test" and identify the locations of the P2 and C2 reference electrodes.

c. For specific structures as shown on the Ground Test Plan Drawings, the test equipment operator #1 shall disconnect the test pit located ground rod (electrode-under-test) from the ground grid system.

d. The test equipment operator #1 shall install the reference electrodes as described under "Test Hardware" at a depth of 8-inches. Specific electrode locations shall be as shown in the Ground Test Plan drawings.

e. The test equipment operator #1 shall connect the C2 electrode of the test equipment to the most distant reference electrode. He shall also connect the closest reference electrode to the P2 electrode of the test equipment. The electrode-under-test shall remain disconnected until otherwise directed by the test equipment operator #2.

f. The test equipment operator #2 shall prepare the test point and connect the test lead to the test point.

g. The test equipment operator #1 shall connect the test lead to the C1/P1 electrode and confirm that the FILTER is switched off. The test equipment operator #2 shall signal to the test equipment operator #1 to make the resistance measurement.

h. The test equipment operator #1 shall notify the test equipment operator #2 of the measured value for the test point. The test equipment operator #2 shall record the value on the data sheet included as part of the Ground Test Plan drawings.

i. The test equipment operator #1 shall verify that the power to the test equipment is OFF and that the C1/P1 electrode has been disconnected.

j. Upon verification that the lead has been disconnected from the test equipment, the test operator #2 shall remove the test leads from the electrode-under-test and the C2 and P2 probes.

k. The test equipment operator #1 shall reconnect the test pit located ground rod with the ground grid system and test for bonding resistance values as set forth in Section III to verify continuity.

l. The test equipment operator #1 and #2 shall collect all equipment and wires, and move on to the next test location and repeat the test procedures specified herein until all earth resistance testing has been completed.

Data Analysis:

The LPOG Project Manager shall collect earth resistance data and review data with previous years of collected information to see if there has been a significant change in the earth resistance over the years. No resistance-to-earth measurement shall exceed 25 ohms.

SECTION III - BONDING RESISTANCE TESTING

Purpose:

This document provides specific test procedures to be used in the performance of bonding resistance testing in accordance with the requirements of Ref.(a).

Scheduling:

Point-to-point bonding resistance testing shall be conducted every 24 months with the exception of portable ground cables and cable reels which shall be tested every 12 months. All testing shall be in accordance with the requirements of Ref.(a) using the methods forwarded below.

Testing Team Membership:

The bonding resistance testing shall be conducted by a team of representatives from the following organizations:

a. LPOG Project Manager
b. Facility Supervisor(s)
c. PWC Philadelphia Detachment - Maintenance and Utilities Personnel conducting electrical testing consisting of:
    1. A Team Leader
    2. Test equipment operator(s)

Responsibility:

This section delegates the responsibilities of the various team members.

The PWC Philadelphia Detachment - Maintenance and Utilities Supervisor is responsible for:

a. Verifying that the personnel conducting electrical testing has provided the correct test equipment, all necessary testing tools, and is skilled in the operation of the test equipment.

b. Ensuring that all test equipment to be used in the testing, described in this document, is properly calibrated and in good operating condition.

c. Scheduling of the bonding resistance testing with the Facility Supervisor and personnel conducting the electrical testing.

d. Ensuring that the Facility Supervisor and EOSP Code 27A, WSFYDETEARLE, Code 27E are aware of any failed test.

e. Entering data in computer data base file.

The LPOG Project Manager is responsible for:

a. Analysis of test results.

b. Development and dissimilation of the test data.

c. Recommend corrective action if required.

Note: It is not necessary for the LPOG Project Leader to be present for the actual testing.

The Facility Supervisor is responsible for:

a. Ensuring that the Facility is available for the personnel conducting electrical testing.

b. Briefing the test team on any explosives hazards that may exist in the building prior to any testing.

c. Providing any personnel necessary to handle explosives.

WARNING

1. **Only authorized ordnance handlers shall handle any explosive materials.**
2. **A minimum of two personnel shall be required to move explosives.**

PWC Philadelphia Detachment - Maintenance and Utilities Team Leader is responsible for:

a. Coordination between facility supervisor and personnel conducting electrical testing.

b. Providing all test equipment, instrument, tools, etc. for proper bond resistance testing.

c. Performing the actual test as ordered by the LPOG Project Manager.

d. Ensuring the actual test is in accordance with the procedures specified herein and as shown on the ground test plan drawings.

e. Ensuring that electrodes meeting the specifications detailed in the procedures are available.

f. The accuracy of testing.

g. Reconnect all ground straps, disconnected prior to testing, as recommended by the Facility Supervisor. Also, assure that all tools have been removed from test area.

h. Document and report any bonding resistance values greater than 1 ohm to Base Civil Engineering for further review.

i. Recording and organizing all test results. Provide LPOG with test result originals, one (1) copy to

Base Civil engineering and one (1) copy to EOSP Code 27A, WSFYDETEARL, Code 27E.

WARNING

Prior to the performance of any testing conducted as a part of these detailed test procedures, the test conductor shall ensure that all bonding is removed between the grounding system under test and any grounded ordnance items throughout the facility.

Test Hardware:

The following test hardware and equipment are required for the conduction of the testing described in this Instruction Manual.

a. A Biddle DET 2/2 digital ground resistance tester shall be used in the measurement of point-to-point bonding resistances in ordnance storage and operating facilities. The C1 and P1 electrodes shall be shunted together and the C2 and P2 electrodes shall be shunted. All measurements shall be made between the C1/P1 and C2/P2 terminals. The tester shall be configured as shown in Figure (3).

b. Three insulated test leads of sufficient length to meet the requirements of the "Specific Test Procedures" paragraph are required for the performance of the testing detailed in this procedure.

c. Cotton coveralls.

CAUTION

Biddle DET 2/2 digital ground resistance tester is not approved for use in hazardous (classified) locations. The test equipment shall not be located in any area where there may be explosive ducts, exposed electro-explosive devices (EED's), flammable and/or combustible vapors.

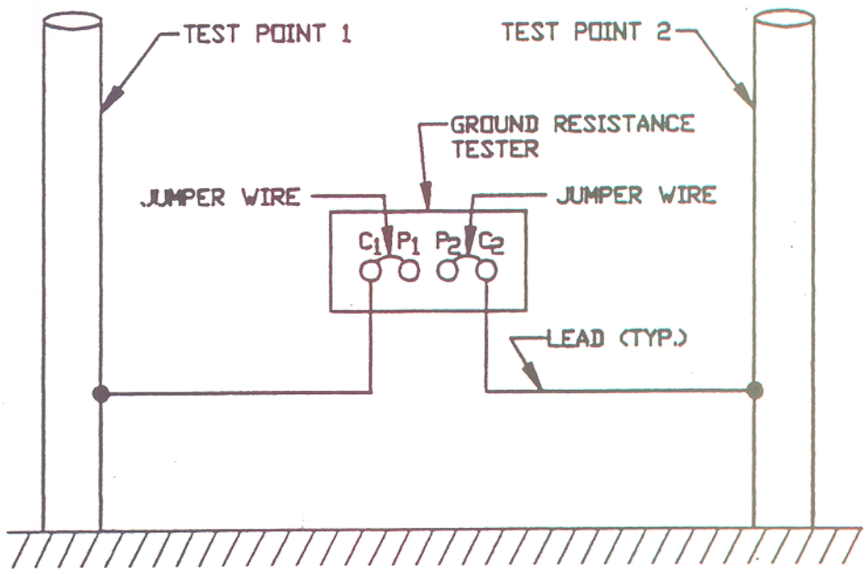

Figure (3) Bonding Resistance Testing Equipment Configuration

Selection of Test Points:

The test points to be used in the bonding resistance testing shall be as specified herein and as shown in the ground test plan drawings.

Specific Test Requirements:

a. Prior to conducting any point-to-point resistance testing the test equipment operator #1 shall ensure that the test equipment is configured as shown in Figure (3).

b. Prior to conducting any point-to-point resistance testing, the resistance of the test leads to be used shall be measured by the test equipment operator #1 and recorded onto the data sheet by the test equipment operator #2.

c. The test equipment operator #2 shall select the test points from the test data sheet provided in the ground test plan drawings.

d. The test equipment operator shall prepare the test points and make the connection between the test leads and the items-under-test. To prepare the test point, the test equipment operator shall sand, scrape, file, wire brush, etc., as required so the test point is free of paint, dirt, rust, corrosion, etc.

CAUTION

Careful attention must also be given to the attachment method made with the test points. Some attachment point techniques which have been successfully used are electrodes with sharp points or electrodes with clamps which have sharp points which can "bite" into the item under test.

e. The test leads shall be disconnected from the test equipment until which time the leads have been

connected to the test points and the test equipment operator #2 has given the command to make the reading.

f. Once the test equipment operator #2 has made the connection between the test leads and the test points, he shall signal to the test equipment operator #1 to make the measurement.

WARNING

1. Prior to connecting the leads to the test equipment, the test equipment operator shall ensure that the power to the test equipment is OFF.
2. Prior to applying power to the test leads, the test equipment operator shall ensure that the C1 and P1 electrodes are shunted together and the C2 and P2 electrodes are shunted, that the TEST CURRENT is set on NORMAL setting, and the FILTER is OFF.

g. The test equipment operator #1 shall make the test.

h. The test equipment operator #1 shall notify the test equipment operator #2 of the test value, that the power to the test equipment is being turned OFF and the test leads are being removed. The test equipment operator #2 shall record the test result on the data sheet.

CAUTION

When significant lead lengths are used in the testing of the bonding resistance between an item and a ground girdle reference point, it is important that the resistance of the leads used in the testing be measured and recorded prior to (and possibly after) testing. This lead resistance must be subtracted from the measured value of bonding resistance of the item under test to obtain the true bonding resistance of the item under test.

i. The test equipment operator #2 shall prepare the next test point and repeat the above steps until all the data is gathered on each of the test points specified by the ground test plan drawings.

Specific Test Points:

1. General:

a. Test bonding between secondary ground girdle and all scheduled exterior machines, equipment, conduits, downspouts, gutters, hand-rails, beams, metal siding, doors, storage cabinets, railroad tracks, gate, gate post fences, grab-bars, steam lines, ramps, metal door stops, vents, and all other metallic items as shown on the ground test plan drawings (1 ohm or less).

b. Test bonding between secondary ground girdle and all scheduled interior machines, equipment, beams, doors, radiators, window frames, tanks, columns, window shutters, mats, tables, static ground systems, assembly and disassembly machines, paint booths, and all associated equipment involved as shown on the ground test plan drawings (1 ohm or less).

2. Lightning Masts:
   a. This test will be performed after successful completion of the Primary Ground Visual Inspection and all discrepancies recorded.

   b. Disconnect the two down conductor pigtail connections from the ground rods located in the two (2) test pockets associated with the lightning mast to be tested. Ensure the pigtails don't make contact with the ground rods during the test.

   c. Connect the test equipment tester test leads to each lightning mast pigtail cable. Record the measurement (1 ohm or less).

   d. Reconnect the pigtails to the ground rods in each test pocket. Perform a bond resistance test between the lightning mast base and both ground rods to test connections.

   e. Perform a bonding resistance test between each ground rod. Record reading (1 ohm or less).

   f. Test bonding between lightning mast and any object within six (6) feet of mast (1 ohm or less).

   g. Disconnect test leads and continue on with the bonding resistance test program as shown in the ground test plan drawings. If resistance readings recorded were more than 1 ohm, a Work Request must be submitted for corrective action.

3. Incoming Service Grounding:
   a. This test is to check the bonding resistance between the incoming service neutral and the secondary girdle (1 ohm or less).

   b. Prior to the actual test, an amp probe or voltage reading should be performed on the neutral to verify zero potential. This is to preclude any electrical backfeed on the test equipment which could result in damage.

WARNING

Extreme caution should be exercised during this test procedure. Entrance into a "live" electrical service panel shall be conducted by qualified personnel only! This test could be conducted while building/facility power is "on" but is not recommended. Coordination between the LPOG Project Manager, facility supervisor(s) and Contractor/Contractor Personnel Team Leader conducting electrical test is a must.

   c. Connect the earth resistance tester leads between the neutral and the test point as shown on the ground test plan drawing and data sheets.

   d. Perform bonding resistance test and record value (1 ohm or less).

e. Disconnect test leads, secure service panel or switch and turn power "on" to the facility.

f. Continue on with the bonding resistance test program as shown on the ground test plan drawings.

4. Ordnance Grounds:

a. Perform bonding resistance between ordnance grounds and the secondary girdle with test points as shown on the ground test plan drawings (1 ohm or less).

b. Disconnect the ordnance ground system from the secondary ground girdle and test to ensure the ordnance ground is isolated from all other grounds. Contact LPOG Project Manager immediately if ordnance ground is not isolated.

c. Reconnect ordnance grounds and perform bonding resistance test to the secondary ground girdle (same procedure as in Item a. above) to ensure proper connection.

5. Portable Ground Cables:

a. Portable ground cables used for grounding ordnance items to the ordnance or static ground shall be visually inspected prior to each use. The cable shall be verified prior to each use as having been electrically tested within the last 12 months.

b. An electrical continuity test shall be performed within 12 months prior to use. Once a cable has been connected, an electrical test need not be performed on that cable until the cable has been disconnected and more than 12 months have elapsed since its last electrical test. Cables shall have a connector-to-connector resistance not exceeding 25 ohms.

c. Perform continuity tests on the ground cable by connecting the leads from an ohmmeter to each end of the ground cable.

6. Ground Cable Reels:

a. An electrical continuity test shall be performed within 12 months prior to use. Perform continuity test by connecting the leads.

b. Perform continuity test by connecting the leads of an ohmmeter to the reel "clip" and the secondary ground girdle. Reels shall have a "clip" to secondary ground girdle resistance not exceeding 1 ohm (±10%).

Data Analysis:

The LPOG Project Manager shall collect all bonding resistance data and review for any bonding connections that exceed 1 ohm.

DOCUMENTATION

ENCLOSURE (4)

BUILDING D-4 AND D-3 ARE LISTED AS INERT STORAGE FACILITIES UNDER CODE 421-32A OF NAV FACT, PAGE 164. (CREATED 01JUN94)

Revision 1-31Aug98

Building D-4 has been reactivated for use. Lightning protection system has been updated and is now included as part of the grounding test plan.

REF. FOR BUILDING D-4

PARTMENT OF THE NAVY
NAVAL WEAPONS STATION EARLE
COLTS NECK, NEW JERSEY 07722-5000

IN REPLY REFER TO
0922AL
DB/PC

01 SEP 1992

From: Al Larkin, Code 0922, NWS Earle, D.P.W.
To: Bob Karpinski, Code B6, NORTHNAVFACENGCOM

Subj: PROPOSED LIGHTNING PROTECTION SYSTEM FOR ORDNANCE PRODUCTION BUILDINGS

Ref: (a) Phonecon 13 Aug 1992 btwn Al Larkin, NWS Earle and Bob Karpinski and Tom Kunik, NORTHNAVFACENGCOM

Encl: (1) Map of Soil-Stained Sampling Locations at NWS Earle
(2) Ltr. from A. Larkin, Code 0922, NWS Earle dtd 19 May 92

1. Enclosure (2) the 19 May 92 letter sent to Code 09A23, NORTHNAVFACENGCOM, outlined the scope of work requested by NWS Earle to meet Safety and Ordnance requirements. Since then, soil stains adjacent to Buildings 544, GB-1, and D-2 have been identified from a previous survey as potential IR sites. See Enclosure (1) for the type of soil-stain and the approximate location. Following discussion in Public Works, we request that the A/E design the lightning protection systems so as to avoid infringing upon the stained areas. NWS Earle is aware that this may result in additional materials cost and supports this alternative.

2. The 35% design submitted prepared by Gillen & Hartmann, Inc. of Valley Forge, PA provided primary lightning protection to the following twelve (12) buildings: D-2, D-3, D4, D-5, E-13, E-14, GB-1, HA-1, MA-1, MAB-544, S-464 and 589. Review by the NWS Earle Ordnance and Safety Departments revealed that Buildings D-3 and S-464 are no longer used for explosive ordnance operations and can be deleted from the project scope. The lighting protection system for Building 589 is approximately 15 years old, and we request that the A/E evaluate the existing system for both primary and secondary protection to determine the necessity or scope of repair. In addition, we request that the design for Building GB-1 be prepared under separate cover. The design for Building GB-1 does not need to consider the potential IR sites. The work for GB-1 will not proceed until the soil stained areas are either resolved or abated. Building GB-1 is not currently utilized for Ordnance operations, however, this approach would give us a design package that would enable us to quickly bring GB-1 into compliance with Explosive Safety Requirement.

REF. FOR BUILDINGS D-3 & S-464

THIS BUILDING NO LONGER EXISTS. BUILDING WAS DEMOLISHED IN 1996.

OPTIONAL FORM 99 (7-90)

FAX TRANSMITTAL | # of pages ▸ 1

To Keith	From Barry
Dept./Agency Chu + Gassman	Phone # 866-2586
Fax # 908-752-0016	Fax # 866-2353

NSN 7540-01-317-7388 5099-101 GENERAL SERVICES ADMINISTRATION

8020

20

09 APR 1993

MEMORANDUM

From: Ordnance Officer
To: Safety
Via: A

Subj: DISESTABLISHMENT OF THE WPNSTA EARLE HELIPAD

1. Recommend Code 04 initiate appropriate action to disestablish the helipad and its applicable Q-D standards. The helipad is no longer required for its original purpose, and the area can now be redesignated to a more useful function.

2. Ordnance point of contact is Paul Anderson, ext. 2563.

G. O'REGAN

Copy to:
Public Works (09/092)

REF. FOR HELOPAD NEAR M-GROUP

Copy as found in Northern Division to Earle Site Approval Request C11-90 dated 13 Jun 82 "Change of use"

otential Explosives Site (PES) and using equation D=9W1/3 for 100,000 lbs., class 1.1 explosives the required separation is 420 feet. Regarding MA-1 as PES and using equation D=9W1/3 with W=12,000 lbs. class 1.1 explosives the required separation is 206 feet. The actual separation between buildings MA-1 and MA-3 is 570 feet which meets NAVSEA OP-5 criteria.

(b) Building 557 is an unbarricaded facility with a maximum allowable NEW = 20,000 lbs. of class/division 1/1. Considering 557 as a PES and using equation D=18W1/3 with W=20,000 lbs. the required separation is 489 feet. Regarding Building MA-3 as an unbarricaded PES using equation D=18W1/3 with W=100,000 lbs. the required separation distance is 836 feet. The actual separation is 1,050 feet satisfying NAVSEA OP-5 criteria. See Attachment F to Enclosure (1).

7. Building (MAB) - 544 is a 100' L X 40' W X 14' H, one story structure situated approximately 100' South-east of Midway Road adjacent to E-Group. Building 544 was constructed in 1969 and has an area = 4,265 S.F.

MAB-544 is listed in the current Engineering Evaluation (EE) Worksheet dated 25 August 1990 under Category Code 216-10: Ammunition Rework Facility. After MOMAG EED operations are moved to Throckmorton Hill via this project all ordnance operations will cease in the building. This site approval also serves as a request for a change in use for Building 544 to Category Code 143-20: Ordnance Operations Building. The total number of workers to be relocated into Building 544 is four (4): one (1) relocated from Bldg. GB-1 and three (3) relocated from Bldg. S-53.

The NWS Earle Ordnance Department facilities indirectly effected by this project (S-53 and GB-1) are described below to illustrate their continued use. Building GB-2 is included for information only.

(a) Building S-53 is a 48' L X 20' W X 13' H one-story structure constructed in 1944. The existing Category Code is 143-20: Ordnance Operations Building and the area = 1,050 S.F. There is no proposed change to the utilization or Category Code.

(b) Building GB-1 is a 141' L X 29' W X 21' H one-story structure constructed in 1944. The existing Category Code is 143-21: Ammunition Segregation Facility and the area = 6,323 S.F. NWS Earle intends to vacate GB-1 by 1 February 1993 and the proposed use is undetermined.

(c) Building GB-2 is a 32' L X 22' W X 16' H one-story structure constructed in 1952. The existing Category Code is 441-30: Hazardous and Flammable Storehouse and the area = 704 S.F. There is no proposed change to the utilization or Category Code.

Added 6/92

REF. FOR BLDG. MAB-544

26JUN98
CG7017-8000

Letter to file

Subject: Telcom between Mr. Bob Tully of NWSE and Mr. R.K. Craven of Chu and Gassman
Re: 3 Point Fall - of - Potential Testing Procedure
For: Large Ground Grid Systems

History: When Chu and Gassman first wrote the Grounding Test Plan in 1993, there was always a question on how to apply the 3PF-o-P to a large ground grid system. The problem is that in large ground grid systems, the "C" probe must be placed thousands of feet from the structure being tested in order to obtain correct earth resistance readings. This is impracticable as well as impossible, but OP-5 clearly states that the 3PFoP testing procedure must be used on Naval Ordnance Facilities.

There were a number of suggestions posed by C&G to help out the situation as well as ~~get~~ some feedback to this dilemma, but a clear answer was never given by either NWSE or Explosive Safety (ES) located in Indian Head, Maryland. The test plan was written with these "gray" areas in mind and documented so in the test plan. ES understood that this was a problem but really had no clear cut answers at that time. It was indicated that if C&G explain why things were done the way they were done, in the test plan, it was acceptable to slightly deviate from the requirements of OP-5. So this was done.

Present: C&G has been retained by NWSE to upgrade the existing test plan that was written +/- 4 years ago. Again this "Gray" area was posed to NWSE in hopes that and acceptable method was found to conduct a 3PF-o-P test on a large grid system in such a manner that was acceptable to the Navy.

Telcom: C&G suggested and asked NWSE since new test pockets were being installed at most locations where there were lightning masts, was it acceptable to isolated one ground rod from the "large" overall grid system, perform a 3PFoP test on that single ground rod, then reconnect that rod to the grid system and use the obtained earth resistance value as the accepted value for the entire ground grid system.

NWSE called ES at Indian Head, Md. and posed the same question. ES indicated that this was an acceptable method to test large ground grid systems using the 3PFoP testing procedure. It was further indicated that all tests conducted must be documented as part of the upgraded grounding test plan.

C&G will proceed in this direction.

END OF TELCOM

23FEB99
CG7017-9003

Letter to file & for documentation in the Station Instruction "Enclosure 4"

Subject: Notes of meeting held in the offices of Building C-29: NWSE.
Acceptance of the installation of an Isolated Test Rod (Test Pocket) at each large ground grid system located at NWSE.

In Attendance:		
	Mr. Chris Karabin	Center for Explosive Safety, Indian Head, Maryland.
	Mr. John Mahoney	NWSE
	Mr. Al Larkin	NWSE
	Mr. Jim Santry	NWSE
	Mr. Bob Tully	NWSE
	Mr. Keith Craven	Chu and Gassman

History: See 26JUN98 "Letter to file" included as part of this "Documentation" section.

Discussion: After further investigation, it was found that all ground rods, associated with the large grid systems, were found to be exothermically welded to the Primary Girdle. Instead of disconnecting these exothermic welds, another test procedure was devised to accommodate this situation. NWSE approached the Center of Explosive Safety and asked if it was acceptable to provide an individual, Isolated Test Rod (test pocket) immediately adjacent to the large grid system and use this for the earth resistance testing of that system. By doing this, a standard 3 point fall-of-potential test can be conducted, which is required by OP-5, to determine earth resistance for that associated area. This was acceptable to Mr. Chris Karabin.

Action: NWSE at this time will install 22 Isolated Test Rods, in locations as shown on the Test Plan Drawings. By way of this file and as it appears in this "Documentation" section (Enclosure 4), the installation of the ITR's have been accepted and will be integrated into the Station Instruction and the Test Plan Drawings.

C&G will proceed in this direction.

END OF MEETING NOTES

26FEB99
CG7017-9002

Letter to file and for documentation in the Station Instruction "Enclosure 4"

Subject: Telcom between Mr. Bob Tully of NWSE and Mr. R.K. Craven of Chu and Gassman, Re: The official removal of GB-1 from the Grounding Test Plan.

Telcom: C&G was directed to remove Building GB-1 from the Grounding Test Plan. Due to the fact that this building is no longer used for any kind of ordnance operations at NWSE. It was agreed that it made economic sense not provide monies, to test the building, which is no longer used.

The go ahead for the removal of GB-1 came from Mr. Al Larkin of the Ordnance Department. Mr. Larkin's direction was past to Mr. Tully for removal of GB-1 from the Grounding Test Plan by C&G.

By way of this Telcom, as it appears in the "Documentation" section (Enclosure 4) of the Station Instruction, Building GB-1 is officially removed from the Grounding Test Plan based on the building's lack of ordnance usage. In addition, the building, at this time, has no future plans of being reactivated for ordnance operations.

C&G will proceed in this direction.

END OF TELCOM

CHU & GASSMAN
CONSULTING ENGINEERS

ELECTRICAL
MECHANICAL
INSTRUMENTATION

December 17, 1993
CG#4091-300-

Mr. Kratovil (Code N7B)
Commanding Officer Northern Division
E.O.D. Technical Center
2008 Stumpneck Road
Indian Head, Maryland 24640-5070

Subject: Naval Weapons Station Earle
Development of Station Operation Plan
Grounding Test Plan

RKC 02MAR99 (REF. ONLY)

Dear Mr. Kratovil:

Our company, Chu & Gassman Consulting Engineers, was contracted by Naval Weapons Station Earle - Department of Public Works, to develop and publish a station operation plan for testing the grounding system of all ordnance handling/storage structures. The intent is to develop a test plan based on the guide lines as set forth in chapters 5 and 6 of NAVSEA OP-5 Volume 1, Fifth Revision, change two (2).

As part of our contract, we have been tasked to physically locate Earth Resistance Probe Test points. We have accomplished this by employing the 3-point fall-of-potential method using a Biddle Det 2/2 earth resistance test meter.

VOID

During our earth resistance testing phase, we have run into a problem, using the 3-point fall-of-potential method, with the large grid systems (primary and secondary) associated with the Ordnance Handling Buildings and the Railroad Classification Yards. We have found it impossible to place our "C" probes at the required distances needed, based on the criteria called for in OP-5 and as required by the 3-point fall-of-potential testing method. The problem arises from the physical constraints posed by the surrounding terrain (i.e., other structures, dense woods, railroad tracks, swamps, brooks, rough terrain, etc.). For the eleven (11) buildings in question, the "C" probe test location distances range anywhere from 800' to 3,000'. For the Railroad Classification Yards, we should be going out ±12,500'. Aside from being impossible due to the terrain, these distances border on the impractical.

We looked into using alternative methods which are as follows:

a. Intersecting Curves Method (Biddle Book, Page 41)

b. Slope Method (Biddle Book, Page 44)

c. Computation Method (NAVSEA'S Grounding and Lightning Protection Handbook - Section 13-6)

d. Simplified Fall-of-Potential Method (Biddle Book, Page 22)

NEW JERSEY OFFICE: 998 NORTH WASHINGTON AVE. P.O. BOX 7010
GREEN BROOK, N.J. 08812-7010 (908) 752-2291 FAX (908) 752-2016

The "Intersecting Curves" and "Slope" methods were ruled out based on discussions with Mr. Chuck Wakefield. Chu & Gassman agreed with Mr. Wakefield's reservation in employing these methods. Chu & Gassman ruled out the computation method, because it was impossible to isolate an individual ground rod from any of the Grid Systems. We finally settled on the "Simplified Fall-of-Potential test method. We found this to be the only workable test method given the conditions previously cited.

Chu & Gassman again contacted Mr. Chuck Wakefield and asked if the simplified 3-Point Fall-of-Potential Method was an acceptable alternative even though it is a departure from the requirements of OP-5. Mr. Wakefield explained that we would have to "apply" for what was termed a "concurrence" before this method could be accepted as part of Earle's S.O.P. Mr. Wakefield instructed Chu & Gassman to contact a Mr. J. Day in pursuance of this "concurrence".

In a conversation with Mr. Jim Day (NAVSEA), we were directed to write the Explosives Ordnance Division Technical Center with our request. By way of this letter, Chu & Gassman is seeking this "concurrence" for eleven (11) Ordnance Buildings and two (2) Railroad Classificaiton Yards.

To help analyize this situation we have provided our test data as follows:

VOID

Simplified 3-Point Fall-of-Potential*					
Building	"C" Probe Test Distance (Feet)	Values (OHMS)			Calculated Accuracy
		40% of Distance	50% of Distance	60% of Distance	
D-2	300	.80	.91	1.1	17%
D-5	300	12.72	12.80	13.02	1.3%
E-13	300	1.81	2.35	3.47	36.4%
E-14	300	7.53	7.76	8.19	4.6%
GB-1	400	11.6	12.0	12.4	3.3%
HA-1	500	18.17	18.76	18.97	1.8%
MA-1	300	82.0	86.6	92.3	6.1%
MA-3	500	1.17	2.15	3.69	57.9%
557	500	15.83	17.32	19.84	12.3%

RKC 02MAR99 (REF ONLY)

Simplified 3-Point Fall-of-Potential*					
Building	"C" Probe Test Distance (Feet)	Values (OHMS)			Calculated Accuracy
		40% of Distance	50% of Distance	60% of Distance	
566	500	.66	.75	.92	18.4%
589	500	6.93	7.50	7.52	2.7%
Railroad Classification Yard #1	500	6.91	6.93	6.93	.09%
Railroad Classification Yard #2	500	3.84	4.49	4.72	8.5%

*Field data and calculations can be submitted on request.

VOID

This concludes our request and we thank you for your time. If we can provide you with any additional information or answer any questions, please call - Direct Telephone Number is (908) 752-9554, Extension 15.

Very truly yours,

Keith Craven

KC:p

cc: David Miller - NWSE
Rick Rahman - NWSE