

INSTRUCTION BOOK

BUS SYSTEMS MEDIUM-VOLTAGE SWITCHGEAR AND BUS DUCT

**IN ADDITION TO THE PERSONNEL PROTECTION PRECAUTIONS AS
OUTLINED ON PAGE 1, REFER TO ANSI STANDARD Z244.1 ENTITLED:
PERSONNEL PROTECTION
LOCKOUT/TAGOUT OF ENERGY SOURCES
MINIMUM SAFETY REQUIREMENTS**

ANSI C37.20.2

6.2.3 INSULATING MATERIALS FOR COVERING BUSES AND CONNECTIONS

The insulating system for power-carrying conductors and connections shall be rated in accordance with Table 1 and shall withstand the tests in 5.2.1. Each conductor shall have an insulating covering that by itself will withstand the maximum rated line-ton-line voltage between the conductor and outside surface of the insulating covering for a period of one minute.

This insulating covering is a requirement and is provided to minimize the possibility of communicating faults and to prevent development of bus faults which would result if foreign objects momentarily contacted bare bus. This insulating covering is usually only a part of the primary insulating system and in such cases the outer surface of this insulating covering will not be at ground potential. It should not be assumed, therefore, that personnel can contact this insulating covering with complete safety.

Where possible, joints shall be completely covered by insulated material at the factory. For interconnecting bus joints which must be made in the field, insulating material shall be supplied for application in accordance with the switchgear manufacturer's instructions.

Insulating materials for buses and connections shall be flame resistant.

These instructions may not cover all details or variations in equipment, nor provide for every possible contingency to be met. Should further information be desired or should specific problems arise which are not covered sufficiently, the matter should be referred to the POWERCON CORPORATION.

**WARNING
IMPORTANT**

IT IS IMPERATIVE THAT YOU READ AND COMPLETELY UNDERSTAND THE WARNING LOCATED TO THE RIGHT OF THIS BLOCK. FAILURE TO DO SO CAN RESULT IN DAMAGE TO PROPERTY, PERSONAL INJURY OR DEATH.

DANGER - HAZARDOUS VOLTAGE

DO NOT REMOVE COVERS, OPEN DOORS, OR WORK ON EQUIPMENT UNLESS POWER HAS BEEN TURNED OFF AND ALL CIRCUITS DE-ENERGIZED AND DISCONNECTED. DISCONNECT, DE-ENERGIZE, LOCK-OUT AND PROPERLY GROUND CIRCUIT(S) BEFORE WORKING ON THIS EQUIPMENT. USE PROPER SAFETY PRECAUTIONS WHEN WORKING ON THIS EQUIPMENT.

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SAFETY

ALL SAFETY CODES, SAFETY STANDARDS AND/OR REGULATIONS AS THEY MAY BE APPLIED TO THIS TYPE OF EQUIPMENT MUST BE STRICTLY ADHERED TO. BEFORE ANY ADJUSTMENTS, SERVICING, PARTS REPLACEMENT OR ANY OTHER ACT IS PERFORMED REQUIRING ANY PHYSICAL CONTACT WITH THE ELECTRICAL COMPONENTS OR WIRING OF THIS EQUIPMENT, THE POWER SUPPLY MUST BE DISCONNECT.

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IN ADDITION TO THE PERSONNEL PRECAUTIONS AS OUTLINED, REFER TO ANSI Z244.1, ENTITLED:

ANSI Z244.1: PERSONNEL PROTECTION LOCKOUT/TAGOUT OF EMERGENCY SOURCES MINIMUM SAFETY REQUIREMENTS.

ANSI/NFPA 70E: ELECTRICAL SAFETY REQUIREMENTS FOR EMPLOYEE WORKPLACES.

ANSI/NFPA 70B: ELECTRICAL EQUIPMENT MAINTENANCE.

BEFORE CHECKING OR MAINTENANCE, AFTER IT HAS BEEN INSTALLED - THE FOLLOWING MUST BE OBSERVED: ONLY QUALIFIED PERSONS MAY OPERATE, INSPECT OR MAINTAIN BUS DUCT. IN ADDITION TO THE PERSONNEL YOU MAY HAVE WHO ARE QUALIFIED, OTHERS MAY BE AVAILABLE FROM AN EXPERIENCED HIGH VOLTAGE CONTRACTOR OR THE UTILITY SERVICING THE INSTALLATION. IT IS THE RESPONSIBILITY OF THE PURCHASER, INSTALLER OR ULTIMATE USER TO INSURE THAT THE WARNING SIGNS ARE NOT REMOVED AND TO MAKE SURE THAT ALL ACCESS COVERS ARE SECURE WHEN THE DUCT IS LEFT UNATTENDED BY QUALIFIED PERSONS, EVEN MOMENTARILY.

**WARNING
IMPORTANT**

THROUGHOUT THIS MANUAL YOU WILL SEE WARNING BLOCKS LIKE THE ONE LOCATED TO THE LEFT. IT IS IMPERATIVE THAT YOU READ AND COMPLETELY UNDERSTAND THE WORDING LOCATED BELOW THESE BLOCKS. FAILURE TO DO SO CAN RESULT IN DAMAGE TO PROPERTY, PERSONAL INJURY OR DEATH.

RECEIVING, HANDLING, AND STORAGE OF EQUIPMENT

RECEIVING

The contents of each package of the shipment are listed in the Packing Details. This list is forwarded with the shipment, packed in one of the cases. The case is especially marked and its number can also be obtained from the Memorandum of Shipment. To avoid the loss of small parts when unpacking, the contents of each case should be carefully checked against the Packing Details before discarding the packing material.

Before leaving the factory all elements are carefully inspected and packed by workmen experienced in the proper handling and packing of electrical equipment. Upon receipt of any apparatus an immediate inspection should be made for any damage sustained while en route. If damage is evident or an indication of rough handling is visible, a claim for damage should be filed at once with the transportation company.

HANDLING

Before uncrating, indoor equipment may be moved by crane with slings under the skids. Speders should be used to keep the cables from rubbing against the equipment. If crane facilities are unavailable, fork lift trucks under the skids may be used.

If it is necessary to store the equipment for any length of time, the following precautions should be taken to prevent breakage, corrosion, damage or deterioration:

1. Uncrate the equipment. Check it thoroughly for damage.
2. Store in a clean, dry place with a moderate temperature (such as 40-100°F) and cover with a suitable cover to prevent deposits of dirt or other foreign substances upon all parts and electrical contact surfaces.
3. If dampness or condensation is encountered in the storage location, (can occur with rapid temperature changes) heaters should be used in the equipment. The suggested arrangement is one 75-watt heat element in each breaker and primary cable compartment. Remove all cartons and other miscellaneous materials packed inside unit before energizing any heaters. If the equipment has been subjected to moisture, it should be carefully dried out using forced warm air and then tested with a 1000 or 2500 volt megger. A reading of at least 200 megohms should be obtained.

Bus Duct

Bus ducts connected between groups of metalclad switchgear and other apparatus should be installed as shown on the arrangement drawings furnished with the ducts. Supports should be provided as indicated on the drawings.

All joints in the bus, including adjustable joints, should be assembled and insulated. Adjustable joints are provided on long runs of the bus duct to allow for variations in building construction, etc. These joints should be loosened before installation of the duct, then tightened after being set in the position required by the fixed points at the ends of the duct.

Outdoor bus ducts must be gasketed top and bottom at the joints between shipping sections. Bolt the two duct sections together, add splice plates, remove bottom access cover from one duct section, bolt top cover in place and fasten roof cap in place over the joint. When covers are removed after installation for inspection the gasket must be examined to insure a tight seal.

Outdoor bus ducts are provided with heaters. Connect these heaters in accordance with the wiring diagrams furnished with the equipment before energizing the bus duct. Check prior to putting on the covers.

Lexan® Sleeving for Use in Bus Insulation

Bus bar insulation extruded from Lexan® resin in the form of tubing is a high temperature thermoplastic material having excellent dielectric and mechanical properties. As with all materials, effects of the environment in the application and cleaning should be considered.

Among other considerations to be given, is the effect of cleaning materials or such items as taping joints and covering the tape with certain varnishes that spill onto the lexan.

Some materials dissolve Lexan® such as methylene chloride, ethylene chloride and tetrachloroethane. The use of these materials are generally not applied to lexan and basically when applied in very light applications will evaporate easily and have no basic effect on the lexan itself.

However, other materials such as gasoline, acetone, ketones, esters, carbon tetrachloride and aromatic hydrocarbons will have a deleterious effect on lexan causing it to either crystallize or craze, with carbon tetrachloride being the most damaging compound.

If cleaning is required, only the aliphatic carbons or alcohols should be used as they will have a minimal effect on the lexan. Grease may be washed off with materials such as Freon TF, isopropyl alcohol, petroleum ether and V M & P naphtha. Ordinary soap and water is the best cleaner for lexan.

MAINTENANCE

INSTALLATION & MAINTENANCE

For heaters as supplied in the duct either external or internal sources of power must be supplied. With either source care must be taken to make sure of energizing the equipment being subjected to moisture. In all cases, the supply must be adequate to feed the entire heater load.



CAUTION

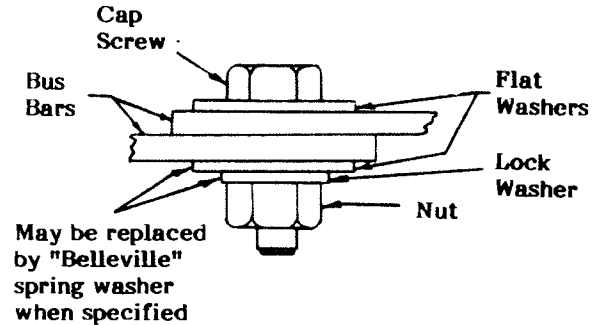
SUPPLY EXTERNAL SOURCES OF CONTROL POWER TO THE SWITCHGEAR MAY CAUSE BACKFEED TO THE HIGH VOLTAGE BUS THROUGH CONTROL POWER OR POTENTIAL TRANSFORMERS. CARE MUST BE TAKEN BY DISCONNECTING THE BACKFEED TRANSFORMERS AND SAFELY GROUNDING THE PRIMARIES BEFORE ENERGIZING THE AUXILIARY POWER.

Connections

The main bus bars and other connection bars may be either copper or aluminum. In either case, the connection surfaces will be silver surface or equivalent. All field assembled joints in primary conductors, regardless of material or method of insulation, should be made as described below.

The main bus is necessarily disconnected before shipping. The main bus should be reconnected with particular attention to the cleanliness of and pressure between the contact surfaces. It is essential that the connections be securely bolted because the conductivity of the joints is dependent on the applied pressure. Refer to manufacturer's instructions and any other special instructions. (Reference Table 1).

1. Wipe silver clean. Do not use sandpaper or any abrasive on the silvered surface. Avoid handling of cleaned surface as much as possible.



(Belleville Washers for Flex Connections)

Figure 1.

Bolt Material	Torque in Foot-Pounds For Bolt Size				
	1/4-20	5/16-18	3/8-16	1/2-13	5/8-11
Steel	5	12	20	50	95
Silicon Bronze	5	10	15	40	55

2. Join the clean contact surfaces by using the hardware provided, torque values listed above.
3. In some cases external connections are made to metalclad bus by bars. The metalclad bars are normally silver plated. Unplated bars, either copper or aluminum, should not be used to connect to silver plated bars.

Main Bus Assembly

For 4.16 kV, 7.2 kV, 13.8 kV, and 34.5 kV equipment:

1. Remove bus duct bottom access covers.
2. Bolt splice plates and bus bars together, following assembly instructions as given under "Connections".

Insulated Bus Systems

All field assembled primary joints and terminations must be insulated for the operating voltage. The method of insulating joints is boots.

Horizontal Mounting

For **overhead** support, ½” drop rods are recommended. Maximum 10-foot spacing. Drop rods and other hardware must be furnished by installer.

Maintain good alignment of the drop rods along the busway run.

Avoid hanging drop rods at busway joints.

After the busway is secured in the hangers, adjust the hangers on the rods for correct elevation.

Sway braces (furnished by the installer) may be required to keep the run straight or to prevent rotation.

Vertical Mounting

Support busway on maximum 16 ft. centers.

Before any installation work is done, consult and study drawings furnished by Powercon. These drawings include arrangement drawings, wiring and elementary diagrams and a summary of material.

Frequently, additional shipping members are installed in the bus and primary area to insure against shipping damage and alignment. It is imperative that all shipping members are removed, joints are properly tightened and insulated before energizing bus.

Obstructions

When a busway run must pass through a wall or floor, an opening one inch larger than the busway cross-section should be provided. Joints may not occur inside walls or floors per the N.E.C. A flange is available to mask the opening after the busway is installed. This must be ordered separately.

MAINTENANCE



DE-ENERGIZE THE BUSWAY BEFORE PERFORMING ANY OF THE FOLLOWING:

Carefully inspect all visible electrical joints and terminations for tightness of bolts, nuts, etc.

Check for signs of overheating at joints, terminations, fuse clips, etc. Or deterioration in insulating material or melting of sealing compound.

Be sure the condition that caused any overheating has been eliminated.

Check for missing or broken parts, rusting or corrosion, dirt, excessive wear, arc spatter, sooty deposits, tracking. Clean or replace parts as required.

Megger the system before re-energizing.

Installation
Quality Control Verification Checklist

Powercon Corporation S.O. _____

Customer Identification Number _____

Run Identification _____

Amp Rating _____

Voltage Rating _____

Refer to IB PCIB-1012

1. **Shipping damage?**
Note any minor damage and report major damage or missing parts to factory.
Be sure to include item number. _____

No	
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2. **Proper storage prior to actual installation.**
 - a. Were bus components kept clean and dry?

Yes	
-----	--
 - b. Were bus components exposed to corrosive fumes, liquids, salts or concrete materials?

No	
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3. **Have you read and understood the instructions?**

Yes	
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4. **Bus Environment during installation.**
 - a. Were bus components kept clean and dry?

Yes	
-----	--
 - b. Were bus components exposed to corrosive fumes, liquids, salts or concrete materials?

No	
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 - c. Any mechanical damage due to handling?

No	
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5. **Did each piece of bus get a pre-installation megger test?**
(Individual pieces should megger infinite. Consult factory if you experience lower reading.)

Yes	
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6. **Mounting and support**
Is each 10 feet of horizontal bus run supported (16 feet for any vertical) (Closer supporting may be required based on job specification.)

Yes	
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Does any support interfere with bus joints?

No	
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Are any bus terminations to other equipment used as support?

No	
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7. **Is bus installed level and plumb?**

Yes	
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- 8. Was a periodic megger test done as this run was installed?
(After every 2 or 3 items or as critical items are installed) (Joints should be tightened for all megger, testing) Yes
- 9. Has the bus been inspected for proper phasing? Yes
- 10. Are all joint bolts properly tightened as described in PCIB-1012? Yes
- 11. Did you check for proper clearances for bus at floors, walls, ceiling, other bus or trades?
(Never use cement materials to seal between the bus and floors or walls.) Yes
- 12. Was all foreign material removed from installed bus? Yes
- 13. When all bus is in place perform final megger test. (Record readings.) Yes
- 14. Was all insulation, including joint insulation clean and dry prior to installing covers? Yes
- 15. Was all bus support insulators properly seated and wedged to bus? Yes
- 16. Are all vent and or weep holes free from obstruction? Yes
- 17. Has Lexan bus insulation been cleaned only with soap and water or Isopropyl alcohol? No other material was used. Yes

Note: Please list any exceptions made to this checklist and any other comments related to the installation of this run of bus.

(Please review Busway Maintenance Procedures provided with your busway installation instructions)

This checklist is intended to provide you (the installer) and the end user with a means of helping to ensure a sound installation of Powercon Corporation Busway. However, it is not intended to cover all items related to the installation, successful startup and long term use of the product and in no way relieves the contractor of his obligation to meet all specification and code requirements.

Installation Contractor

Signed _____

Date _____