****
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
Preparing Activity: KSC

NASA/KSC-27 05 26.00 98 (September 2009)

Superseding
NASA/KSC-27 05 26.00 98 (October 2007)

NASA/KSC GUIDE SPECIFICATIONS

References are in agreement with UMRL dated July 2009
****

SECTION TABLE OF CONTENTS

DIVISION 27 - COMMUNICATIONS

SECTION 27 05 26.00 98

GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS

09/09

-- End of Section Table of Contents --

****
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
Preparing Activity: KSC

NASA/KSC-27 05 26.00 98 (September 2009)

Superseding
NASA/KSC-27 05 26.00 98 (October 2007)

NASA/KSC GUIDE SPECIFICATIONS

References are in agreement with UMRL dated July 2009
****

SECTION 27 05 26.00 98

GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS
09/09

****
NOTE: This specification covers the requirements for electrical system and equipment grounding including ground rods, grounding conductors, connectors, and other accessories for small jobs. The section excludes instrumentation and static grounding systems.

Provide drawings showing plan layout of each grounding electrode, ground mat, ground grid, substation ground bus, interconnecting grounding conductor, and tap connections to steel building columns and outdoor electrical equipment. Provide detail drawings of ground mats and ground grids showing configuration, ground rod spacing, interconnecting cable and tap connections to substation yard fence, substation ground bus, and interior equipment.

If grounding systems as shown fail to achieve the desired measured resistance to ground, additional ground rods could be required.

Edit this guide specification for project specific requirements by adding, deleting, or revising text. For bracketed items, choose applicable items(s) or insert appropriate information.

Remove information and requirements not required in respective project, whether or not brackets are present.

Recommended changes to a NASAKSC Master Specification Section should be submitted as a Criteria Change Request (CCR) to the appropriate Technical Proponent (TP) through the SpecsIntact Help Desk.
****

PART 1 GENERAL

1.1 REFERENCES

****
NOTE: This paragraph is used to list the publications cited in the text of the guide specification. The publications are referred to in the text by basic designation only and listed in this paragraph by organization, designation, date, and title.

Use the Reference Wizard's Check Reference feature when you add a RID outside of the Section's Reference Article to automatically place the reference in the Reference Article. Also use the Reference Wizard's Check Reference feature to update the issue dates.

References not used in the text are automatically deleted from this section of the project specification when you choose to reconcile references in the publish print process.
****

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM B 8	(2004) Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft

AMERICAN WELDING SOCIETY (AWS)

AWS A3.0	(2001) Standard Welding Terms and Definitions Including Terms for Adhesive Bonding, Brazing, Soldering, Thermal Cutting and Thermal Spraying
AWS B2.1/B2.1M	(2009) Specification for Welding Procedure and Performance Qualification

JOHN F. KENNEDY SPACE CENTER (KSC)

KSC-SPEC-Z-0005A	(Rev A; 1995) Specification for Brazing, Steel, Copper, Aluminum, Nickel, and Magnesium Alloys
KSC-STD-E-0012E	(Rev E; 2001) Standard for Facility Grounding and Lightning Protection

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2008; AMD 1 2008) National Electrical Code - 2008 Edition

NFPA 780 (2007) Standard for the Installation of Lightning Protection Systems

U.S. AIR FORCE TECHNICAL ORDERS (TO)

TO 31W3-10-15 (1980; CHG 3 1982) Outside Plant Cable Testing

UNDERWRITERS LABORATORIES (UL)

UL 467 (2007) Standard for Grounding and Bonding Equipment

1.2 GENERAL REQUIREMENTS

****
NOTE: If section 26 05 00.00 40 COMMON WORK RESULTS FOR ELECTRICAL and Section 26 00 00.00 20 BASIC ELECTRICAL MATERIALS AND METHODS are not included in the project specification, applicable requirements there from to be inserted and the following paragraph deleted.
****

Section 26 05 00.00 40 COMMON WORK RESULTS FOR ELECTRICAL and Section 26 00 00.00 20 BASIC ELECTRICAL MATERIALS AND METHODS apply to work specified in this section.

1.3 SUBMITTALS

****
NOTE: Review Submittal Description (SD) definitions in Section 01 33 00 SUBMITTAL PROCEDURES and edit the following list to reflect only the submittals required for the project. Keep submittals to the minimum required for adequate quality control.

A "G" following a submittal item indicates that the submittal requires Government approval. Some submittals are already marked with a "G". Only delete an existing "G" if the submittal item is not complex and can be reviewed through the Contractor's Quality Control system. Only add a "G" if the submittal is sufficiently important or complex in context of the project.

For submittals requiring Government approval on Army projects, use a code of up to three characters within the submittal tags following the "G" designation to indicate the approving authority. Codes for Army projects using the Resident Management System (RMS) are: "AE" for Architect-Engineer; "DO" for District Office (Engineering Division or other organization in the District Office); "AO" for Area Office; "RO" for Resident Office; and "PO" for Project Office. Codes following the "G" typically are not used for Navy, Air Force, and NASA projects.

Choose the first bracketed item for Navy, Air Force and NASA projects, or choose the second bracketed item for Army projects.

****

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are [for Contractor Quality Control approval.][for information only. When used, a designation following the "G" designation identifies the office that reviews the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Submit manufacturer's catalog data for the following items:

Ground Rods

Ground and Bond Wires

Grounding and Bonding Connectors

Grounding and Bonding Fasteners

PART 2 PRODUCTS

2.1 GROUND AND BOND WIRES

Provide annealed bare copper, Class "B" stranded ground and bond wires in accordance with ASTM B 8 and with 98 percent conductivity; size wires in accordance with the requirements of NFPA 70 and NFPA 780.

2.2 GROUNDING AND BONDING CONNECTORS

Provide grounding and bonding connectors conforming to the requirements of UL 467.

2.3 GROUNDING AND BONDING FASTENERS

All bolts, nuts, washers, lock washers, and associated fasteners used for grounding and bonding connections to be [copper] [bronze] [tin plated tempered brass].

2.4 GROUND RODS

Provide 20 mm diameter by 6100 mm 3/4 inch by 20 feet solid copper ground rods in accordance with KSC-STD-E-0012E.

PART 3 EXECUTION

3.1 GENERAL

Specify NFPA 70 and NFPA 780 bonding and grounding requirements as a minimum.

3.2 BONDING

3.2.1 Types of Bonds

****
NOTE: Choose from one of the bond types or a combination of bond types listed below.
****

Unless otherwise specified herein,accomplish bonding of metal surfaces by [brazing] [welding] [clamping] [structural joining methods] [a combination thereof].

3.2.1.1 Brazing

Brazing solder to conform to KSC-SPEC-Z-0005A.

3.2.1.2 Welding

Welding to be by the exothermic process with procedures conforming to the AWS A3.0, AWS B2.1/B2.1M, and manufacturer's recommendation.

3.2.1.3 Clamping

In external locations, use clamping only where a disconnect type of connection is required. Connection device can utilize either spring-loaded jaws or threaded fasteners. Construct the device so that positive contact pressure is maintained at all times. This method includes the use of machine bolts with tooth type or spring type lock washers.

3.2.2 Cleaning of Bonding Surfaces

Thoroughly clean all surfaces which comprise the bond, removing all paint, oxides, and other resistance films from the mating area before joining. Use gentle and uniform pressure, along with an appropriate abrasive, to ensure a smooth uniform surface without "point contacts. Do not remove excessive metal from the surface. Clean clad metals with a fine steel wool or emery paper in such a manner that the cladding material is not penetrated by the cleaning process. Then clean bare metal with a solvent-moistened cheesecloth. Remove all grease, oil, dirt, corrosive preventatives, and other contaminants using this same method. Allow this cleaned area to air dry before making bond. Attach bond within 1 hour after cleaning. Seal joint and refinish the exposed surfaces within 2 hours to prevent oxidation. If additional time is required, apply a corrosion-preventative compound until the area can be refinished.

3.2.3 Bond Resistance

Test resistance of any bond in accordance with TO 31W3-10-15. Rework bonds that fail to successfully comply to test parameters at no additional cost to the Government.

3.2.4 Enclosure Bonding

Bond all new FOT cabinets to ground. Make at least one copper connection from the system ground point to one or more enclosures in the area, such that all enclosures and equipment, when properly bonded together, provide a low impedance path to ground.

3.2.5 Cable Tray Bonding

Bond cable tray sections together. Consider cable tray sections in tandem assembly as having electrical continuity when these sections are bonded with appropriate high strength bolts. Whenever expansion joints are required, install a jumper consisting of a bond strap. Ground trays to the building's ground system.

3.2.6 Bonding of Conduit and Raceway Systems

Bond metal conduit, fittings, junction boxes, outlet boxes, armored and metal sheathed cable, and other raceways as listed below. Ensure adequate electrical contact at the joints and terminations.

3.2.7 Rigid Metal Conduit and Terminations

[Clean and coat with conductive epoxy] [Weld as specified herein] all threaded connections and wrench tight. Paint all exposed threads . [Weld] [Coat with conductive epoxy and bond] all conduits entering boxes and enclosures to the box with bonding type locknuts [(one outside and one inside)] [locknut and grounding type bushing]. Locknuts that gouge into the metal box when tightened are acceptable.

3.2.8 Protection of Finished Bonds

Protect finished bonds by painting to match the original finish after bond is made.

3.2.9 Splice Bonds

Maintain shield continuity through each splice for cable with full shielding. Provide bond clamp with perforating teeth to penetrate the cable's metallic shield and be connected across the splice with the equivalent of a 13 mm2 No. 6 AWG diameter copper conductor.

3.3 GROUNDING CONNECTIONS

Provide bonded ground connections in accordance with paragraph entitled, "Bonding," of this section.

Weld all ground connections that are buried or in inaccessible locations. Join all strands without causing any weakening or damage.

3.4 PLACING GROUND RODS

Install and test ground rods in accordance with KSC-STD-E-0012E.

-- End of Section --