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STANDARDS PUBLICATION/NO. EW 5-1982

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Guidelines for the Preparation of the Material Safety Data Sheet for Welding Consumables and Related Products

NEMA

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION ■ 2101 L STREET, N.W., WASHINGTON, D.C. 20037

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Foreword

User needs have been considered throughout the development and revision of these standards.

This publication is a guide of practical information for the preparation of Appendix A for the Material Safety Data Sheet (MSDS) for electrodes, filler metals, and fluxes for use in welding and related processes. These guidelines are intended to assist the manufacturers and suppliers of these products in providing accurate and pertinent safety information. These guidelines are based on U.S. Department of Labor Form OSHA 20, as detailed in OSHA Publication 2265, U.S. Government Printing Office, Washington, D.C. 20402.

These recommendations of the Arc Welding Section of the National Electrical Manufacturers Association will be reviewed periodically by the Section for the purpose of updating MSDS to reflect advancing technology for today's climate. Please address any comments or questions you may have on the text to:

Manager, Engineering Department
National Electrical Manufacturers Association
2101 L Street, N.W.
Washington, D.C. 20037

Purpose

The purpose of these guidelines is intended to inform producers, distributors, engineers, code officials, and users about some of the properties and potential health hazards of welding consumables and processes. It is also intended to assist in selecting and obtaining the proper or special protection needed to protect personnel from harmful fumes and gases.

Scope

This document sets forth guidelines for the preparation of Appendix A for the Material Safety Data Sheet (MSDS) for electrodes, filler metals, and fluxes for use in welding and related processes. These guidelines are intended to assist the manufacturers and suppliers of these products in providing accurate and pertinent safety information. These guidelines are based on U.S. Department of Labor Form OSHA 20, as detailed in OSHA Publication 2265, U.S. Government Printing Office, Washington, D.C. 20402. Modifications to this basic OSHA 20 format are recommended where they serve to more effectively communicate safety information that is peculiar to welding consumables and processes.

The location and wording of safety information on the MSDS, as recommended in these guidelines, may be modified by individual companies to suit their manner of presentation.

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GUIDELINES FOR THE PREPARATION OF THE MATERIAL SAFETY DATA SHEET FOR WELDING CONSUMABLES AND RELATED PRODUCTS

(Approved as Authorized Engineering Information 5-12-1982)

Section 1
IDENTIFICATION

Manufacturer's/Suppliers Name and Address—Self explanatory.

Telephone Number—This should be a source for further information or in the event of an emergency involving the product.

Trade Name—Name under which the product is marketed.

Classification—Applicable classification or specification, if any, to which the product corresponds. (Examples are: AWS E7024, Mil-11018M).

Product Type—General descriptive class of product and intended use. (Examples are: Submerged arc welding flux, flux cored arc welding electrode, shielded metal arc welding electrode). Other information such as size, stock number, etc., may also appear.

Section 2
HAZARDOUS[1] MATERIALS

The table that makes up this section should list the composition by weight percent of the product and the appropriate Threshold Limit Values (TLVs)[2] for each ingredient as specified in the latest available edition of *Threshold Limit Values for Chemical Substances and Physical Agents in the Workroom Environment,* with intended changes by the American Conference of Governmental Industrial Hygienists, P.O. Box 1937, Cincinnati, Ohio 45201. It is recommended that materials be included in this table in a manner judged appropriate by the producer, using procedures outlined in OSHA Publication 2265. It is recommended that the TLV's shown be those for the materials as they exist in the product.

To clarify the nature of this section the following passage should appear either above or below the table:

> "IMPORTANT! This section covers the materials from which this product is manufactured. The fumes and gases produced during welding with (normal use of)[3] this product are covered by Section 6."

1 The term "hazardous" in "Hazardous Materials" should be interpreted as a term required and defined in OSHA 2265 and does not necessarily imply the existence of any hazard.

2 Registered Trademark of the American Conference of Governmental Industrial Hygienists.

3 Optional language.

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Section 3
PHYSICAL DATA

This section is not applicable for most welding consumables and related products. Where it is determined by the producer that the inclusion of physical data such as appearance information is appropriate for a product, the procedures set down in OSHA Publication 2265 should be followed.

Section 4
FIRE AND EXPLOSION HAZARD DATA

Welding consumables and related products are generally nonflammable. The following text is recommended: "(Nonflammable) Welding arc and sparks can ignite combustibles. Refer to American National Standard Z49.1, *Safety in Welding and Cutting* published by the American Welding Society, P.O. Box 351040, Miami, FL 33135, for fire prevention and protection information during the use of welding and allied procedures." Where it is determined by the producer that other information pertaining to this section is appropriate, the procedures set down in OSHA Publication 2265 should be followed.

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Section 5
HEALTH HAZARD DATA

Threshold Limit Value—An overall TLV is not applicable for most welding consumables and related products in their as-manufactured conditions. Therefore, it is recommended that a general TLV for the fumes resulting from normal use of the product be referenced. The following passage is recommended:

> "The ACGIH-1980 (or latest date) recommended general limit for welding fume NOC (Not Otherwise Classified) is 5 mg/m^3. ACGIH 1980 preface states, 'The TLV-TWA should be used as guides in the control of health hazards and should not be used as fine lines between safe and dangerous concentrations.' See Section 6 for specific fume constituents which may modify this TLV."

Effects of Overexposure—It is recommended to include here the statements of hazards and consequences from the appropriate AWS/ANSI minimum precautionary label that applies to the product. For an arc welding product the current statements and a recommended preface are as follows:

> "Electric arc welding may create one or more of the following health hazards:
>
> **FUMES AND GASES** can be dangerous to your health.*
> **ARC RAYS** can injure eyes and burn skin.
> **ELECTRIC SHOCK** can kill."

It is recommended that the following passage also be included for all products immediately following the **FUMES AND GASES** statement above:

> "*Short term overexposure to welding fumes may result in discomfort such as: dizziness, nausea, or dryness or irritation of nose, throat, or eyes (see Sections 6 and 8)."

Emergency and First Aid Procedures—It is not recommended that specific effects of overexposure, emergency, and first aid procedures be included for all possible decomposition products listed in Section 6. It is recommended that this specific information be included only for decomposition products which in the judgment of the producer require special attention. (Examples may be included).

The following general statement is recommended:

> "Call for medical aid. Employ first aid techniques recommended by the American Red Cross."

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Section 6
REACTIVITY DATA

The only topic in this section that is applicable for most welding consumables and related products is Hazardous Decomposition Products. Where it is determined by the producer that other topics are relevant to a product, the procedures set down in OSHA Publication 2265 should be followed.

Hazardous Decomposition Products—The following text is recommended to provide information on the reasonably expected Hazardous Decomposition Products that can occur during normal use of the welding consumable. The text should include the probable significant fume constituents for the specific welding consumable of interest. Special attention should be directed to any fume constituent with a low TLV which may cause the TLV for the overall fume to be below the general welding fume (NOC) level of 5 mg/m^3. For example, consider hexavalent chromium (Cr^{+6}), manganese, copper and nickel.

"Welding fumes and gases cannot be classified simply. The composition and quantity of both are dependent upon the metal being welded, the process, procedure, and electrodes used. Other conditions which also influence the composition and quantity of the fumes and gases to which workers may be exposed include: coatings on the metal being welded (such as paint, plating, or galvanizing), the number of welders and the volume of the work area, the quality and amount of ventilation, the position of the welder's head with respect to the fume plume, as well as the presence of contaminants in the atmosphere (such as chlorinated hydrocarbon vapors from cleaning and degreasing activities).

When the electrode is consumed, the fume and gas decomposition products generated are different in percent and form from the ingredients listed in Section 2. Decomposition products of normal operation include those originating from the volatilization, reaction, or oxidation of the materials shown in Section 2, plus those from the base metal and coating, etc., as noted above.

Reasonably expected fume constituents of this product could include: (See examples below)."

Example for carbon dioxide shielded flux-cored electrode (AWS 5.20 E70-T-1):

"Reasonably expected fume constituents of this product could include: primarily oxides of iron; secondarily complex oxides of manganese, silicon, titanium, and sodium."

Example for stainless steel covered electrodes (AWS 5.4):

"Reasonably expected fume constituents of this product would include: primarily fluorides and complex oxides of iron and silicon; secondarily complex oxides of manganese, titanium, chromium, nickel, sodium and potassium. The present OSHA PEL for hexavalent chromium (Cr^{+6}) is 0.05 mg/m^3 which will result in a significant reduction from the 5 mg/m^3 general welding fume (NOC) level. The limit of 0.05 mg/m^3 for hexavalent chromium in these electrodes comes from the limit shown at the bottom of OSHA Table Z-2, which is for 0.1 mg of CrO_3/m^3† which calculates to 0.05 mg of Cr^{+6}/m^3. It applies to soluble chromates of the types found in covered stainless electrode fumes.

Gaseous reaction products may include carbon monoxide and carbon dioxide. Ozone and nitrogen oxides may be formed by the radiation from the arc.

One recommended way to determine the composition and quantity of fumes and gases to which workers are exposed is to take an air sample from inside the welder's helmet if worn or in the worker's breathing zone. See ANSI/AWS F1.1-78, available from the American Welding Society, P.O. Box 351040, Miami, FL 33135."

* PEL- Permissible Exposure Limit

† OSHA Safety and Health Standards, 29 CFR 1910, Subpart Z - Toxic and Hazardous Substances, 1910.1000 Air Contaminants Table Z-2: 8-hour time weighted averages, available from the U.S. Printing Office, Washington, D.C. 20402. ANSI Publication Z37.7-1973, Chromic Acid and Hexavalent Chromium Compound, available from the American National Standards Institute, 1430 Broadway, New York, NY 10018. (This publication also includes PELs.)

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Section 7
SPILL OR LEAK PROCEDURES

This section is not applicable for most welding consumables and related products. Where it is determined by the producer that information pertaining to this section is appropriate for a product, the procedures set down in OSHA Publication 2265 should be followed.

Sections 8 and 9
SPECIAL PROTECTION INFORMATION AND SPECIAL PRECAUTIONS

It is recommended that for welding consumables and related products the topics of Special Protection Information and Special Precautions be combined into one section. The combining of these sections adds clarity to the overall safety message since the two areas of concern are closely interrelated for welding consumables.

The following general text is recommended for this section:

"Read and understand the manufacturer's instructions and the precautionary label on the product. See American National Standard Z49.1, *Safety In Welding and Cutting* published by the American Welding Society, P.O. Box 351040, Miami, FL 33135, and OSHA Publication 2206 (29CFR1910), Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402 for more details on many of the following:

Ventilation—Use enough ventilation, local exhaust at the arc, or both, to keep the fumes and gases from the worker's breathing zone and the general area. Train the welder to keep his head out of the fumes.

Respiratory Protection—Use respirable fume respirator or air supplied respirator when welding in confined space or where local exhaust or ventilation does not keep exposure below TLV.

Eye Protection—Wear helmet or use face shield with filter lens shade number (insert number here) or darker. Provide protective screens and flash goggles, if necessary, to shield others.

Protective Clothing—Wear hand, head, and body protection which help to prevent injury from radiation, sparks, and electrical shock. See ANSI Z49.1. At a minimum this includes welder's gloves and a protective face shield, and may include arm protectors, aprons, hats, shoulder protection, as well as dark substantial clothing. Train the welder not to touch live electrical parts and to insulate himself from work and ground."

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Appendix A
MATERIAL SAFETY DATA SHEET
Welding Consumables and Related Products
Essentially Similar to U.S. Department of Labor Form OSHA-20

Section 1 - IDENTIFICATION

Manufacturer/Supplier Name	Telephone No.
Address:	
Trade Name	Classification
Product Type	

Section 2 - HAZARDOUS* MATERIALS

IMPORTANT!

This section covers the materials from which this product is manufactured. The fumes and gases produced during welding with (normal use of)** this product are covered by Section 6.

*The term "hazardous" in "Hazardous Materials" should be interpreted as a term required and defined in OSHA 2265 and does not necessarily imply the existence of any hazard.

**Optional language.

Covering or Flux	Weight %	TLV (Source) (Units)	Other	Weight %	TLV (Source) (Units)

Section 3 - PHYSICAL DATA

Not applicable (appearance information may be included).

Section 4 - FIRE AND EXPLOSION HAZARD DATA

(Nonflammable) Welding arc and sparks can ignite combustibles. References in Guidelines (i.e., ANSI Z49.1).

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Section 5 - HEALTH HAZARD DATA

Threshold Limit Valve:

The ACGIH recommended general limit for Welding Fume NOC (Not Otherwise Classified) is 5 mg/m^3. ACGIH-1980 (or latest date) preface states "The TLV-TWA should be used as guides in the control of health hazards and should not be used as fine lines between safe and dangerous concentrations." See Section 6 for specific fume constituents which may modify this TLV.

Effects of Overexposure

Electric arc welding may create one or more of the following health hazards:

FUMES AND GASES can be dangerous to your health.

Short-term overexposure to welding fumes may result in discomfort such as dizziness, nausea, or dryness or irritation of nose, throat, or eyes.

ARC RAYS can injure eyes and burn skin.

ELECTRIC SHOCK can kill.

See Sections 6 and 8.

Emergency and First Aid Procedures

Call for medical aid. Employ first aid techniques recommended by the American Red Cross.

Section 6 - REACTIVITY DATA

Hazardous Decomposition Products

Welding fumes and gases cannot be classified simply. The composition and quantity of both are dependent upon the metal being welded, the process, procedures, and electrodes used. Other conditions which also influence the composition and quantity of the fumes and gases to which workers may be exposed include: coatings on the metal being welded (such as paint, plating, or galvanizing), the number of welders and the volume of the work area, the quality and amount of ventilation, the position of the welder's head with respect to the fume plume, as well as the presence of contaminants in the atmosphere (such as chlorinated hydrocarbon vapors from cleaning and degreasing activities).

When the electrode is consumed, the fume and gas decomposition products generated are different in percent and form from the ingredients listed in Section 2. Decomposition products of normal operation include those originating from the volatilization, reaction, or oxidation of the materials shown in Section 2, plus those from the base metal and coating, etc., as noted above.

Reasonably expected fume constituents of this product would include:

Gaseous reaction products such as carbon monoxide and carbon dioxide. Ozone and nitrogen oxides may be formed by the radiation from the arc.

One recommended way to determine the composition and quantity of fumes and gases to which workers are exposed is to take an air sample from inside the welder's helmet if worn or in the worker's breathing zone. See ANSI/AWS F1.1-78, available from the American Welding Society, P.O. Box 351040, Miami, FL 33135.

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Section 7 - SPILL OR LEAK PROCEDURES

NOT APPLICABLE.

Section 8 and 9 - SPECIAL PROTECTION INFORMATION AND PRECAUTIONS

Read and understand the manufacturer's instructions and the precautionary label on the product. See American National Standard Z49.1, *Safety in Welding and Cutting* published by the American Welding Society, P.O. Box 351040, Miami, FL 33135 and OSHA Publication 2206 (29CFR1910), U.S. Government Printing Office, Washington, D.C. 20402 for more detail on many of the following.

Ventilation

Use enough ventilation, local exhaust at the arc, or both, to keep the fumes and gases below TLV's in the worker's breathing zone and the general area. Train the welder to keep his head out of the fumes.

Respiratory Protection

Use respirable fume respirator or air supplied respirator when welding in confined space or where local exhaust or ventilation does not keep exposure below TLV.

Eye Protection

Wear helmet or use face shield with filter lens shade number (insert number here) or darker. Provide protective screens and flash goggles, if necessary, to shield others.

Protective Clothing

Wear head, head, and body protection which help to prevent injury from radiation, sparks, and electrical shock. See ANSI Z49.1. At a minimum this includes welder's gloves and a protective face shield, and may include arm protectors, aprons, hats, shoulder protection, as well as dark substantial clothing. Train the welder not to touch live electrical parts and to insulate himself from work and ground.

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NEMA STANDARDIZATION

The purpose of NEMA Standards, their classification and status are set forth in certain clauses of the NEMA Bylaws, which are quoted below:

Purpose of Standards

National Electrical Manufacturers Association Standards are adopted in the public interest and are designed to eliminate misunderstandings between the manufacturer and the purchaser and to assist the purchaser in selecting and obtaining the proper product for its particular need. Existence of a National Electrical Manufacturers Association Standard does not in any respect preclude any member or nonmember from manufacturing or selling products not conforming to the standard.

(Bylaw—Art. V, Sec. 1)

Definition of a Standard

A standard of the National Electrical Manufacturers Association defines a product, process or procedure with reference to one or more of the following: nomenclature, composition, construction, dimensions, tolerances, safety, operating characteristics, performance, rating, testing, and the service for which they are designed.

(Bylaw—Art. V, Sec. 2, Subsection A)

Dimensions

Where dimensions are given for interchangeability purposes, alternate dimensions satisfying the other provisions of the standards publication may be capable of otherwise equivalent performance.

(NEMA Policy Memorandum 84-2, dated June 7, 1984)

Classes of Standards

National Electrical Manufacturers Association Standards are of two classes:

1. NEMA Standard, which relates to a product commercially standardized and subject to repetitive manufacture, which standard has been approved by at least 90 percent of the members of the Subdivision eligible to vote thereon;
2. Suggested Standard for Future Design, which may not have been regularly applied to a commercial product, but which suggests a sound engineering approach to future development, which standard has been approved by at least two-thirds of the members of the Subdivision eligible to vote thereon.

(Bylaw—Art. V, Sec. 2, Subsection B)

Authorized Engineering Information

Authorized Engineering Information consists of explanatory data and other engineering information of an informative character not falling within the classification of NEMA Standard or Suggested Standard for Future Design.

(Bylaw—Art. V, Sec. 6, 1st Sentence)

Official Standards Proposal

An Official Standards Proposal is an official draft of a proposed standard which is formally recommended to an outside organization(s) for consideration, comment and/or approval.

(Bylaw—Art. V, Sec. 4, Subsection A)

Identification of Status

Standards in NEMA Standards Publications are identified in the foreword or following each standard as "NEMA Standard" or "Suggested Standard for Future Design." These indicate the status of the standard. These words are followed by a date which indicates when the standard was adopted in its present form by the Association.

The material identified as "Authorized Engineering Information" and "Official Standards Proposal" is designated similarly.

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ARC WELDING SECTION
OF THE
NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION

MEMBER COMPANIES

Acco Industries Inc.
Page Welding Division
Bowling Green, KY 42101

Airco Welding Products
Division of Airco, Inc.
Murray Hill, NJ 07974

Alloy Rods Division
Chemetron Corporation
Hanover, PA 17331

Century Manufacturing Company
Minneapolis, MN 55431

Emerson Electric Company
Special Products Division
Hazelwood, MO 63042

Hobart Brothers Company
Troy, OH 45373

The Lincoln Electric Company
Cleveland, OH 44117

Miller Electric Manufacturing Co.
Appleton, WI 54912

National-Standard Company
Niles, MI 49120

Pow Con Corporation
Tempe, AZ 85281

Sandvik, Inc.
Scranton, PA 18501

Stoody Company
Industry, CA 91745

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York, PA 17405

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Cabot Corporation
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