



THE CALVERT COMPANY



ISO 9001 Certified



Non-Segregated and Segregated Phase Bus Systems

Metal Enclosed Bus (Reference ANSI/IEEE C37.23 - 1987)

The ANSI Standard defines metal enclosed bus as an assembly of conductors with associated connections, joints and insulating support within a grounded metal enclosure. In general, three types of construction are used; non-segregated phase, segregated phase, and isolated phase.

Definitions

- (1) Non-segregated phase bus. All conductors are in a common metal enclosure without barriers between the phases. (Figure 1)



Figure 1 - Non-Segregated Phase Bus Cross Section

- (2) Segregated phase bus. All conductors are in a common metal enclosure and the phases are segregated by metal barriers. (Figure 2)

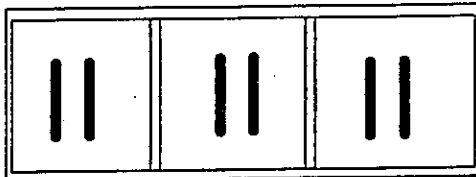


Figure 2 - Segregated Phase Bus Cross Section

- (3) Isolated phase bus (Refer to Calvert Catalog IPB). Each phase conductor is enclosed by an individual metal housing separated from adjacent conductor housings by an air space. (Figure 3)

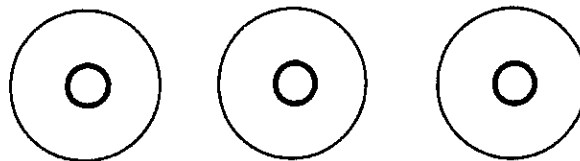


Figure 3 - Isolated Phase Bus Cross Section

Calvert Metal Enclosed Bus Product Line

(1) Conductor Mounting

The bus bar shape and mounting configuration depends upon the bus continuous current rating. The Figures 4, 5, and 6 show the Calvert standard designs for various continuous ampere ratings.

Current Rating: 1200,
1600,

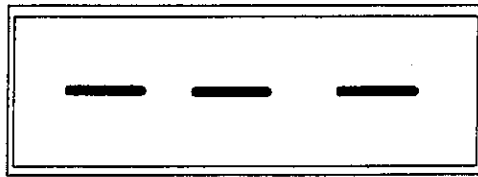


Figure 4

NOTES: Copper or aluminum conductor mounted horizontally. Limited current ratings due to heat dissipation.

Current Rating: 1200,
1600, 2000, 2500,
3000, 3500, 4000,
4500, 5000, 6000,

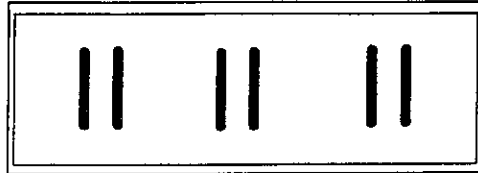


Figure 5

NOTES: Copper or aluminum conductor mounted vertically. Vertical mounted bars increase heat dissipation which allows higher continuous ratings.

Current Rating:
5000, 6000, 7000,
8000, 10000A

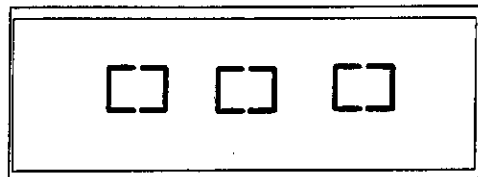


Figure 6

NOTES: Aluminum channel with a 10 to 14 inch square cross section is used to dissipate heat and reduce costs.

2) Enclosure Design

The metal enclosure is designed to meet various NEMA and IEC definitions. The two basic configurations are indoor ventilated and outdoor non-ventilated. Both indoor and outdoor are fabricated from aluminum.

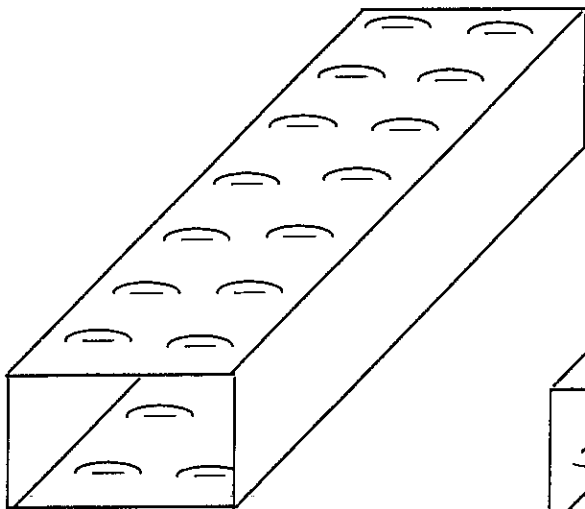


Figure 7 - Ventilating Top and Bottom Covers for Indoor Application

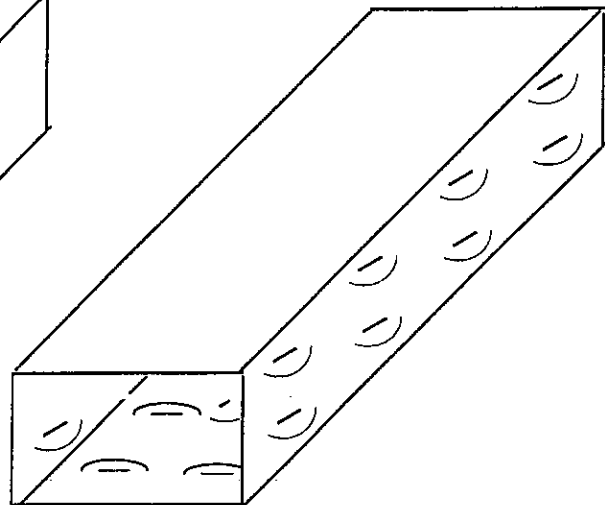
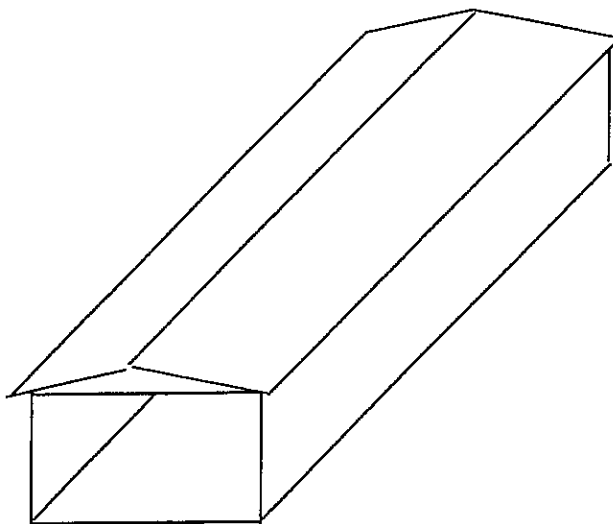


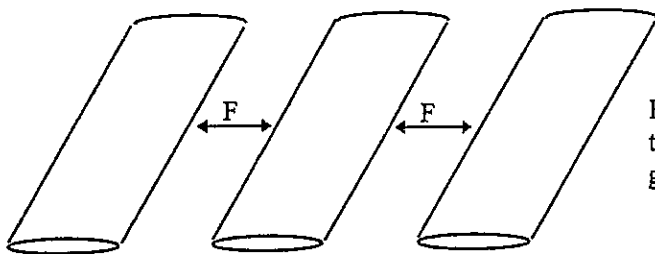
Figure 8 - Ventilating Side Sheets and Ventilating Bottom Cover for Indoor Drip Proof Design



**Figure 9 - Non-Ventilated Enclosure
with a Peaked Top Cover for
Outdoor Application**

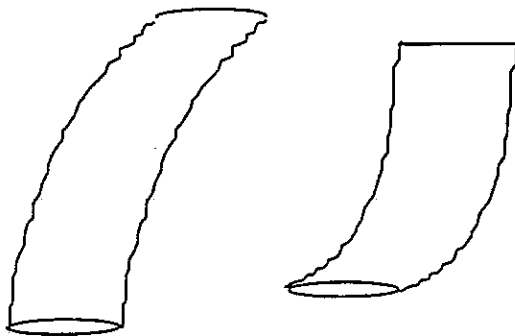
(3) Short Circuit Strength Bus Design Considerations

Calvert Designed bus is supplied to meet all short circuit requirements. Using a combination of the number of conductors per phase, conductor mounting (vertical or horizontal) orientation and location of bus insulators/supports, Calvert can customize the bus to meet the requirement without affecting the overall price.



Horizontally mounted bars offer the most resistance to forces generated by short circuits.

Figure 10 - Normal Conditions



Horizontally mounted bars require bars to be stacked to meet the continuous current requirements. Multiple bars drastically affect the heat dissipation capability.

**Figure 11 - Deflection Caused
by Short Circuits**

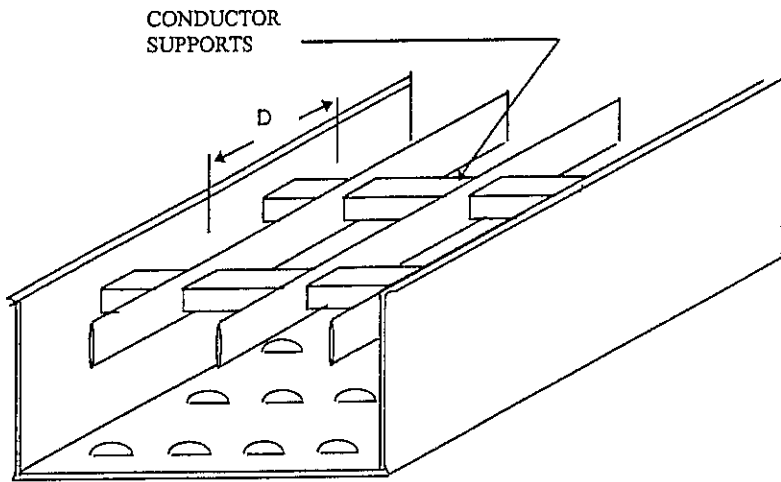


Figure 12

Vertically mounted bars provide the most effective heat dissipation, hence a high current rating. However, this configuration is the weakest for short circuit requirements.

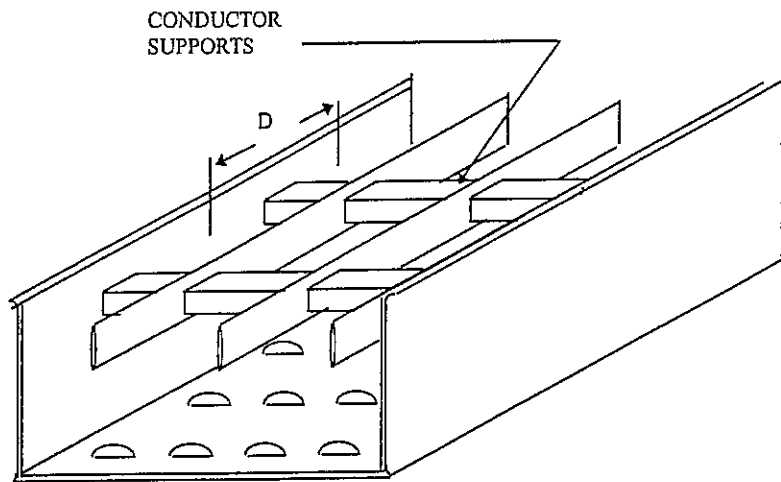


Figure 13

The distance between the conductor supports (D) is easily changed to accommodate short circuit requirements.

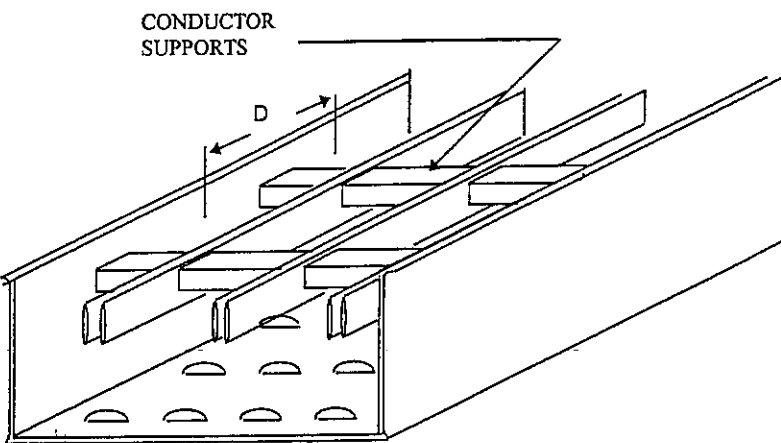


Figure 14

Another solution is to add more bars in the same phase to increase rigidity, as well as decrease the distance between supports.

(4) Bus Layout Accessories
a) Straight Sections

Bus sections are fabricated in 12-foot sections. During the actual bus layout design, Calvert Engineers will determine the optimum length for each section to insure existing equipment location does not interfere with field assembled joints.

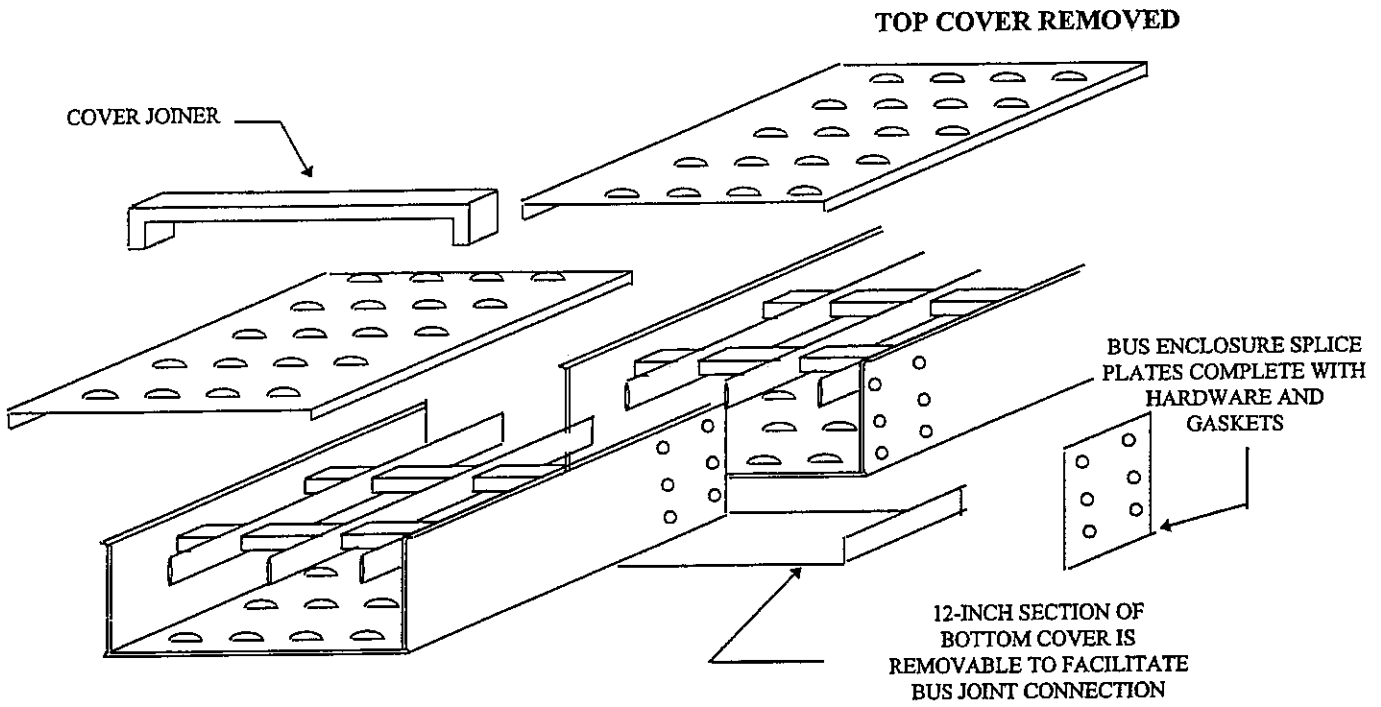


Figure 15

Bus splice plates, hardware, and PVC (plastisol) insulation boots are supplied in kit form to complete the joint connection.

b) Elbows

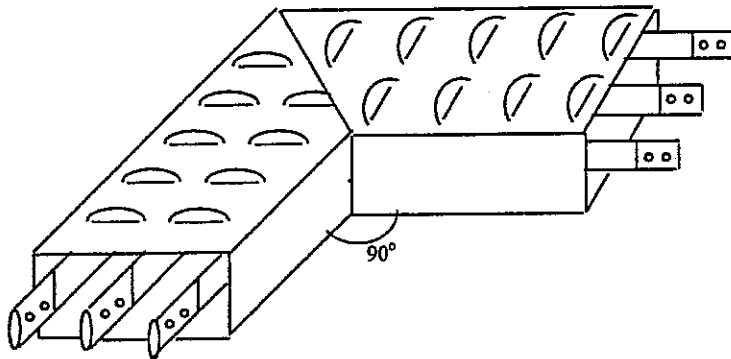


Figure 16 - Horizontal Elbow

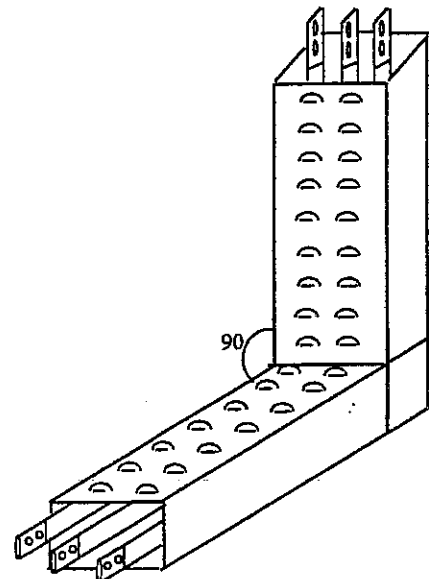
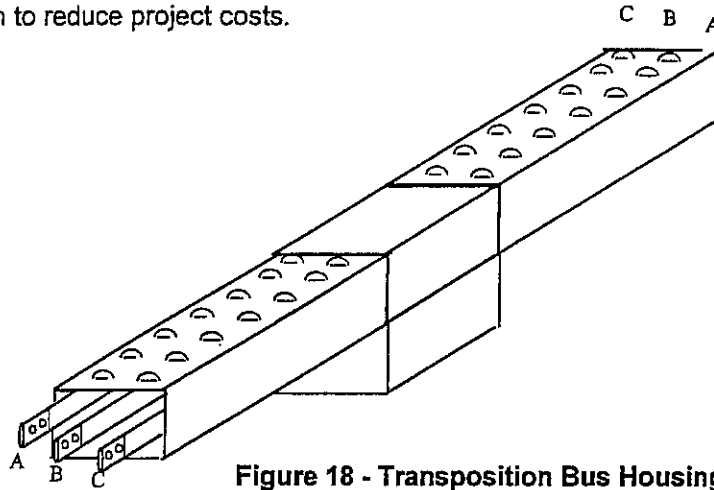


Figure 17 - Vertical Elbow

c) Phase Transposition

Depending upon the layout required, transpositions can be built into elbows and transition section to reduce project costs.



The transposition bus housing is the same height as the straight bus section/

Figure 18 - Transposition Bus Housing

d) Tee-Tap

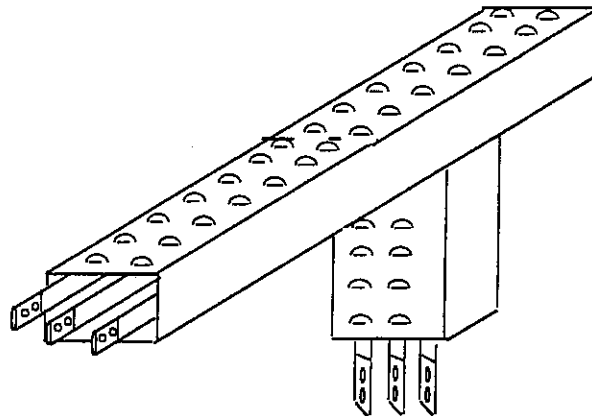


Figure 19 - Tee Tap

e) Transformer Compartment

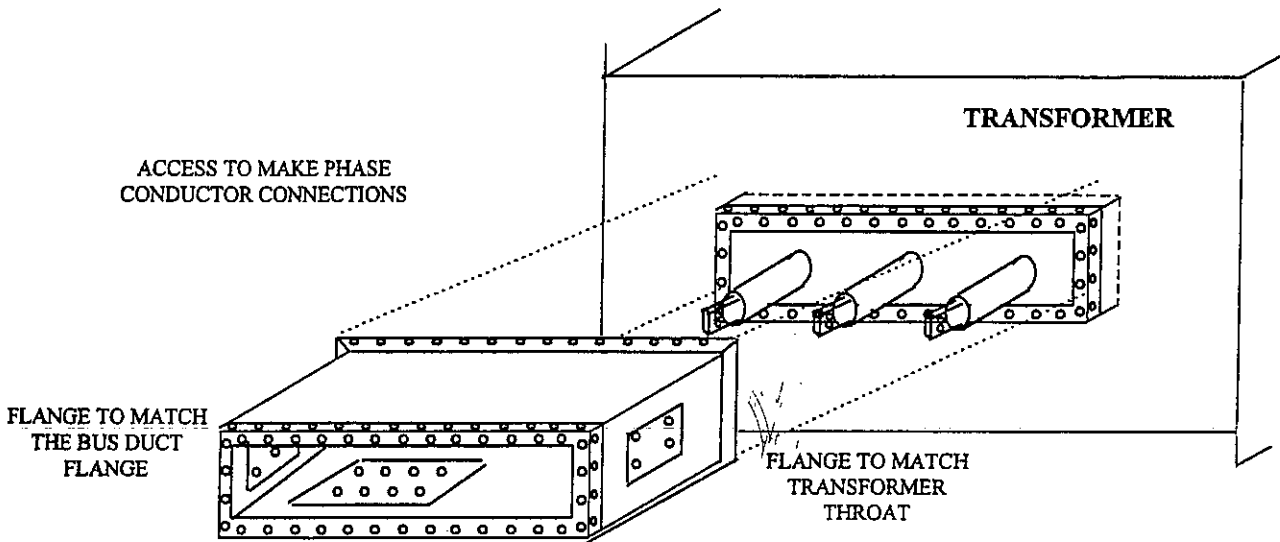


Figure 20 - Transformer Compartment

f) Switchgear Compartment

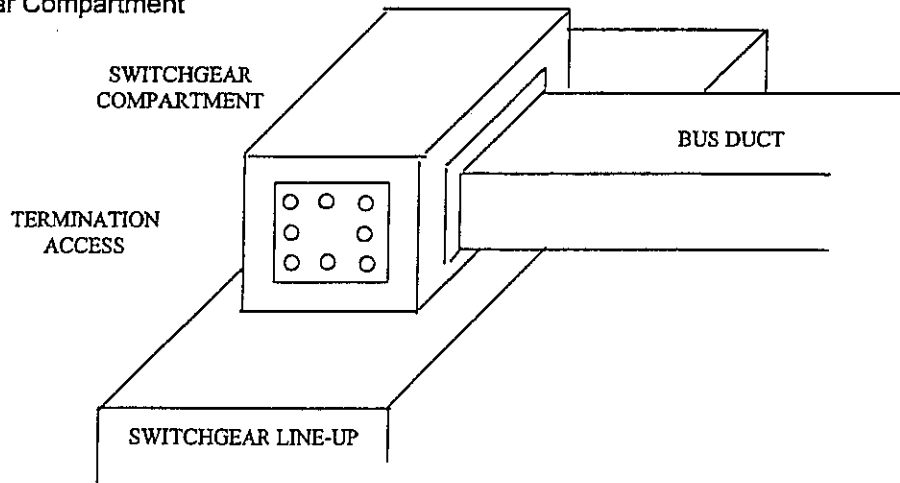


Figure 21 - Switchgear Compartment

g) Ground Bus

The bar bus enclosure will carry ground fault current. The conductivity of the bus enclosure is approximately 50% of copper bar. A 2 x 1/4 inch copper ground bus is available for installation on the outside of the bus enclosure.

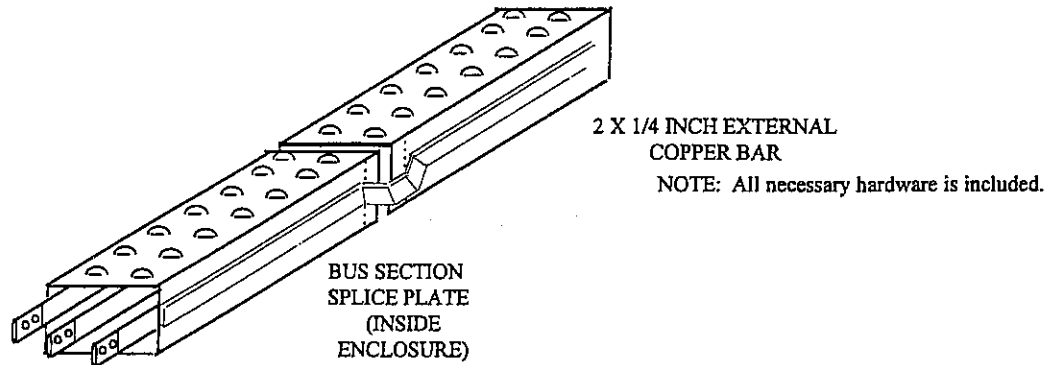


Figure 22 - Ground Bus

h) Bus Conductor Splice Insulating Boots

PVC Insulating boots are provided for conductor joints.

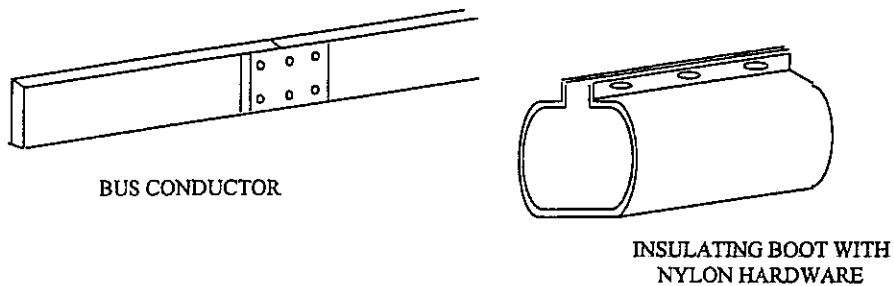


Figure 23 - Insulating Boots

Custom designed boots are provided for bus bar connection to switchgear, transformers and generators. A mold is fabricated to match the actual terminations and bus configuration for each project. The mold is used to form the PVC boots. This process insures a quality fit for each termination.

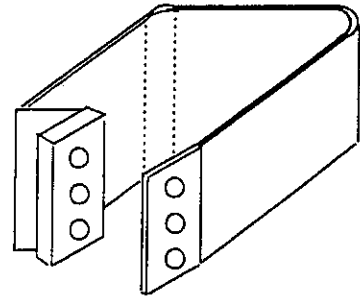


Figure 24

i) Expansion Joints and Earthquake Joints

Many bus duct installations require expansion joints to accommodate minor deviations in actual customer equipment locations. An expansion joint in between the bus and the connected equipment will solve this deviation. Expansion joints also serve as an earthquake proof joint.

The expansion joint consists of a neoprene/nylon bellows that is mounted on the bus. The x, y, z expansion distances vary according to the application, 1 to 3 inches.

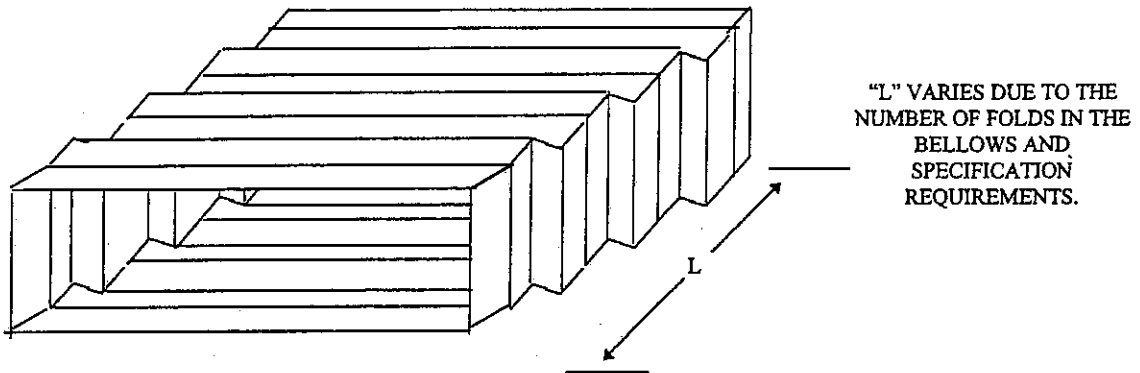


Figure 25 - Expansion Joint

When a bellows is applied, the bus bar joint is accomplished using flexible connectors.

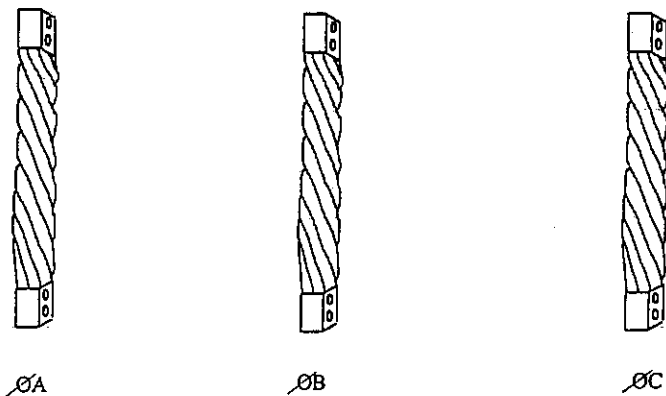


Figure 26 - Flexible Connectors

j) Seal Plates and Fire Stops

Seal plates are fabricated from fiberglass sheet. They are cut to fit the cross section of the bus. When properly installed and sealed the seal plate will prevent transfer of gasses, contaminated air, etc. from one part of a plant to another. To make a firestop from a seal plate, sylgard compound is added to the surface of the seal plate. Sylgard compound will improve the burn-through time up to 3 hours, depending on the quantity used.

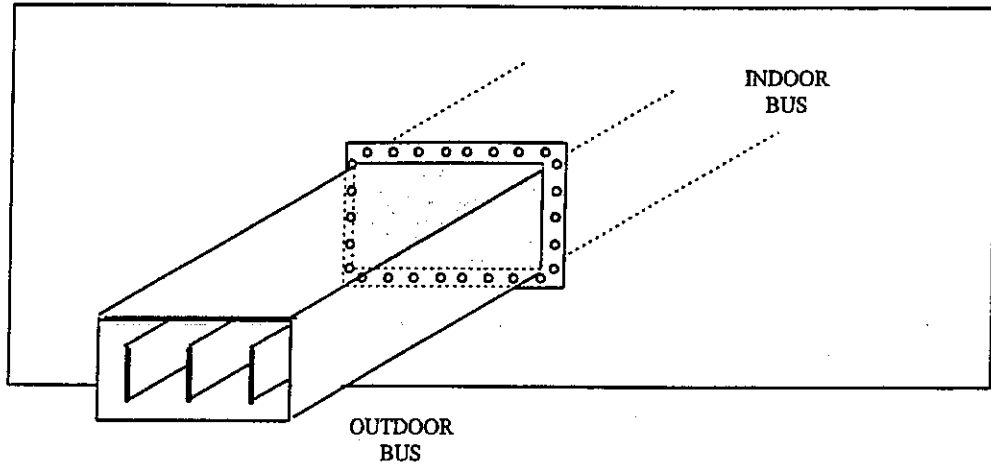


Figure 27 - Seal Plate/Firestop

k) Heater Assembly

Calvert can supply bus duct heaters to prevent condensation from forming on the inside of the bus sections. 240 volt, 500 watt and 480 volt, 500 watt heaters are available.

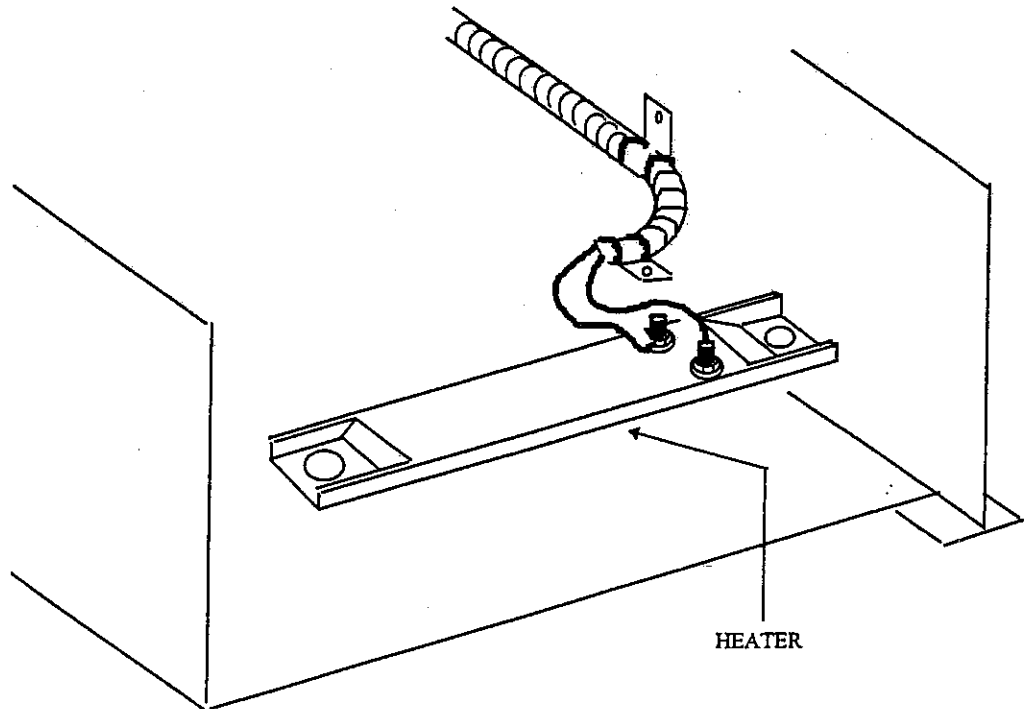


Figure 28 - Heater Assembly

I) Supports for Bar Bus Duct

Calvert has designed and supplied hundreds of bar bus duct supports to suit individual requirements. The following description of various supports is shown for design conceptual ideas. It is the intent of Calvert to provide a complete bus system, so only the basic supports are shown.

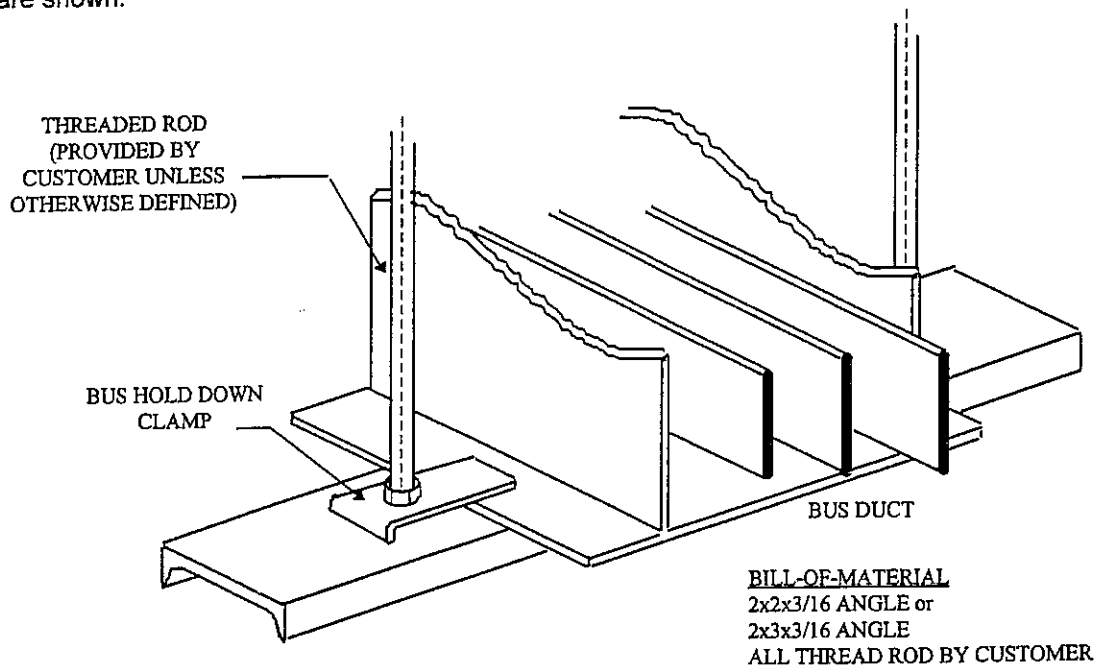


Figure 29 - Trapeze Support for Overhead Installation

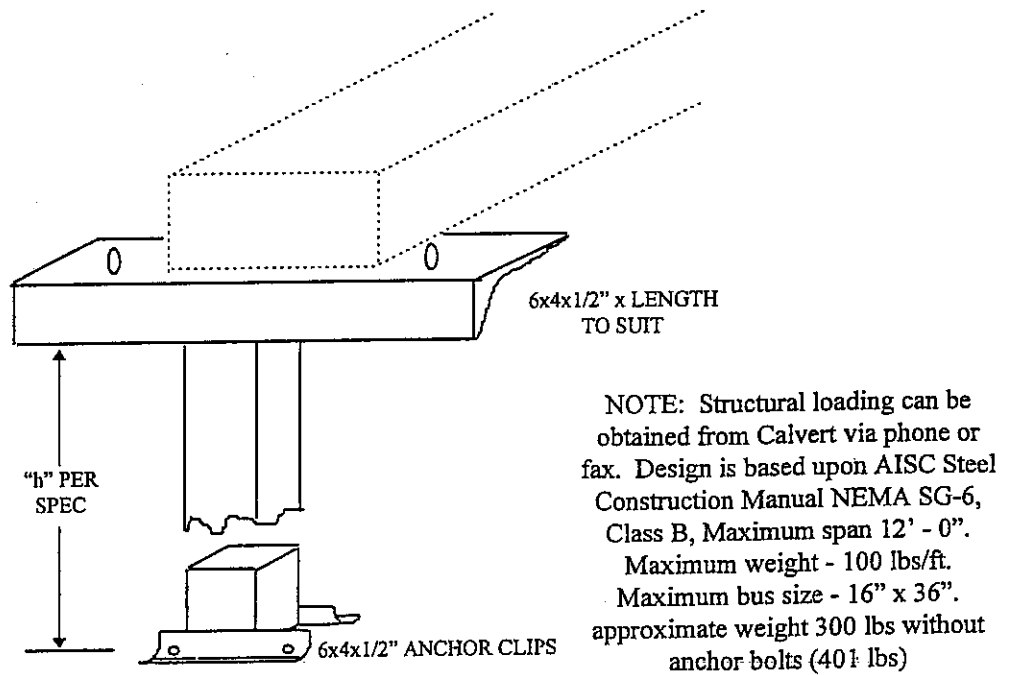


Figure 30 - Single Column Support for Overhead Installation

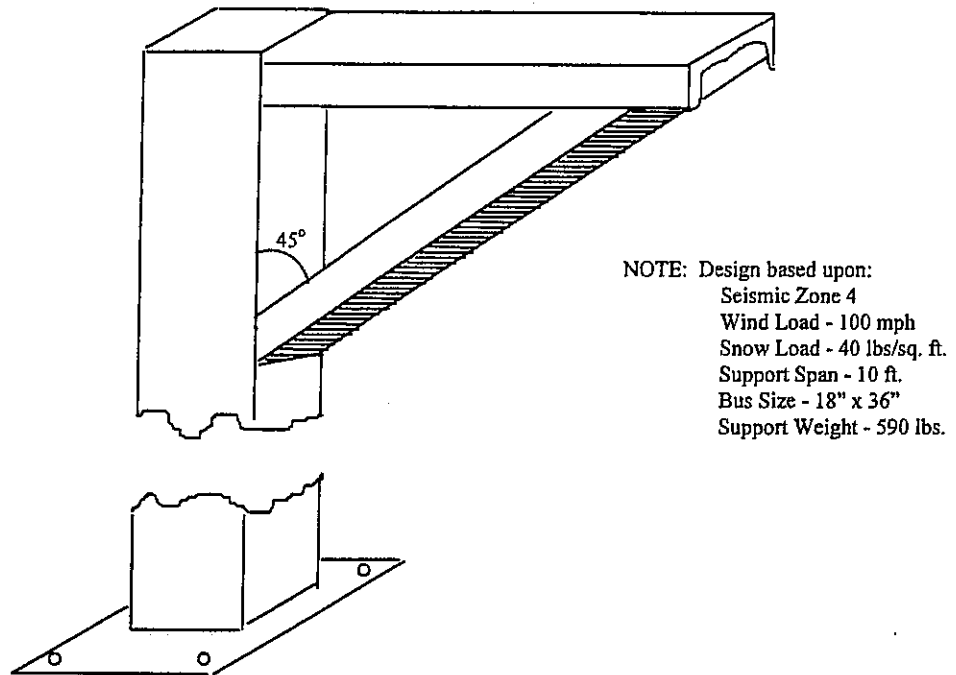


Figure 31 - Single Column Support with Offset for Overhead Installation

m) Omni Block Assembly Cross Section

Omni blocks are used for all conductor bar sizes. The omni blocks are cut on the horizontal plane. Omni blocks have a plug that controls the phase-to-phase distance (3") and phase-to-ground (4"). The omni blocks are clamped in a channel that is bolted/welded in the bus enclosure.

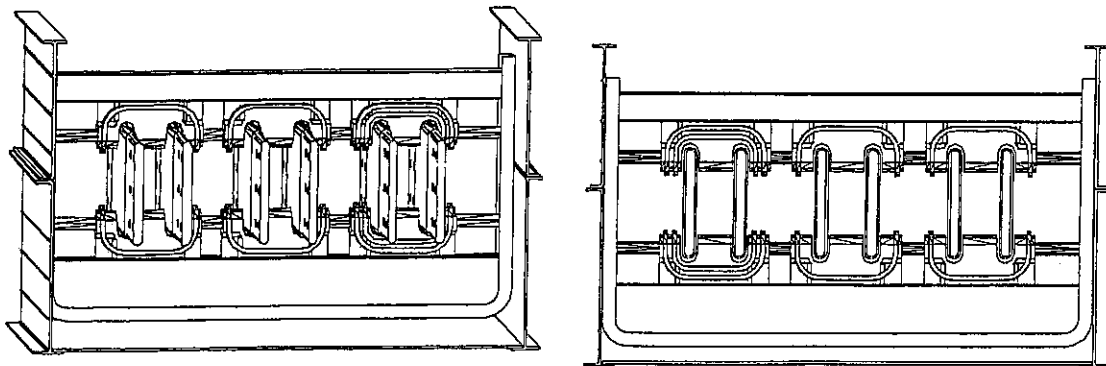


Figure 32 - Omni Block Assembly Cross Sections

n) Typical Omni Block Dimensions

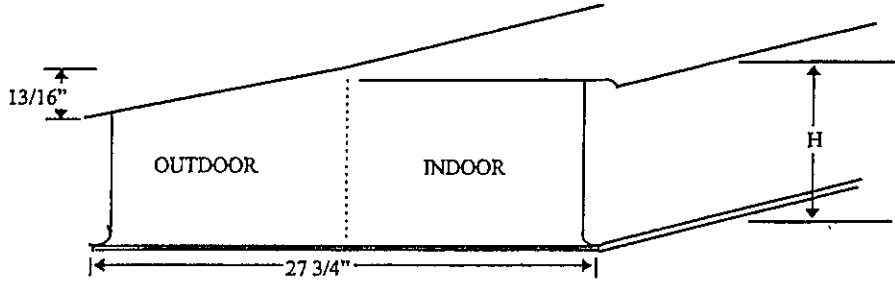


Figure 33 - Omni Block Dimensions

Table 1

Ampere	Conductor Size & Quantity (inches)	H indoor (inches)	Distance Between Supports (inches)	Weight per Foot (pounds/ft.)
1200	1-3/8x4	16	48	45
1600	1-1/2x4	16	48	50
2000	1-3/8x6	18	48	54
2500	2-3/8x4	16	48	63
3000	2-3/8x6	18	48	54
3500	2-1/2x6	18	48	65
4000	2-1/2x8	20	48	125
4500	2-1/2x8	20	48	125
5000	2-1/2x10	22	48	145
5500	2-1/2x10	22	48	145
6000	2-1/2x12	22	48	169

o) Typical Dimensions - Horizontal Mounted Bus Bar

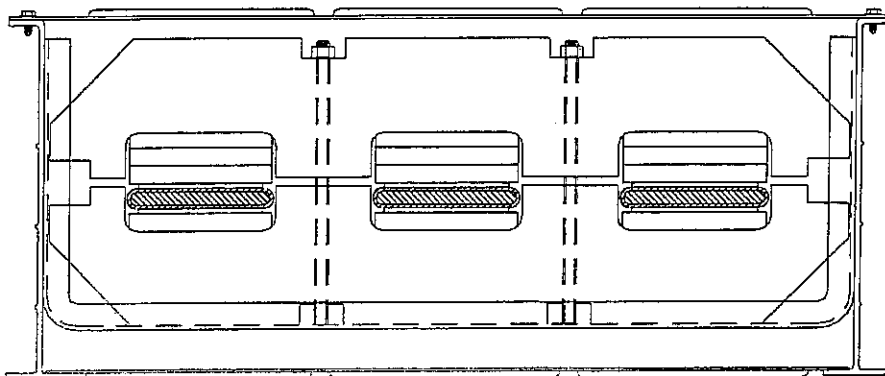


Figure 34 - Horizontal Mounted Bus Bar

Table 2

Ampere	Conductor Size & Quantity (inches)	H indoor (inches)	Weight per Foot (pounds/ft.)
1200	1-3/8x4	10	31
1600	1-5/8x4	10	46
2000	2-3/8x6	10	52

For applications above 2000 ampere, refer to omni block configuration.

p) Porcelain Insulated Non-Segregated Bus

Porcelain insulated non-segregated bus is available for continuous current ratings above 6000 ampere and 25kV voltage ratings. Note from the cross section drawing, the overall size and weight. Depending upon the ampere rating and voltage requirements, the user may want to compare prices and layout dimensions to an installation using isolated phase bus (refer to Calvert Catalog IPB).

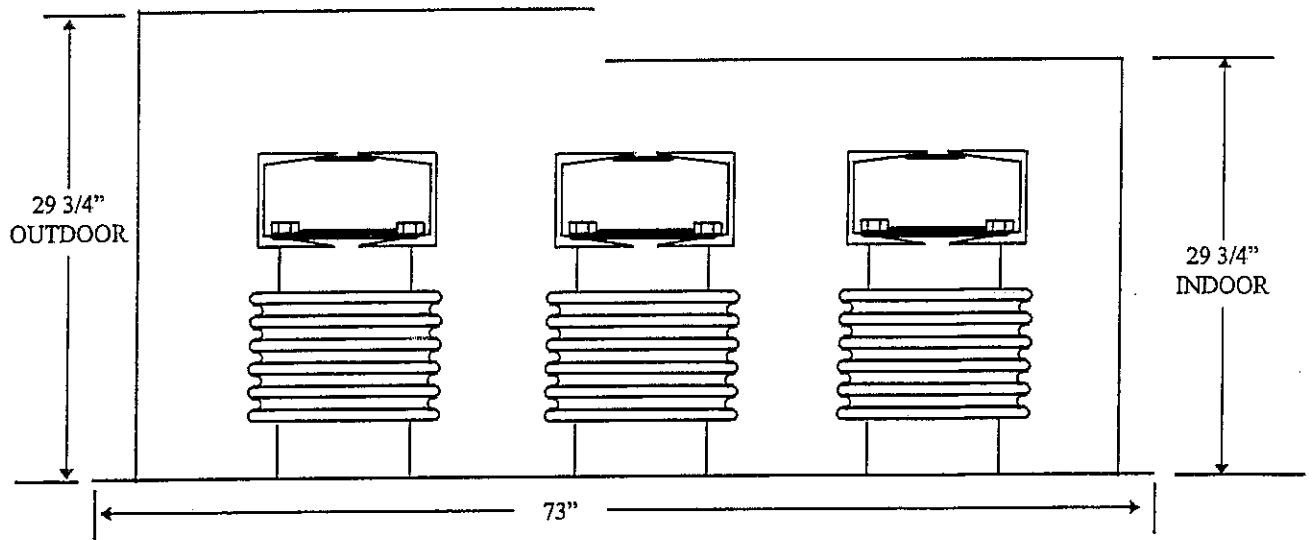


Figure 33 - Porcelain Insulated Non-Segregated Bus