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INSTRUCTIONS FOR HANDLING, INSTALLATION, OPERATION AND MAINTENANCE OF BUSWAY RATED 600 VOLTS OR LESS

Retain for Use of Qualified Maintenance Personnel

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

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INSTRUCTIONS FOR HANDLING, INSTALLATION, OPERATION AND MAINTENANCE OF BUSWAY RATED 600 VOLTS OR LESS

(Approved as Authorized Engineering Information)

This publication is a guide of practical information containing instructions for the handling, installation, operation and maintenance of busway and associated fittings rated 600 volts or less. These recommendations of the Busway Section of the National Electrical Manufacturers Association will be found useful by architects, electrical engineers, electrical contractors, electricians, maintenance engineers and others responsible for the handling, installation, operation and maintenance of busway and associated fittings. They will be reviewed periodically by the Section for the purpose of updating them to reflect advancing technology. User input has been considered in the development of this publication. Please address any comments or questions you may have on the text to:

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Section 1

GENERAL

1. Proper planning and coordination between trades, heating contractors and plumbing contractors are important for a good busway layout.

2. The successful operation of busway is dependent upon proper handling, installation, operation and maintenance, as well as upon proper design and manufacture. Neglecting certain fundamental installation and maintenance requirements may lead to personal injury and the failure and loss of the busway as well as damage to other property.

WARNING—THERE IS A HAZARD OF ELECTRICAL SHOCK OR BURN WHENEVER WORKING IN OR AROUND ELECTRICAL EQUIPMENT. FOLLOW ALL MANUFACTURER'S WARNING AND INSTALLATION INSTRUCTIONS.

Section 2

HANDLING

These guidelines are provided to help reduce the risk of personal injury and equipment damage during handling, as well as to facilitate moving the busway sections and fittings at the job site.

1. Follow the manufacturer's handling instructions for the specific equipment, if available.

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2. Handle busway with care to avoid damage to internal components and the enclosure or its finish. Avoid subjecting busway to twisting, denting, impact and, in general, rough handling.

3. Do not use busbar ends for lifting busway sections or fittings.

4. When the busway is received, unpack it sufficiently to inspect it for concealed damage and to determine that the shipment is complete and correct.

5. If busway is to be stored any length of time prior to installation, restore the packing for protection during that period (See Section 3). Where conditions permit, leave the packing intact until the sections or fittings are at their final installation location.

6. Know the capabilities of the moving means available to handle the weight of the sections or fittings.

7. Platform dollies provide a simple method of moving busway on one floor level if there is little or no incline. Balance the load carefully.

8. A fork-lift truck may offer a more convenient method of handling busway and has the added advantage of permitting it to be hoisted between levels. Balance the load carefully.

9. Platform lifts or elevators, either manually or power operated, can be used advantageously in moving loads of busway between elevations.

Section 3

STORAGE

1. Busway sections and fittings which are not to be installed and energized immediately should be stored in a clean dry space having a uniform temperature to prevent condensation. Preferably, they should be stored in a heated building having adequate air circulation and protected from dirt, fumes, water, and physical damage.

2. Busway should not be stored outdoors. However, if it must be stored outdoors, cover it securely to provide protection from weather and dirt. Temporary electrical heating should be installed beneath the cover to prevent condensation. At least 3 watts per cubic foot is adequate for the average environment.

3. Outdoor busway should be treated exactly the same as indoor busway until after it is installed. It is not weather resistant until completely and properly installed.

Section 4

INSTALLATION

A. General

1. Provide sufficient horizontal and vertical clearance from walls and ceilings to provide easy access to joints, both for the original installation and possible removal of a section when required.

2. Follow the manufacturer's installation instructions and the current edition of the National Electrical Code.

B. Unpacking

1. Care must be used in unpacking. Band cutters should be used on all banding securing the package.

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2. Nail pullers should be used for unpacking wooden crates to avoid damage.

3. Remove any support blocks which may have been used for shipping.

C. Hoisting and Handling (See Also Section 2)

1. If a crane is used to install busway, use nylon straps and distribute or balance the weight of each lift. If cables are used, spreaders should be used to avoid damage to the busway's metal housing.

2. If a fork truck or similar hoist is used, properly position the busway on the fork to distribute its weight. Careful approach is a must to avoid any damage to the metal housing that could pinch the bus bar insulation and result in a failure.

3. Do not drag the busway across the floor.

4. When installing vertical sections, it is easier to lower the busway from the floor above where it will be installed. Vertical sections are often stored on the floor above their final location to facilitate lowering them into position.

D. Hanging or Supporting

1. Use the hangers or the hanging recommendations supplied by the manufacturer in the manner prescribed to afford a secure installation and proper spacing.

2. Level and plumb busway (align vertically and horizontally) before the final tightening of all joints.

3. Consider sway bracing for plug-in busway. Exercise caution when plugs are used on one side of a busway or when there are more plugs on one side than on the other.

E. Joint Assembly

1. Ensure that all contact surfaces are clean and free of contaminants.

2. Align the busbar ends of adjoining sections, verifying proper phase alignment, and slide the sections together.

3. Use joint pullers, if available.

4. Follow the manufacturer's instructions for proper completion of joint assemblies and torquing of joint bolts.

5. Busway should be properly covered during installation to protect it from moisture, plaster or other types of contaminants.

F. Grounding

1. Properly bond the busway to other equipment grounding conductors in the system.

2. Properly ground all equipment grounding conductors in the system to the system ground in accordance with the National Electrical Code.

G. Mounting Plug-in Devices

1. Follow the manufacturer's instructions for the proper mounting of plug-in devices.

2. Allow sufficient clearances to install, operate, and remove devices and open covers when necessary.

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3. All plug-in openings that are not in use should be covered when such covers are provided.

4. All tap off or plug-in devices should be in the 'Off' position during mounting.

H. Protection From Liquids, Moisture and Other Contaminants

Busway should be protected from liquids, moisture and other contaminants to prevent electrical failure. Some common sources of such contaminants are:

1. During Construction—Indoor busways must be protected from moisture during and after installation. Special attention should be given to riser busways during construction to protect them from moisture from uncompleted roofs, walls, etc. Outdoor busway must be treated exactly the same as indoor busway until after it is installed. It is not weather resistant until completely and properly installed.

2. Floor Level Liquids—Four-inch minimum curbs should be installed around all floor openings for riser busways to prevent floor level liquids from entering the opening.

3. Leaking Roof—Protect indoor busway with a temporary sheet metal shield or other protective cover to prevent water from falling onto the busway until the roof is repaired.

4. Pipes—Protect indoor busway with a temporary sheet metal shield or other protective cover to prevent water from falling onto the busway until leaking pipes are repaired. Where pipes (especially cold water pipes) pass directly above indoor busway, the busway should be protected from dripping condensate by insulating the pipe or permanently shielding the busway with sheet metal or plastic.

5. Sprinklers—Protect indoor busway from direct spray of sprinklers.

6. Snow—Outdoor busway should be mounted sufficiently above the ground or roof so that snow build-up does not surround the busway and result in water being forced into the busway through weep holes.

I. Summary

1. Review erection drawings very carefully.

2. Check the bill of material.

3. Check description and identification of each piece before installing it.

4. Follow instruction labels on each piece for torque requirements.

5. Follow manufacturer's joint assembly instruction drawing for both indoor and outdoor procedures.

6. Conduct an insulation resistance test on each section of busway before it is installed.

7. Conduct an insulation resistance test on the portion of each run already installed on a daily basis.

8. Check for possible sources of water that may fall on indoor busway, and take corrective action to prevent this.

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Section 5

STEPS TO BE TAKEN BEFORE ENERGIZING

WARNING—THERE IS A HAZARD OF ELECTRICAL SHOCK OR BURN WHENEVER WORKING IN OR AROUND ELECTRICAL EQUIPMENT. FOLLOW ALL MANUFACTURER'S WARNING AND INSTALLATION INSTRUCTIONS.

1. Recheck all joint connections for tightness. Follow the manufacturer's torquing recommendations.

2. Ensure that all tap-off or plug-in devices are in the 'OFF' position.

3. Isolate the busway run by disconnecting all connections to transformers, switchboards, meters, and so forth.

4. Conduct an insulation resistance test with an insulation resistance tester rated 1000 volts to ensure that the system is free from short circuits and grounds (phase to ground, phase to neutral and phase to phase). It should be noted that readings vary inversely with the length of run and width or number of bars per phase. Readings will vary with humidity. Readings of less than 1 megohm for a 100-foot run (MEGOHMS = 100 / Length of Busway in Feet) should be investigated.

5. Verify that the system phasing matches the busway phasing before reconnecting all connections to transformers, switchboards, meters, and so forth.

Section 6

ENERGIZING EQUIPMENT

WARNING—ENERGIZING A BUSWAY RUN FOR THE FIRST TIME IS POTENTIALLY DANGEROUS.

1. When the equipment is energized for the first time, qualified electrical personnel should be present. If short circuits and ground faults caused by damage or poor installation practices have not been detected in the check-out procedure, serious damage can result when the power is turned on.

2. There should be no load on the busway when it is energized. Since busway typically extends through several rooms and floor levels, care should be taken to see that all devices fed from the busway are in the 'OFF' position.

3. The equipment should be energized in sequence by starting at the source end of the system and working toward the load end. In other words, energize the main devices, then the feeder devices and then the branch-circuit devices. Turn the devices to the 'ON' position with a firm positive motion.

   Protective devices which are not quick-acting should not be 'teased' into the closed position.

4. After all devices have been closed, loads such as lighting circuits, contactors, heaters, and motors may be turned 'ON'.

5. Busway, when operating properly, will have a moderate hum. Excessive noise may be an indication of hardware that has not been tightened or of metal parts that have been improperly assembled.

6. Occurrence of sparking at any point along the busway is not a normal condition. The busway must be de-energized immediately, and remain de-energized until the sparking condition has been corrected.

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Section 7

CARE AND MAINTENANCE

WARNING—TURN OFF POWER TO BUSWAY BEFORE PERFORMING ANY OF THE FOLLOWING OPERATIONS. CHECK THE VOLTAGE OF ALL INCOMING LINE TERMINALS TO POSITIVELY ASCERTAIN THAT THE BUSWAY IS TOTALLY DE-ENERGIZED.

A. Busway

Inspect busway once each year or after any severe electrical short circuit or ground fault.

1. Look for any moisture or signs of previous wetness or dripping onto the busway or onto connection boxes (indoor busway) from leaky roofs, pipes, sprinklers or other sources of moisture. Look for any recent changes in sprinklers or other plumbing that might now be a source of trouble to busway.

   a. Seal off any cracks or openings which have allowed moisture to enter the busway or its connection boxes. Eliminate the source of any dripping onto the busway and any other source of moisture (indoor busway). See Section 4, par. H, for more specific details on preventing liquid from getting onto the busway.

   b. Replace or thoroughly dry and clean any insulating material which is damp or wet or shows accumulation of deposited material from previous wettings. Consult the manufacturer for proper procedures.

2. If there is appreciable accumulation of dust and dirt, clean it off by using a brush, vacuum cleaner, or clean lint-free rags. In order to avoid blowing dust into busway joints, circuit breakers, or other equipment, do not use a blower or compressed air.

3. Carefully inspect all visible electrical joints and terminals.

   a. Check tightness of bolts, nuts, and so forth, in accordance with the manufacturer's instructions, where provided.

   b. If joints or terminations appear to be badly discolored, corroded or pitted, or show evidence of having been subjected to high temperatures, the parts should be disassembled and replaced or cleaned.

CAUTION—DO NOT REMOVE PLATING ON ALUMINUM PARTS IN JOINTS OR TERMINATIONS. REPLACE DAMAGED ALUMINUM PARTS.

4. Check the insulation resistance prior to re-energizing the busway. A permanent record should be kept of resistance readings. If readings decrease appreciably with time, deterioration is taking place. Refer to Section 5, Item 4.

B. Busway Plugs and Cubicles with Protective Devices

1. Closely examine the fuse clips. If there is any sign of over-heating or looseness, check the spring pressure, tightness of clamps, and so forth. Replace the fuse clips if the spring pressure compares unfavorably with that of other identical fuse clips in other equipment.

2. Look for any signs of deterioration in insulating material or melting of the sealing compound. Replace such insulating parts and assemblies where the sealing compound has melted.

3. BE SURE THAT THE CONDITION WHICH CAUSED THE OVERHEATING HAS BEEN CORRECTED.

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4. Check the operation of all mechanical components.

   a. Check all switch operator mechanisms and external operators of circuit breakers. Be sure that each operator mechanism quickly and positively throws the contacts fully 'ON' and fully 'OFF'.

   b. Check the mechanisms of all electrical and mechanical interlocks and padlocking means.

   c. Check for missing or broken parts, proper spring tension, free movement, rusting or corrosion, dirt, and excessive wear.

   d. Examine all readily accessible arc chutes and insulating parts for cracks or breakage and for arc spatter, sooty deposits, oil or tracking.

   e. Clean off arc spatter, oil and sooty deposits. Replace the device if appreciable material has burned away or if parts are charred or cracked.

5. Lubricate the operating parts of switch mechanisms, and other moving parts, according to the manufacturer's instructions.

   a. Use clean, nonmetallic, light grease or oil as instructed.

   b. Do not oil or grease parts of molded case circuit breakers.

   c. If no instructions are given on the devices, sliding copper contacts, operating mechanisms and interlocks may be lubricated with clean, light grease.

   d. Wipe off excess lubrication to avoid accumulation of foreign material.

6. Operate each switch or circuit breaker several times to ensure sure that all mechanisms are free and in proper working order.

7. Retighten all wire connections.

8. Check fuses to ensure they have the proper ampere rating and interrupting rating. Make sure that non-current-limiting fuses are never used as replacements for current-limiting fuses. Never attempt to defeat rejection mechanisms which are provided to prevent the installation of the wrong type of fuses.

9. Check the insulation resistance of devices prior to their reinstallation on the busway.

Section 8

PERMISSIBLE LOADING OF BUSWAYS

1. Busways-With or Without Overcurrent Protection—The total continuous load current should not exceed the current rating on the busway nameplate.

2. Busway Plugs—The total continuous load current on a busway fusible plug should not exceed 80 percent of the ampere rating of the fuses. The total continuous load current on other types of plugs, should not exceed 80 percent of the ampere rating of the plug unless the device is rated to carry 100 percent of its ampere rating. Cycling loads with high inrush currents may require additional consideration when sizing plug-in units. Consult the manufacturers literature for proper sizing under these conditions.

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3. Ambient Temperatures Above 40°C (104°F)—When busways are installed in locations that have a continuous ambient temperature above 40°C (104°F), the busways should be derated in accordance with the manufacturers recommendations, if furnished, or the following table:

AMBIENT TEMPERATURE	MULTIPLIER
40°C (104°F)	1.00
45°C (113°F)	0.95
50°C (122°F)	0.90
55°C (131°F)	0.85
60°C (140°F)	0.80
65°C (149°F)	0.74
70°C (158°F)	0.67

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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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