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NEMA STANDARDS PUBLICATION NO. EW 6

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Guidelines for Precautionary Labeling for Arc-Welding and Cutting Products

NEMA

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

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NEMA EW*6 94 ■ 6470247 0508005 730 ■

NEMA Standards Publication EW 6-1994

GUIDELINES FOR PRECAUTIONARY LABELING FOR ARC-WELDING AND CUTTING PRODUCTS

Published by

National Electrical Manufacturers Association
2101 L Street, N.W.
Washington, DC 20037-1526

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Foreword

User needs have been considered throughout the development of these guidelines.

This NEMA standards publication is intended to provide a basis of common understanding within the electrical welding industry community. Copies were sent during the draft stage to a number of typical individuals and organizations in the public and private sector. These parties have an interest in, or responsibility for, the purchase, future application, use, or inspection of arc welding and cutting products. Their comments, prior to final NEMA approval, provided vital user and general interest input and resulted in a number of substantive changes being made in this publication. As future major revisions to this publication are proposed, NEMA intends to offer the same or similar individuals and organizations an opportunity to participate in such changes.

These recommendations will be reviewed periodically by the Arc Welding Section for the purpose of updating. Proposed or recommended revisions should be submitted to:

Vice President, Engineering Department
National Electrical Manufacturers Association
2101 L Street, N.W., Suite 300
Washington, D.C. 20037-1526

Purpose

The purpose of this publication is to provide guidelines for the precautionary labeling of arc welding and arc cutting products and equipment. Further, its purpose is to promote uniformity of labeling practices of manufacturers so that the message is more easily recognized and understood by the user.

Scope

This publication provides guidelines for the wording, format, and graphic symbols for precautionary labeling used on arc welding and cutting products. It suggests factors to be considered in deciding whether precautionary labeling is necessary.

Precautionary labeling, as used in this publication, is an informative marking attached to or marked on a product or its package, intended to be read at close range, which calls attention to the basic hazards and their consequences to persons or property. It gives information on how such hazards may be avoided and may also list other sources of information for more complete details.

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Background

In welding or cutting, as in most jobs, exposure to certain hazards occurs. Users must be alert to these hazards by their experience, training, education, and common sense. It is not the purpose of precautionary labeling to train operators, but rather, to provide a means to quickly remind and alert them to the basic product hazards each time the equipment is used (OSHA 29 CFR 1910 AND ANSI Z49.1).

These guidelines include two major points: (1) data for precautionary labeling for plasma arc cutting equipment, and (2) a list of 38 standardized symbols for optional use on safety labels or instructions and information on color and size for these symbols. Symbols attract attention and appeal to nonreaders and multilingual audiences, and thus were included in this standard. These optional symbols were designed to quickly remind and alert the user each time he goes to the equipment of the hazards which may be encountered in welding and cutting. The basic symbols depict welding and cutting hazards based on ANSI Z49.1 and build forward from that point.

Available symbols related to welding hazards or those which could be adapted for that purpose were collected and reviewed. The symbols presented here were selected to show basic hazards in the context of the welding environment with maximum clarity. As a secondary matter, some symbols were revised to show hazard avoidance, provided no erosion of the meaning was apparent in identifying the basic hazard. The selected symbols depicting the basic arc welding process or equipment hazards were then tested using a field survey questionnaire designed to comply with ANSI Z535 methods, which was distributed to experienced and inexperienced welders and a variety of welding equipment users. Approximately 14,500 questionnaires were distributed, and the returned data was tabulated and processed by NEMA central office personnel. Although a minimum comprehension rate of 85% was established, the results for nearly all symbols tested were significantly in excess of that figure, with most in the range of 95–100%. In some cases modifications were made to symbol elements to address concerns which arose during testing. Additional symbols for other processes, hazards, and general purposes were developed by modifying tested symbols or constructing new symbols based on survey experience using ISO and FMC elements and methods.

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Section 1
REFERENCES

The following standards are available from the addresses shown. When ordering these standards, we suggest that you ask for the latest edition.

American Welding Society
550 N.W. LeJeune Road
Miami, FL 33126

ANSI Z49.1-1988 — *Safety in Welding and Cutting*

American National Standards Institute, Inc.
11 West 42nd Street
New York, NY 10036

ANSI Z129.1-1976 — *American National Standard for the Precautionary Labeling of Hazardous Industrial Chemicals*

Canadian Standards Association
Engineering & Quality Assurance
178 Rexdale Boulevard
Rexdale (Toronto), Ontario, Canada M9W 1R3

C22.2 No. 60-M1990 — *Arc Welding Equipment*

FMC Corporation
Corporate Technology Center
P.O. Box 580
Santa Clara, California 95052

FMC-1989 — *Product Safety Sign and Label System*

Beuth Verlag, GmbH
Burggrafenstr. 6, 1000 Berlin 30
Germany

DIN 30 600 — *Graphic Symbols (Bildzeichen Ubersicht)*

International Organization for Standardization
Case postale 56
Sales Department, 1, Rue de Varembe,
CH-1211 Geneva 20
Switzerland

ISO 7000: 1989 — *Graphical Symbols for Use on Equipment*

International Electrotechnical Commission
Sales Department, 1, rue de
Varembe, 1211 Geneva 20
Switzerland

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IEC 417-1973 — *Graphic Symbols for Use On Equipment. Index, Survey and Compilation of the Single Sheets*

National Electrical Manufacturers Association
2101 L Street, N.W., Suite 300, Washington,
D.C. 20037-1526

EW 4-1993 — *Graphic Symbols for Arc Welding Apparatus*
ANSI Z535.1-1991 — *Safety Color Code*
ANSI Z535.2-1991 — *Environmental and Facility Safety Signs (Hazard Alerting Devices)*
ANSI Z535.3-1991 — *Criteria for Safety Symbols*
ANSI Z535.4-1991 — *Product Safety Signs and Labels*
ANSI Z535.5-1991 — *Accident Prevention Tags (For Temporary Hazards)*

Westinghouse Electric Corp.
Westinghouse Bldg.
Gateway Center
Pittsburgh, PA 15222

MB 3699-1985 — *Product Safety Label Handbook*

Underwriters Laboratories Inc.
Casualty & Chemical Hazards Dept.
333 Pfingsten Road
Northbrook, IL 60062-2096

UL 551 — *Transformer-Type Arc Welding Machines*

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Section 2
GUIDELINES FOR WORDING AND FORMAT FOR PRECAUTIONARY LABELING

2.1 GENERAL REQUIREMENTS

2.1.1 Wording

The effectiveness of precautionary labeling may be improved by uniformity of wording and format. A chief consideration is understandability by the users. The wording should be as brief and as clear as possible.

2.1.2 Labeling

The labeling should be in a conspicuous place on the product or its package. Label placement is chosen considering the available space on a product and visibility by the operator during normal use. If such space is not available, a reference note may appear in a conspicuous place identifying the location of the precautionary labeling.

Where possible, precautionary labeling should meet existing durability requirements for labels (see CSA and UL references in Section 1).

The size and legibility of the labeling should be such that it is easily read and understood by users with normal vision before they are likely to encounter the hazards.

2.2 LABELING INFORMATION FOR ARC WELDING AND CUTTING PRODUCTS

The elements to be considered in precautionary labeling and their suggested order of listing are given below:

a. Product Identification
b. Signal Word (DANGER, WARNING, CAUTION)
c. Statement of Hazards and Their Consequences
d. Precautionary Measures
e. Additional Information

Precautionary labeling for a given product may not require all of the above elements. However, the labeling should alert and remind the reader/user of the basic hazards. The included elements should depend upon the product, the process, and the hazards.

2.3 DETAILED DESCRIPTIONS FOR "LABELING INFORMATION" ELEMENTS

2.3.1 Product Identification

Product identification should be employed only in cases where the product is not otherwise identified.

2.3.2 Signal Word

A signal word is used to draw attention to the presence and degree of a hazard or hazards. There should be three recognized signal words. In descending order of severity they are defined as follows in ANSI Z535.4.

a. **DANGER:** Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury. This signal word is to be limited to the most extreme situations.

b. **WARNING:** Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

c. **CAUTION:** Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury. It may also be used to alert against unsafe practices.

Note: DANGER or WARNING should not be considered for property damage accidents unless personal injury risk appropriate to these levels is also involved. CAUTION is permitted for property-damage-only accidents.

The signal word should be printed so that it is the dominant word in the labeling and it should be in capital letters. Where one or more signal words could be used, because of multiple hazards, only the signal word corresponding to the class of greatest hazard should be used. The signal word may be preceded by the international safety alert symbol for attention (see Table 5-1).

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When red, orange, and yellow are associated with the signal words DANGER, WARNING, and CAUTION respectively, the colors should conform to ANSI Z535.1.

2.3.3 Statement of Hazards and Their Consequences

This means to alert the reader/user, in brief terms, of the specific hazard(s) and their consequences; for example, "ELECTRIC SHOCK can kill," "LOUD NOISE can damage hearing," and "IMPROPER PARALLELING can damage equipment." The statement of hazard(s) should be so printed that it is the second most dominant wording, and should be in capital letters. If the graphic symbol (appropriate for the hazard) is to be used, the graphic symbol may augment or replace the statement of hazard in text format. See Table 5-1.

2.3.4 Precautionary Measures

Immediately following the statement of hazard and its consequences, understandable statement(s) should be listed that describe the precaution(s) to be taken. For instance, a signal word, statement of hazard and consequence, and precaution might be: "**WARNING**: ELECTRIC SHOCK can kill. Do not touch live electrical parts."

The same product might qualify for other signal words and statements of hazard and precautions, such as:

a. **WARNING**:
- LOUD NOISE can damage hearing. Wear ear protection.

b. **CAUTION**:
- IMPROPER PARALLELING can damage equipment. See operating manual.

In a case where multiple hazards are present, only the signal word for the greatest hazard should be used, but all of the statements of hazards, their consequences and precautions should be included. The label would then read:

WARNING:

ELECTRIC SHOCK can kill.
- Do not touch live electrical parts.

LOUD NOISE can damage hearing.
- Wear ear protection.

IMPROPER PARALLELING can damage equipment.
- See operating manual.

The example used above should apply both to the product and to the process. As an alternative format to the example, all statements of hazard may be grouped together followed by all precautionary measures.

WARNING:

ELECTRIC SHOCK can kill.
LOUD NOISE can damage hearing.
IMPROPER PARALLELING can damage equipment.
- Do not touch live electrical parts.
- Wear ear protection.
- See operating manual.

2.3.5 When complete details cannot be reasonably given on the label, sources of additional information should be listed or the information may be included in the operating manual, for example:

Read American National Standard Z49.1, *Safety in Welding and Cutting,* available from the American Welding Society, 550 N.W. LeJeune Rd., Miami, FL 33126; OSHA Safety and Health Standards, 29 CFR 1910, from the U.S. Government Printing Office, Washington, D.C. 20402.

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Section 3
REVIEW OF LABEL

The object of the precautionary label should be to clearly convey the necessary information. Review the label; ask others to explain its meaning; revise until it is easily understandable.

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Section 4
PRECAUTIONARY LABELING

4.1 GENERAL PRECAUTIONARY LABELING

As a minimum, the information shown in Figure 4-1, or its equivalent, shall be placed on stock containers of materials such as wires, fluxes, and electrodes and on major equipment such as power sources, wire feeders and controls used in arc welding, arc cutting, and allied processes. The information shall be readily visible and may be on a label, nameplate, or other printed form. Graphic symbols may be used in conjunction with precautionary labeling and, if used, should conform with those in Section 5.

Where noise has been determined to be a hazard, the statement of hazard "LOUD NOISE can damage hearing" shall be added. It should be placed after the statement of hazard, "ELECTRIC SHOCK can kill."

Additional precautionary measures can be added as appropriate to special requirements, or when new knowledge indicates.

First aid information is an optional item. It is generally recommended only on products that present immediate and major health hazards. First aid information shall follow the last precautionary measure.

The company name and address should appear on the label unless it is readily visible elsewhere on the product.

A label identification number should appear on the label.

WARNING: ELECTRIC SHOCK can kill. FUMES AND GASES can be hazardous to your health. ARC RAYS can injure eyes and burn skin. WELDING (Cutting)* SPARKS can cause fire or explosion.

- Do not touch live electrical parts.
- Always wear dry insulating gloves.
- Keep your head out of the fumes.
- Use enough ventilation or exhaust at the arc to keep fumes and gases from your breathing zone, and the general area.
- Wear correct eye, ear, and body protection.
- Do not weld (cut)* near flammable material.
- Do not weld (cut)* on closed containers.
- Read and follow the manufacturer's instructions, employer's safety practices, and Material Safety Data Sheets (MSDSs).

Read American National Standard Z49.1, *Safety in Welding and Cutting,* available from the American Welding Society, 550 N.W. LeJeune Road, Miami, FL 33126; OSHA Safety and Health Standards, 29 CFR 1910, available from U.S. Government Printing Office, Washington, D.C. 20402.

Do Not Remove This Label.

---

* Choose proper term(s) for either welding, cutting, or both applications

Figure 4-1
GENERAL PRECAUTIONARY LABEL

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4.2 PLASMA ARC CUTTING LABELING

In addition to the general precautionary labeling information shown in Figure 4-1, the minimum information shown in Figure 4-2, or its equivalent, should appear on plasma arc cutting equipment.

Plasma arc can injure.

- Keep away from torch tip.
- Keep body and flammables away from cutting path.

Figure 4-2
PLASMA ARC CUTTING EQUIPMENT

4.3 ENGINE-DRIVEN ARC WELDING AND CUTTING POWER SOURCES LABELING

In addition to the general precautionary labeling information shown in Figures 4-1 and 4-2, the following minimum information, or its equivalent, should appear on engine-driven arc-welding and cutting power sources as shown in Figure 4-3. When appearing on separate labeling, the appropriate signal word should be used.

4.4 ELECTRICALLY SUPPLIED ARC WELDING AND CUTTING LABELING

In addition to the general precautionary labeling information shown in Figures 4-1 and 4-2, the following minimum information shown in Figure 4-4, or its equivalent, should appear on electrically supplied arc-welding and cutting power sources. When appearing on separate labeling, the appropriate signal word, as required by the guidelines, should be used.

ENGINE FUEL can cause fire or explosion.

- Stop engine before fueling.
- Do not smoke when fueling.
- Avoid sparks and open flame when fueling.
- Do not overfill tank.
- Clean up spilled fuel before starting engine.

ENGINE EXHAUST gases can KILL.

- Use in open, well-ventilated areas or vent the engine exhaust to the outside.

MOVING PARTS can cause serious injury.

- Keep away from moving parts.
- Do not operate with protective covers, panels, or guards removed.
- Stop engine before servicing.

Only qualified personnel should install, use, or service this equipment.

OPTIONAL:

LOUD NOISE can damage hearing.

- Wear ear protection.

Figure 4-3
ENGINE-DRIVEN ARC WELDING AND CUTTING POWER SOURCES

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ELECTRIC SHOCK can kill.

- Install and ground machine according to all national and local codes and manufacturer's instructions.
- Read operating manual, electrical code, and manufacturer's instructions before installing or operating.
- Do not operate with protective covers, panels, or guards removed.
- Disconnect input power before servicing.

Only qualified personnel should install, use, or service this equipment.

OPTIONAL:

- Connect cord to fused input power system with ground.
- Use grounding terminal inside machine.

Figure 4-4
ELECTRICALLY SUPPLIED ARC-WELDING AND CUTTING POWER SOURCES

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Section 5
GRAPHIC SYMBOLS

Graphic symbols may be used in conjunction with precautionary labels as shown in Section 4. If used, they should conform to the following table. Colors used for symbols should be black on white but white on black or other high contrast color combinations should be used. Minimum graphic symbol block size should be 0.50 inches (12.5 mm) by 0.50 inches (12.5mm) As required, basic graphic symbol elements may be combined. (See combined electric shock symbol). Table 5-1 provides the different types of graphic symbols that may be used to identify the specific hazard. Figure 5-1 is an example of a layout of a warning label using various graphic symbols.

NOTE: For symbols requiring a dot pattern, such as fumes, the use of a 45% gray shade is recommended.

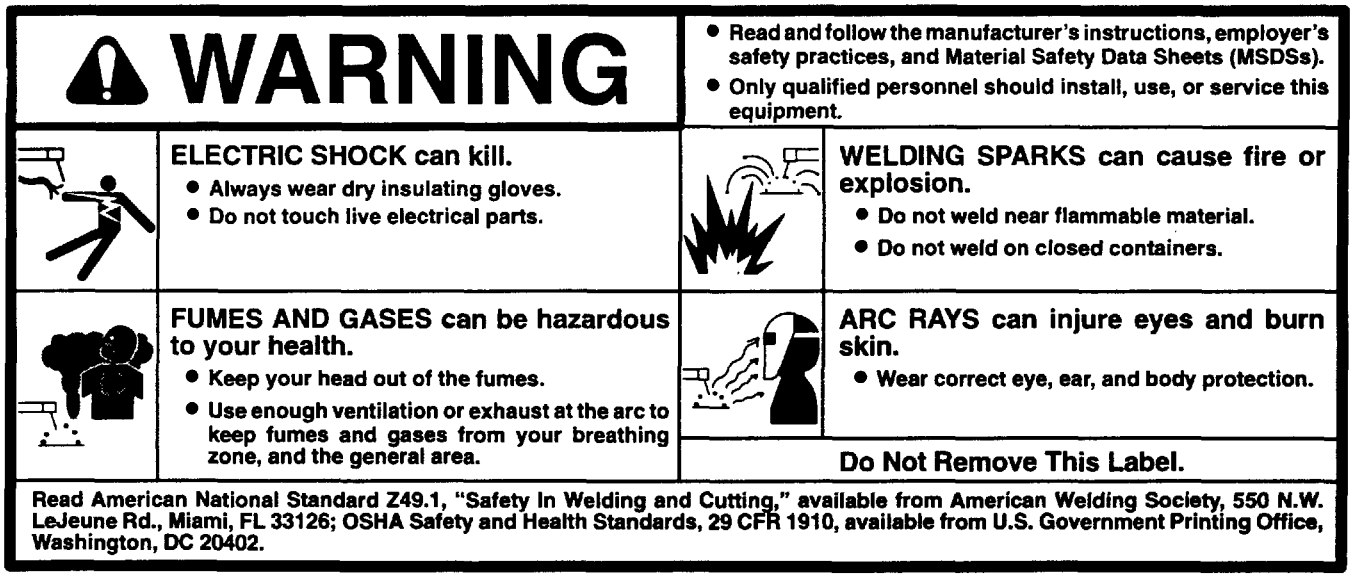

Figure 5-1
EXAMPLE LAYOUT OF WARNING LABEL

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Table 5-1
GRAPHIC HAZARD SYMBOLS

NO.	HAZARD	SOURCE OF HAZARD	SYMBOL	SOURCE
1	ELECTRIC SHOCK	WELDING ELECTRODE		ISO, FMC, NEMA COMMITTEE
2	ELECTRIC SHOCK	WIRING		FMC
3	ELECTRIC SHOCK	WELDING ELECTRODE AND WIRING		ISO, FMC, NEMA COMMITTEE
4	FUMES AND GASES	ANY SOURCE		FMC, NEMA COMMITTEE
5	FUMES AND GASES	WELDING FUMES AND GASES		ISO, FMC, NEMA COMMITTEE
6	ARC RAYS	WELDING ARC		ISO, FMC, NEMA COMMITTEE
7	FIRE	ENGINE FUEL		FMC
8	FUMES AND GASES	ENGINE EXHAUST		FMC, NEMA COMMITTEE
9	FUMES AND GASES	ENGINE EXHAUST AND WELDING		ISO, FMC, NEMA COMMITTEE

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NO.	HAZARD	SOURCE OF HAZARD	SYMBOL	SOURCE
10	MOVING PARTS	MOVING PARTS SUCH AS FANS AND ROTORS		FMC, NEMA COMMITTEE
11	LOUD NOISE	ENGINE, MACHINERY, AND ARC NOISE		FMC
12	FIRE OR EXPLOSION	WELDING SPARKS		ISO, FMC, NEMA COMMITTEE
13	BATTERY EXPLOSION	EXPLOSIVE GASES FROM BATTERIES		ISO, FMC, SAE, NEMA COMMITTEE
14	BATTERY ACID	BATTERIES CONTAINING ACID		ISO, FMC, SAE, NEMA COMMITTEE
15	HOT ENGINE COOLANT	ENGINE RADIATORS		FMC, SAE, NEMA COMMITTEE
16	PACEMAKER MALFUNCTION	ELECTROMAGNETIC FIELDS & HIGH FREQUENCY ENERGY FROM WELDING		ISO, FMC, NEMA COMMITTEE
17	PINCH POINTS ON MOVING PARTS	GEARS AND DRIVE ROLLS		FMC, NEMA COMMITTEE
18	FALLING EQUIPMENT	FALLING OBJECTS		FMC
19	EXPLOSION	PRESSURIZED GAS CYLINDERS		ISO, FMC, NEMA COMMITTEE

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NO.	HAZARD	SOURCE OF HAZARD	SYMBOL	SOURCE
20	ELECTRIC SHOCK	PLASMA CUTTING TORCH		ISO, FMC, NEMA COMMITTEE
21	FUMES AND GASES	PLASMA CUTTING ARC		ISO, FMC, NEMA COMMITTEE
22	ARC RAYS	PLASMA CUTTING ARC		ISO, FMC, NEMA COMMITTEE
23	FIRE OR EXPLOSION	PLASMA CUTTING SPARKS		ISO, FMC, NEMA COMMITTEE
24	PACEMAKER MALFUNCTION	ELECTROMAGNETIC FIELDS & HIGH FREQUENCY ENERGY FROM PLASMA CUTTING		NEMA COMMITTEE
25	PLASMA ARC	PLASMA CUTTING TORCH		ISO, FMC, NEMA COMMITTEE
26	FUMES AND GASES	SHIELDING GAS CYLINDER OR OTHER GAS SOURCE		FMC, NEMA COMMITTEE
27	HOT SURFACES	WORKPIECES FROM WELDING AND CUTTING; MUFFLER AND EXHAUST PIPES		FMC
28	WELDING WIRE	WELDING GUN AND WIRE		ISO, FMC, NEMA COMMITTEE
29	FLYING PARTICLES	CHIPPING AND GRINDING		FMC

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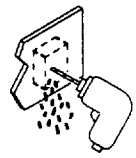
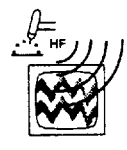
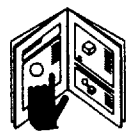
NO.	HAZARD	SOURCE OF HAZARD	SYMBOL	SOURCE
30	ELECTRIC MOTOR DAMAGE	INCORRECT CONNECTIONS TO AUXILIARY POWER		ISO, FMC
31	PC BOARD DAMAGE	STATIC ELECTRICITY		ISO, FMC, NEMA COMMITTEE
32	EQUIPMENT DAMAGE	FILINGS AND TOOL CONTACT FROM DRILLING INTO HIDDEN PARTS		NEMA COMMITTEE
33	FUEL SPRAY	PRESSURIZED FUEL IN TANK		FMC, NEMA COMMITTEE
34	EXPLODING PARTS	ELECTRICAL COMPONENTS (SUCH AS CAPACITORS)		FMC, NEMA COMMITTEE
35	ELECTRICAL INTERFERENCE	HIGH FREQUENCY RADIATION FROM WELDING AND WELDING EQUIPMENT		ISO, NEMA COMMITTEE
36	FALLING EQUIPMENT	IMPROPER LIFTING OR MOVING (USE NO HOOKS)		ISO, IEC, ANSI, NEMA COMMITTEE
37	THIS SYMBOL IS THE INTERNATIONAL SAFETY ALERT SYMBOL. IT IS PLACED BEFORE THE SIGNAL WORD (DANGER, WARNING, CAUTION).			ISO, IEC, SAE
38	READ INSTRUCTION MANUAL			FMC, NEMA COMMITTEE

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NEMA STANDARDIZATION BACKGROUND

The purpose of NEMA standards, their classification, and status are set forth in certain clauses of the NEMA *Standardization Policies and Procedures* manual and are referenced 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 their particular needs. 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.

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, dimensions, tolerances, safety, operating characteristics, performance, rating, testing, and the service for which they are designed.

(Standardization Policies and Procedures, p. 1)

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.

(Standardization Policies and Procedures, p. 6)

Categories of Standards

National Electrical Manufacturers Association Standards are of three classes, which have received the affirmative vote of at least two-thirds of the Subdivision votes cast in the affirmative or negative:

1. NEMA Standard, which relates to a product, process, or procedure commercially standardized and subject to repetitive manufacture.
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.
3. Adoptive Standard, which is adopted in whole or in part from the standards of another organization, either domestic, regional, or international.

(Standardization Policies and Procedures, pp. 5)

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, which standard has received the affirmative vote of at least two-thirds of the Subdivision votes cast in the affirmative or negative.

(Standardization Policies and Procedures, pp. 5)

Identification of Status

Standards in NEMA Standards Publications are identified as "NEMA Standard," "Suggested Standard for Future Design," or "Adoptive Standard." These indicate the status of the standard. A statement incorporating the auxiliary verb "shall" indicates that compliance with a requirement is mandatory for compliance with the standard. These classes of standards are identified in the foreword or throughout the text.

The material identified as "Authorized Engineering Information" is designated similarly. Statements incorporating other auxiliary verbs such as "should," "may," etc. refer to the authorized engineering information and not to procedures required for compliance with the standard.

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ARC WELDING SECTION
OF THE
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MEMBER COMPANIES

ARC Machines Inc.
Pacoima, CA

Century Manufacturing Company
Minneapolis, MN

ESAB Welding & Cutting Products
Consumables Division (Alloy Rods)
Hanover, PA

ESAB Welding & Cutting Products
Equipment Division
Florence, SC

Hobart Brothers Co.
Troy, OH

Hypertherm Inc.
Hanover, NH

The Lincoln Electric Co.
Cleveland, OH

Miller Electric Mfg. Company
Appleton, WI

National Standard Co.
Niles, MI

POWERCON, Inc.
San Diego, CA

Sandvik Steel Company
Scranton, PA

Systematics
West Chester, PA

Thermadyne
Thermal Dynamics
Stoody Deloro Stellite, Inc.
St. Louis, MO

UTP Welding Materials, Inc.
Houston, TX

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