

Material Specification

**Contaminated-Environment
Protection**

Substation & Civil Engineering

Date: 27 Aug 12

© 2012 by MidAmerican Energy / PacifiCorp. All rights reserved.

Project Issue Date: _____

Company Project Information

Attachment to Exhibit _____, Section _____, Attachment no. _____

Project name: _____

Edited by: _____

Material Specification Contents

SECTION	PAGE
1 Scope	1
2 Applicable Documents	1
2.1 Industry Publications	1
3 General	1
3.1 Application Information	1
3.2 Authorized Material Specification	1
4 General Contaminated-Environment Protection Requirements	2
4.1 Codes and Standards	2
4.2 Bushing and Insulator Creep Distance	2
4.3 Accessory Compartment(s)	2
4.4 Corrosion Resistance of Exposed Metal Parts	2
5 Issuing Department	4

Contaminated-Environment Protection

1 Scope

This material specification states the requirements for contaminated-environment protection of substation equipment to be purchased by the company.

2 Applicable Documents

The following publications shall be used in conjunction with this material specification and form a part of this material specification to the extent specified herein. When a referenced publication is superseded by an approved revision, the revision shall apply.

2.1 Industry Publications

Referenced industry publications include:

- ANSI/NFPA 70, *National Electrical Code*
- ASTM B 117, *Standard Method of Salt Spray (Fog) Testing*
- ASTM D 1654, *Standard Method of Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments*
- ASTM D 2247, *Standard Method for Testing Coated Metal Specimens at 100% Relative Humidity*
- ASTM D 2794, *Standard Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact)*
- ASTM D 3359, *Standard Methods for Measuring Adhesion by Tape Test*
- ASTM G 53, *Standard Recommended Practice for Operating Light- and Water-Exposure Apparatus (Fluorescent UV-Condensation Type) for Exposure of Nonmetallic Materials*

3 General

3.1 Application Information

This material specification states the general requirements for contaminated-environment protection of substation equipment. The equipment-specific requirements, which may vary depending on the particular equipment and application, shall be stated in the purchase order. The purchase order shall specify whether the equipment shall be designed to withstand a marine or sulfur-contaminated environment, in which case this material specification must accompany the company material specification for specific substation equipment identified in the purchase order.



210-2

Princ Engineer (L.Davis): *LD*
 Mgr Substation Eng (S. Haacke): *SH*

**Material Specification
 Substation Equipment
 Contaminated-Environ
 ment Protection**



ZS 066

Princ Engineer (H. Sharifnia): *HRS*
 Standards Mgr (D. Scott): *D.S.*

210-2 / ZS 066

3.2 Authorized Material Specification

This material specification is not considered valid until each page contains the approval signature (or initials) of the persons named in the title blocks.

4 General Contaminated-Environment Protection Requirements

4.1 Codes and Standards

Except as required otherwise by this material specification, the general contaminated-environment protection requirements shall be in accordance with the latest applicable industry codes, including ANSI, IEEE, and NEMA standards, as well as any company construction standards and material specifications in effect on the date of invitation to bid.

4.2 Bushing and Insulator Creep Distance

Unless checked (✓) below, a heavy contamination level of 44 mm/kV per IEEE C57.19.100, based on nominal line-to-ground kV, shall be the minimum bushing and insulator creep distance.

Extra heavy contamination (54 mm/kV or greater per IEEE C57.19.100)

4.3 Accessory Compartment(s)

The control compartment and other accessory compartment(s) shall be NEMA 4X.

4.4 Corrosion Resistance of Exposed Metal Parts

4.4.1 Required Metals and Coatings

All exposed, bronze and copper parts shall be galvanized, or plated with tin or cadmium to a minimum plating thickness of 0.001 inch. All other exposed, unpainted metal parts shall be aluminum; stainless steel in compliance with type 302, 304, or 316; or galvanized steel in compliance with ASTM A123, A653, or A924. The hardware shall mechanically comply with A153 or B693. All exposed, painted metal parts shall have a minimum total coating thickness of 5 mils.

4.4.2 Additional Requirements for Painted Parts

To verify the capability of the paint coating to withstand corrosive environments, the supplier shall certify that painted test specimens have passed the tests specified in sections 4.4.2.1 through 4.4.2.3 of this document.



210-2

Princ Engineer (L.Davis): *[Signature]*
Mgr Substation Eng (S. Haacke): *[Signature]*

Material Specification
Substation Equipment
**Contaminated-Environ
ment Protection**



ZS 066

Princ Engineer (H. Sharifnia): *[Signature]*
Standards Mgr (D. Scott): *[Signature]*

4.4.2.1 Marine or Sulfur Environment Tests

For either a marine or sulfur-contaminated environment, applicable tests shall include the following:

- 1. ASTM D 2247, Humidity Test: 1000 hours with no blisters
- 2. ASTM D 2794, Impact Test:
 - a. 2 inch-pound reverse impact, without cracking or losing adhesion
 - b. 160 inch-pound direct impact, without cracking or losing adhesion
- 3. ASTM D 3359, Adhesion Test: no peeling or removal
- 4. ASTM G 53, Light and Condensation Test: 500 hours with no more than 50% loss of gloss

4.4.2.2 Salt Spray Test

If suitability for marine environment is specified in the purchase order, painted test specimens shall also pass the ASTM B 117, Salt Spray Test, for a minimum of 1000 hours with the following results:

- 1. For an unscribed specimen, there shall be no blisters or corrosion of the specimen.
- 2. For a scribed specimen, loss of adhesion shall not be more than 1/8 inch from scribe, and the underfilm corrosion shall not be more than 1/16 inch from scribe.

4.4.2.3 High Sulfur Environment Protection

If suitability for sulfur-contaminated environment is specified in the purchase order, the manufacturer shall submit documentation showing the corrosion resistance of all exposed materials used in the equipment to be reviewed and approved by the company.

Exposed metal not suitable for a sulfur-contaminated environment shall be protected using a sulfur-resistant epoxy coating. The manufacturer shall submit their proposed coating and coating-application system in writing, to be approved by the company.



210-2

Princ Engineer (L.Davis): *LTD*
Mgr Substation Eng (S. Haacke): *SH*

Material Specification
Substation Equipment
Contaminated-Environ
ment Protection



ZS 066

Princ Engineer (H. Sharifnia): *HRS*
Standards Mgr (D. Scott): *D.S.*

210-2 / ZS 066

5 Issuing Department

The engineering standards and technical services department of PacifiCorp published this material specification. Questions regarding editing, revision history and document output may be directed to the lead editor at (503) 813-5293. Technical questions and comments may be submitted to Steve Haacke, MidAmerican Energy Company substation engineering, (563) 333-8388 or Hamid Sharifnia, PacifiCorp substation standards engineering, (503) 813-6935.

This material specification shall be used and duplicated only in support of MidAmerican Energy Company and/or PacifiCorp projects. This document is considered a valid publication when the signature block in the footer has been initialed by the authoring engineers and department managers.



210-2

Princ Engineer (L.Davis):

Mgr Substation Eng (S. Haacke):

Material Specification
Substation Equipment
Contaminated-Environment Protection



ZS 066

Princ Engineer (H. Sharifnia):

Standards Mgr (D. Scott):