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Graphic Symbols for Arc Welding Apparatus

NEMA

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

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GRAPHIC SYMBOLS

(Approved as Authorized Engineering Information 1-27-1982)

Foreword

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

This NEMA 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. The parties would have an interest in or responsibility for the purchase, future application, use or inspection of arc welding power sources, and associated equipment. 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 or organizations an opportunity to participate in future revisions.

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 graphic symbols to reflect advancing technology or the latest state of the art. Please address any comments or questions, you may have, on the text to:

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National Electrical Manufacturers Association
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Purpose

The purpose of this publication is to provide manufacturers and users of arc welding and cutting apparatus with a uniform system of symbols and their meanings which will be used and recognized throughout the arc welding industry. These graphic symbols are meant to transmit the required message independently of any language, and their use should minimize language difficulties that may arise when equipment is used in various countries.

Scope

This publication establishes graphic symbols for arc welding and cutting apparatus. The symbols provided include those needed to describe and identify the type of welding and cutting equipment and the welding and cutting processes for which the equipment is designed. Symbols are also provided to identify controls, indicators, and connection points and to instruct the operator in their use.

The present publication does not cover graphic symbols required to alert personnel of immediate or potential personal hazards in the use of the equipment.

History of Graphic Symbols

This information provides a practical means of communicating to operators of arc welding equipment the function and use of equipment controls that are peculiar to the arc welding industry.

Symbols have been in use in certain countries for a number of years. Such symbols were developed as needed by equipment manufacturers to ease the language communication problem.

In 1957, the International Organization for Standardization Technical Committee 44 (Welding) (ISO/TC44) began work on the rating of manual arc welding equipment. This led in 1968 to the publication of ISO Recommendation R700, First Edition, entitled *Rating of Manual Arc Welding Equipment.*

In 1976, Subcommittee SC4 (Arc Welding Equipment) of ISO/TC44 proposed a revision of ISO R700 which incorporates graphic symbols for identification of the equipment and description of the welding processes for which the equipment may be used.

In 1977, representatives of arc welding equipment manufacturers reviewed ISO symbols and proposed other symbols for use and identification of equipment controls. This group became the NEMA Arc Welding Apparatus Graphic Symbol Committee.

In 1982, this first edition of NEMA Authorized Engineering Information for *Graphic Symbols For Arc Welding Apparatus* was published. In its preparation, consideration was given to the work of other organizations, such as the International Organization for Standardization, the American Welding Society, Society of Automotive Engineers, The American Society of Mechanical Engineers, and the various welding equipment manufacturers including European manufacturers. Many of the symbols were adopted directly from the work of the above organizations and credit is hereby given to them.

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Section 1

APPLICATION OF GRAPHIC SYMBOLS

1.1 GENERAL

The symbols will usually be placed on equipment to instruct as to its use and operation. In addition, there may be warnings or limits as to use of some controls. In some cases, symbols may be used to identify the complete package or subassemblies.

The user of equipment establishes the meaning of symbols by reference to the pictorial section of this standard.

Symbols should be accompanied by words and phrases until such time that universal recognition is achieved. Words or phrases, to be used in addition to the symbols are to be selected by the manufacturer. The process of selecting symbols for a particular application is simplified by following the steps below.

Section 2

IDENTIFICATION OF PARTS AND KEY WORD OR PHRASE

2.1 List all parts that physically exist that need identification by symbols. Group similar parts together in tabular form, e.g.

Switches, receptacles, terminals

2.2 List after each part its exact function, e.g.

Switch - to control input power
Rheostat - to control welding current
Lamp - to indicate low oil pressure when lit
Terminal - to identify as work lead connection

2.3 List the direction of movement, and result of such movement, associated with the part, e.g.

Rotate clockwise to increase
Push up for ON; down for OFF
Pull out to STOP

2.4 List the command associated with the part, e.g.

Do not switch while welding

2.5 List the quantity and unit of measurement related to the part, e.g.

0-10 dial, in seconds
0-10 dial, no meaning to graduations

2.6 List all items (words or phrases) that are not physical parts but for which symbols are to be selected, e.g.

Water, high frequency, positive polarity

2.7 Review the above steps to assure that all physical parts have some distinguishing description that clearly states, in an understandable manner, exactly what is to be represented by graphic symbols. It is important that the language description be clear before attempting to select symbols.

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Section 3

SELECTION OF SYMBOLS

3.1 A symbol may exist that exactly transmits the requirements worked out in the preceding section. However, it is usually necessary to use a building block approach and use individual symbols as required.

3.2 Refer to the index and/or symbol section. Select symbols by looking at both Function/Key Word column and PART TYPE column. List the Symbol Numbers opposite the parts and items listed in Section 2. Use this as a guide for preparing the artwork for labels or silkscreens. Consistent positioning of each symbol around the device promotes overall readability.

3.3 Alternative methods of applying symbols are shown in the examples. Select the method that best identifies the control or component, how it is to be used, and what is indicated, as applicable.

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Section 4

EXAMPLES OF THE GROUPING OF SYMBOLS

4.1 The type of the part, its function, and the number of the symbol are shown in the examples for illustration purposes only. Words or phrases accompanying the symbols may vary with each manufacturers terminology.

4.2 INPUT POWER CONTACTOR SWITCH

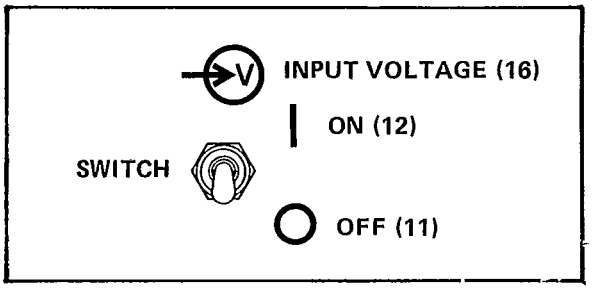

Figure 1

4.3 RHEOSTAT WITH CALIBRATED DIAL

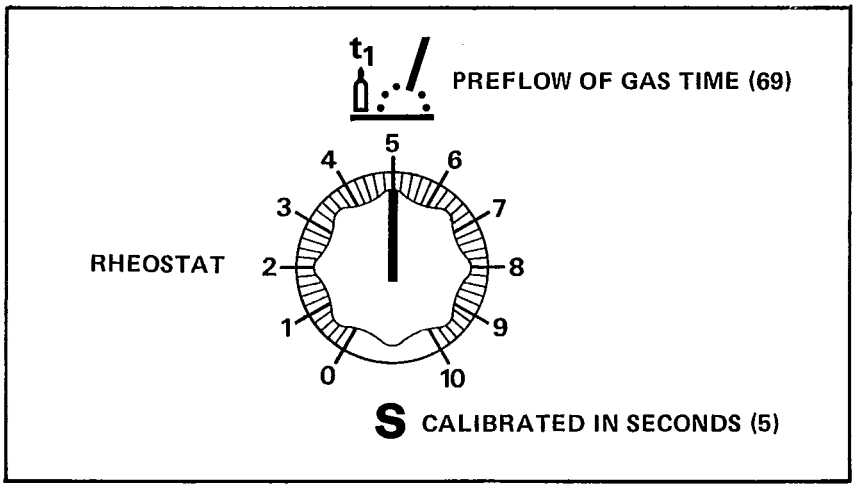

Figure 2

NOTE: Symbol (47) for increase/decrease of quantity is not necessary when a numbered dial is supplied.

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4.4 USE OF HIGH FREQUENCY FOR GTAW (TIG) WELDING

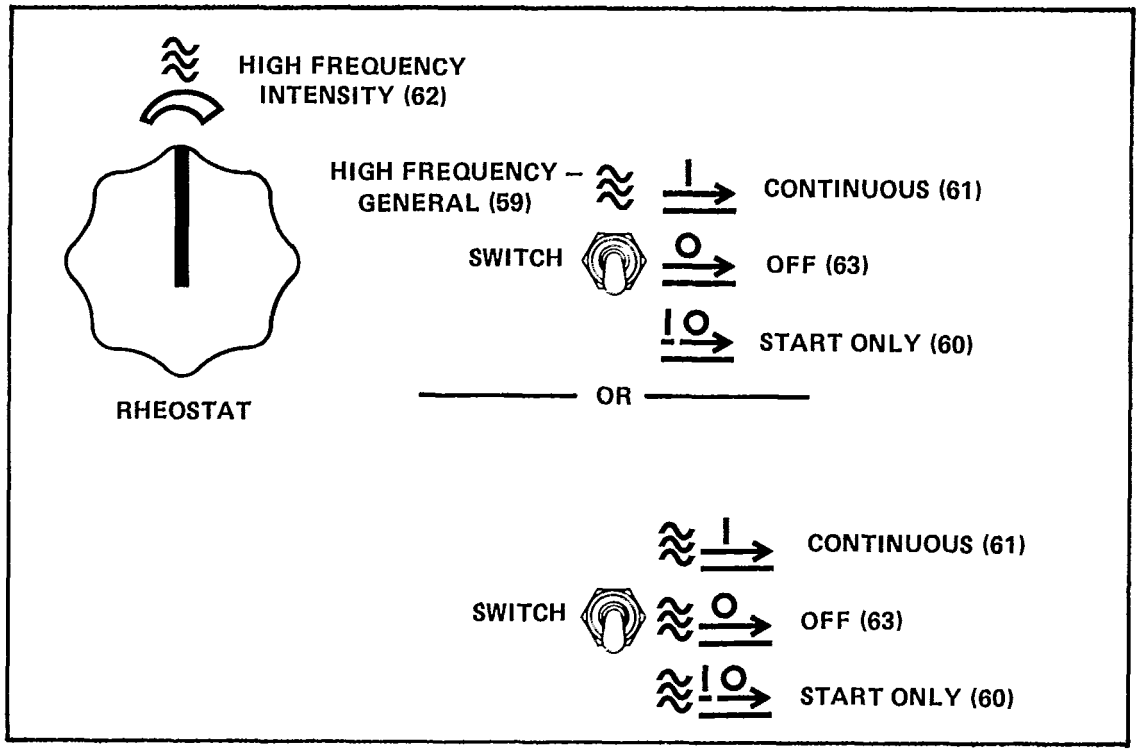

Figure 3

4.5 CONTROL OF AMPERAGE BY PANEL RHEOSTAT OR REMOTE RHEOSTAT CONNECTED THROUGH RECEPTACLE

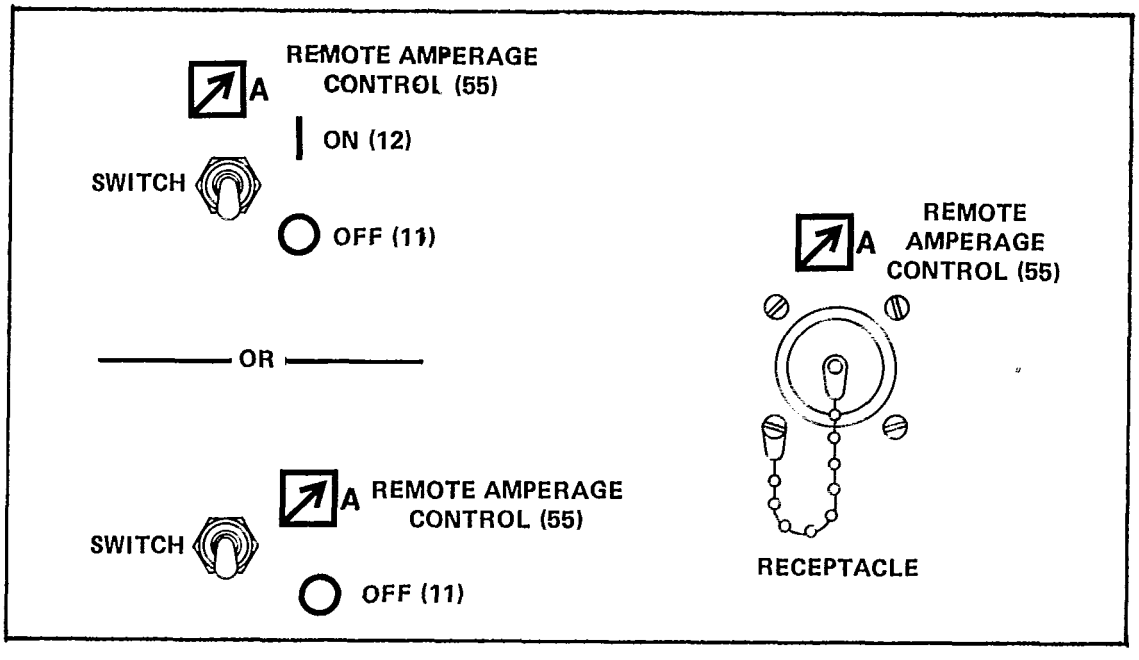

Figure 4

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4.6 TERMINALS AND POLARITY SWITCH ON AC/DC WELDER

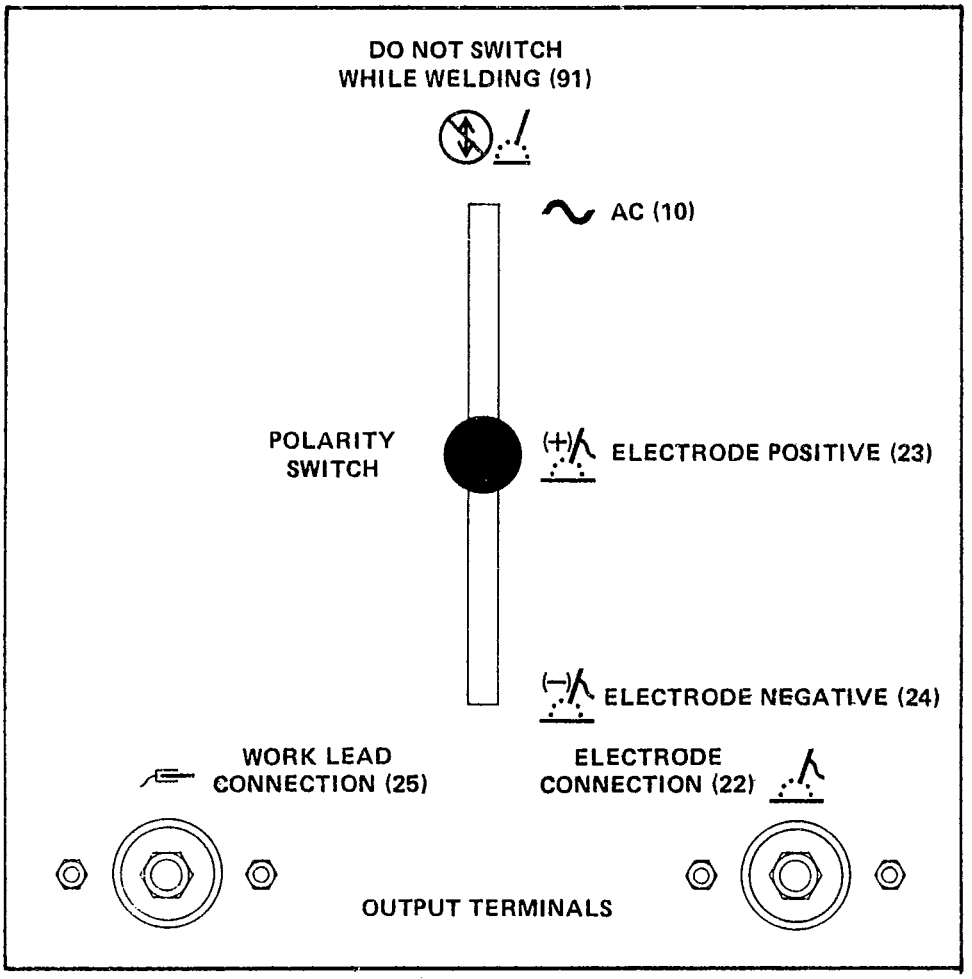

Figure 5

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GRAPHIC SYMBOLS

NO.	FUNCTION/KEY WORD OR PHRASE	PART TYPE	SYMBOL	SOURCE*
1	Amperage	Rheostat, Ammeter, Etc.	A	SI
2	Voltage	Rheostat, Voltmeter, Etc.	V	SI
3	Hertz	———	Hz	SI
4	Phase (Electrical)	———	ϕ	NEMA Committee
5	Seconds	———	s	SI
6	Time	———	t	SI
7	Negative	Terminal, Switch, Etc.	—	IEC 417 5006
8	Positive	Terminal, Switch, Etc.	+	IEC 417 5005
9	Direct Current (DC)	Terminal, Switch, Etc.	⎓	IEC 417 5031
10	Alternating Current (AC)	Terminal, Switch, Etc.	~	IEC 417 5032
11	Off	Switch	○	IEC 417 5008
12	ON	Switch	|	IEC 417 5007

*IEC (INTERNATIONAL ELECTRO TECHNICAL COMMISSION)
ISO (INTERNATIONAL ORGANIZATION FOR STANDARDIZATION)
SI (INTERNATIONAL SYSTEM OF UNITS)
SAE (SOCIETY OF AUTOMOTIVE ENGINEERS)
INTERNATIONAL STANDARD)

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GRAPHIC SYMBOLS

NO.	FUNCTION/KEY WORD OR PHRASE	PART TYPE	SYMBOL	SOURCE
13	Gas (Supply)	———		NEMA Committee
14	Input	———		IEC 417 5034
15	Output	———		IEC 417 5035
16	Input Voltage	Switch		NEMA Committee
17	Water Input	Connection		NEMA Committee
18	Water Output	Connection		NEMA Committee
19	Gas Input	Connection		NEMA Committee
20	Gas Output	Connection		NEMA Committee
21	Welding Arc (General) - Non Descriptive of Process	———		ISO N93 DIS 3957-0459
22	Electrode Connection	Terminal		NEMA Committee
23	Electrode Positive (Reverse Polarity) - Machines With Polarity Switch	Switch		NEMA Committee
24	Electrode Negative (Straight Polarity) - Machines With Polarity Switch	Switch		NEMA Committee

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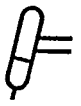
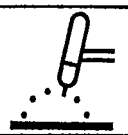
GRAPHIC SYMBOLS

NO.	FUNCTION/KEY WORD OR PHRASE	PART TYPE	SYMBOL	SOURCE
25	Work Connection	Terminal		ISO N93 DIS3957-0453
26	Constant Current (CC) or Variable Voltage (VV)	Terminal, Switch, Etc.		ISO N93 DIS 3957-0454
27	Constant Voltage (CV) or Constant Potential (CP)	Terminal, Switch, Etc.		ISO N93 DIS 3957-0455
28	Gas Metal Arc Welding Gun	Terminal		ISO N93 DIS 3957-0464
29	Shielded Metal Arc Electrode Holder	Terminal		ISO N93 DIS 3957-0463
30	Plasma Torch	———		ISO N93 DIS 3957-0477
31	Gas Tungsten Arc Welding Torch	Terminal		ISO N93 DIS 3957-0465
32	Gas Tungsten Arc Welding Electrode Size	Switch, Rheostat		NEMA Committee
33	Shielded Metal Arc Welding	———		ISO N93 DIS 3957-0460
34	Gas Metal Arc Welding	———		ISO N93 DIS 3957-0461
35	Submerged Arc Welding	———		ISO N93 DIS 3957-0467
36	Gas Tungsten Arc Welding	———		ISO N93 DIS 3957-0462

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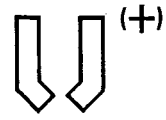
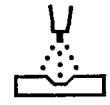
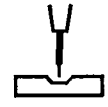
GRAPHIC SYMBOLS

NO.	FUNCTION/KEY WORD OR PHRASE	PART TYPE	SYMBOL	SOURCE
37	Air Carbon Arc Cutting (AAC)	Switch		NEMA Committee
38	Plasma Arc Cutting Process	———		ISO N93 DIS 3957-0479
39	Plasma Arc Welding Process	———		ISO N93 DIS 3957-0478
40	Plasma Torch Connection + to Nozzle (Positive Supply)	Terminal		ISO N93 DIS 3957-0483
41	Plasma Torch Connection—to Electrode (Negative Supply)	Terminal		ISO N93 DIS 3957-0482
42	Spray Transfer	———		ISO N93 DIS 3957-0472
43	Short Circuiting Transfer	———		ISO N93 DIS 3957-0471
44	Globular Transfer	———		ISO N93 DIS 3957-0473
45	Increase/Decrease of Quantity (Rotating; Number of Positions Illustrated to be Indicative of Switching Device)	Switch		ISO N95 31
46	Increase/Decrease of Quantity (Rotating & OFF Position)	Switch, Rheostat		ISO N95 32
47	Increase/Decrease of Quantity (Rotating)	Rheostat		ISO N95 30
48				

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GRAPHIC SYMBOLS

NO.	FUNCTION/KEY WORD OR PHRASE	PART TYPE	SYMBOL	SOURCE
49	Increase/Decrease of Quantity (Linear; Number of Positions Illustrated to be Indicative of Switch Device)	Switch		ISO N95 28
50	Increase/Decrease of Quantity (Linear)	Rheostat		ISO N95 27
51	Slow	Switch, Rheostat		Dreyfuss Page 157
52	Fast	Switch, Rheostat		Dreyfuss Page 157
53	Remote	———		Dreyfuss Page 63
54	Remote Voltage Control	Switch, Rheostat, Receptacle		Dreyfuss Page 63 & NEMA Committee
55	Remote Amperage Control	Switch, Rheostat, Receptacle		Dreyfuss Page 63 & NEMA Committee
56	Remote Amperage or Voltage Control for CC/CV Machines	Switch, Rheostat, Receptacle		Dreyfuss Page 63 & NEMA Committee
57	Remote On-Off Control of Power Source Output	Switch, Receptacle		Dreyfuss Page 63 & NEMA Committee
58	Remote On-Off control of Power Source Output and Amperage Control	Switch, Rheostat, Receptacle		Dreyfuss Page 63 & NEMA Committee
59	High Frequency — General	Switch, Terminal		Part of ISO N93 DIS 3957-0476
60	High Frequency (Start Only) DC Welding	Switch		NEMA Committee

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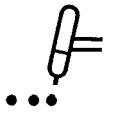
GRAPHIC SYMBOLS

NO.	FUNCTION/KEY WORD OR PHRASE	PART TYPE	SYMBOL	SOURCE
61	High Frequency (Continuous) AC Welding	Switch		NEMA Committee
62	High Frequency - Intensity	Rheostat		NEMA Committee
63	High Frequency — Off	Switch		NEMA Committee
64	Spot Welding (General) — Non Descriptive of Process	Switch		ISO N93 DIS 3957-0468
65	Spotwelding Arc Time	Rheostat, Switch		NEMA Committee
66	Gas Tungsten Arc Welding - Spot Welding	———		ISO N93 DIS 3957-0470
67	Gas Metal Arc Welding - Spot Welding	———		ISO N93 DIS 3957-0469
68	Post Flow of Gas Time	Timing Control		NEMA Committee
69	Pre Flow of Gas Time	Timing Control		NEMA Committee
70	Engine	———		SAE J298 Part of 11 & 12
71	Engine Oil Pressure	Gauge		SAE J298 12
72	Engine RPM	———		SAE J298 11

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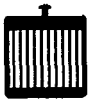
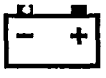
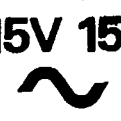
NO.	FUNCTION/KEY WORD OR PHRASE	PART TYPE	SYMBOL	SOURCE
73	Engine Oil	———		ISO 2575 Item 4.17
74	Pull to Stop — Diesel Engine	Pull Knob		NEMA Committee
75	Engine Choke	Pull or Rotating Knob, Etc.		ISO 2575 Item 4.12
76	Fuel	———		SAE J298 & J389a
77	Engine Coolant	———		NEMA Committee
78				
79	Engine Coolant Temperature	Gauge		ISO 2575 Item 4.15
80	Battery (Engine)	———		ISO 2575 Item 4.16
81	Air Filter	———		SAE J298
82	Plasma Gas	Connection, Switch		ISO N93 DIS 3957-0480
83	Plasma Shielding Gas	Connection, Switch		ISO N93 DIS 3957-0481
84	Receptacle Rating - Auxiliary Power (Values to vary to represent specific power output - use AC or DC symbol as applicable)	Receptacle		NEMA Committee

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GRAPHIC SYMBOLS

NO.	FUNCTION/KEY WORD OR PHRASE	PART TYPE	SYMBOL	SOURCE
85	Wire Feed	Switch, Rheostat, Receptacle		NEMA Committee
86	Hopper (powder, flux)	———		ISO N93 DIS 3957-0466
87	Arc Ignition by Contact	———		ISO N93 DIS 3957-0475
88	Arc Welding Equipment Carriage	———		ISO N93 DIS 3957-0451
89	Meltback (Burnback)	Timing Control		NEMA Committee
90	Purge By Gas	Switch		ISO N93 DIS 3957-0474
91	Do Not Switch While Welding	Switch		NEMA Committee
92	Air Carbon Arc Cutting Electrode Holder	———		NEMA Committee

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GRAPHIC SYMBOLS

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Function/Key Word or Phrase	Symbol Number
Hertz	3
High Frequency (Continuous) AC Welding	61
High Frequency (Start Only) DC Welding	60
High Frequency - Intensity	62
High Frequency - Off	63
High Frequency - General	59
Hopper (powder, flux)	86
Increase/Decrease of Quantity (Linear)	50
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Function/Key Word or Phrase	Symbol Number
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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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