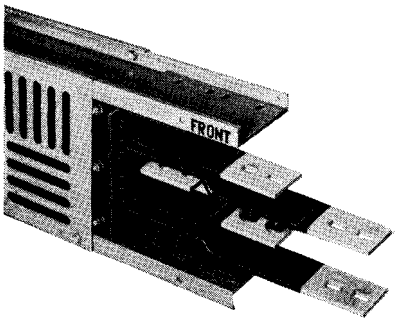
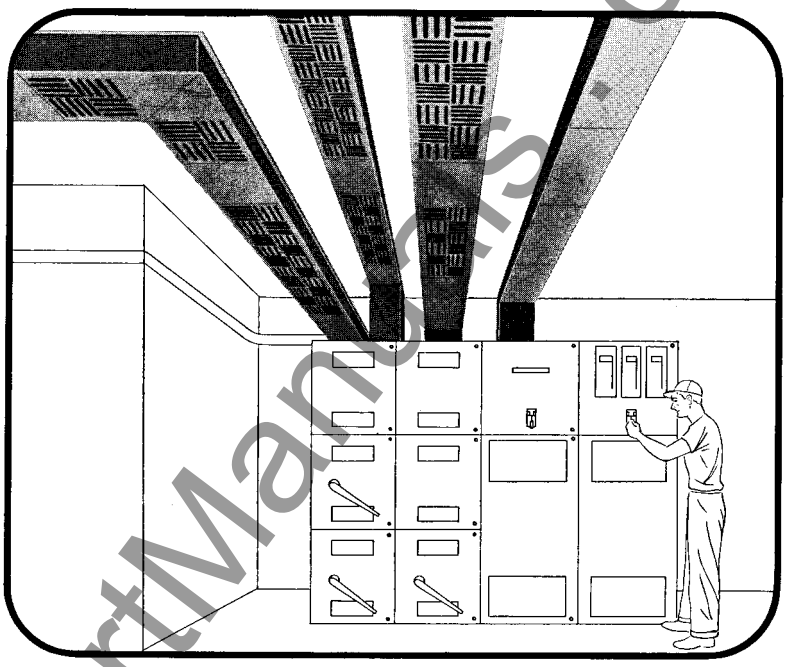
low impedance bus duct





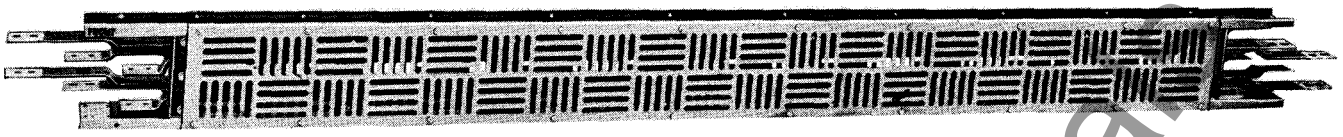
in this section:

March, 1965
supersedes application data 30-662 dated April, 1961
mailed to: E/250/AD,DB; D/808/AD.DB; C/315/AD

AIA File No. 31-C-621

general information

10 foot section of low impedance bus duct with ventilated housing



application

Low impedance bus duct is ordinarily used to conduct large amounts of power over long distances with a minimum voltage drop. It consists of insulated copper or aluminum bars, closely spaced, supported by clamp type supports. These are enclosed in a 16-gauge steel housing, utilizing the 4-channel interlocking type construction.

Low impedance duct is available in two different enclosures: 1. indoor ventilated, 2. outdoor ventilated.

For most applications a totally enclosed housing is not necessary since the bus bars are fully insulated (except for a short space at the splice between sections where uninsulated portions are staggered). Therefore, ventilated bus duct is usually specified.

The two types of ventilated bus duct, indoor and outdoor, are identical in appearance. However, outdoor ventilated bus duct has a galvaneal sheet steel housing that is both bonderized and painted. It also has special hardware and ventilated access covers.

construction

All hardware used in assembling low impedance duct is zinc-chromate plated. Special fasteners are used to join sections of duct. These fasteners are inserted into drawn, threaded holes in the housing, providing a rigid mechanical connection between all sections of the system.

Bus bars of outdoor and indoor bus duct are insulated their entire length with a polyvinyl chloride plastic tubing except for the ends which are silver-plated for good contact at lap joints. Instead of drilling the bus bars to make connections, steel inserts are forced under high pressure into one end and slotted holes are used in the other. These steel inserts have large collars on the side of the bar away from the lap. This, together with a large washer on the bolt, assures a very low-resistance splice when the bolt is drawn up tight. Joints are staggered so that there is always insulation on the bus bars adjacent to the splice, and are made with heat-treated steel bolts having a tensile strength of 100,000 lbs. per square inch.

Bus bars of all ratings using two bars per-phase are insulated and firmly supported on 3/4-inch centers by molded supports spaced at 17-inch intervals. Three 5/16-inch steel bolts hold the supports and bus bars firmly in place. Bus bars of ratings using four bars per phase are supported on 3/4-inch centers by molded supports spaced at 20 13/32-inch intervals. For reduced reactance, bars of opposite polarity are interlaced to provide a repeating phase sequence. Straight lengths can be varied between 21 1/4-inch minimum to 120-inch maximum.

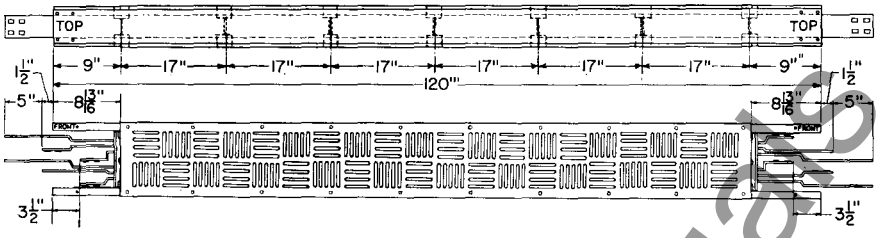
standards

Westinghouse low-impedance bus duct is manufactured to withstand short circuit stresses in accordance with NEMA short circuit ratings for busways. These ratings are listed on page 9, a.d. 30-560.

All ratings have the Underwriters Laboratories Inc. listing unless noted otherwise.

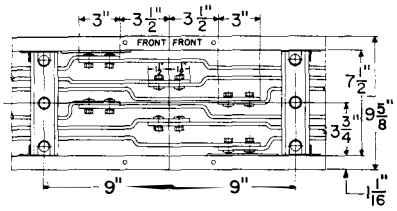
straight lengths

10 foot section top and front views

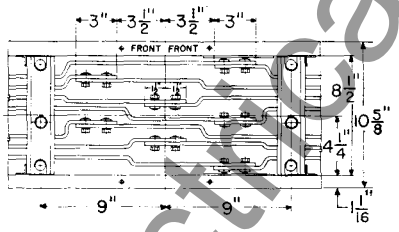


800 amp. to 3000 amp.—copper
600 amp. to 3000 amp.—aluminum

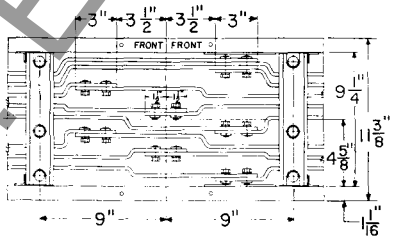
3 phase/3-wire joint



3 phase/4-wire ½ neutral joint



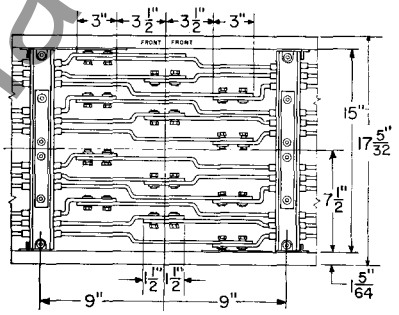
3 phase/4-wire/full size neutral joint



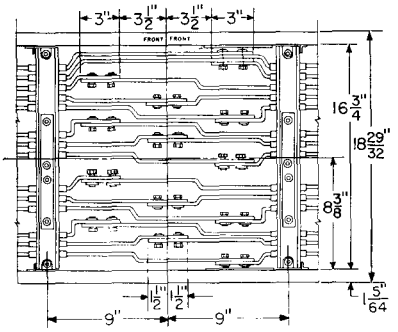
note: for cross section dimensions see page 21.

4000 amp. to 5000 amp.—copper
4000 amp. to 5000 amp.—aluminum

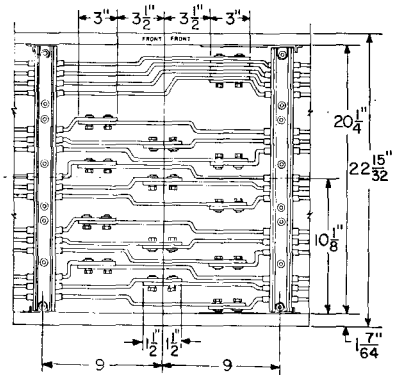
3 phase/3-wire joint



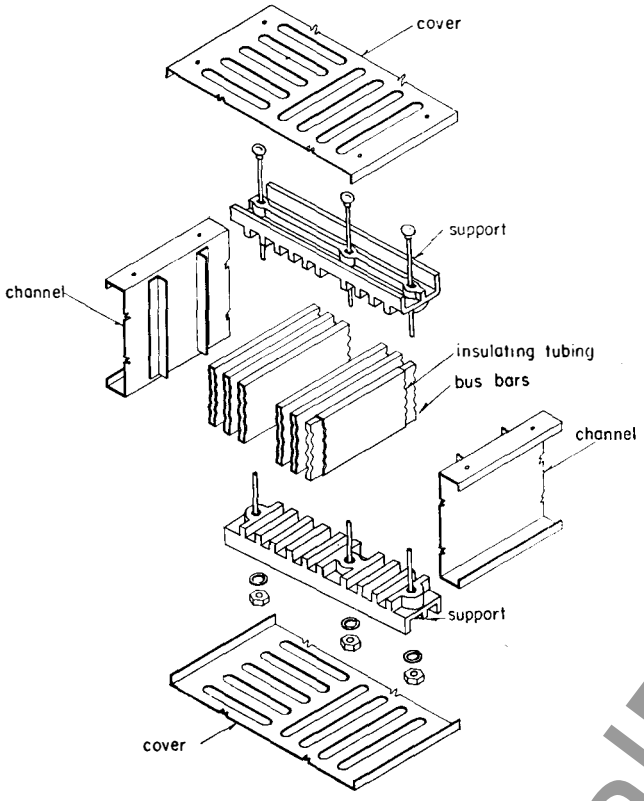
3 phase/4-wire ½ neutral joint



3 phase/4-wire/full size neutral joint



construction details



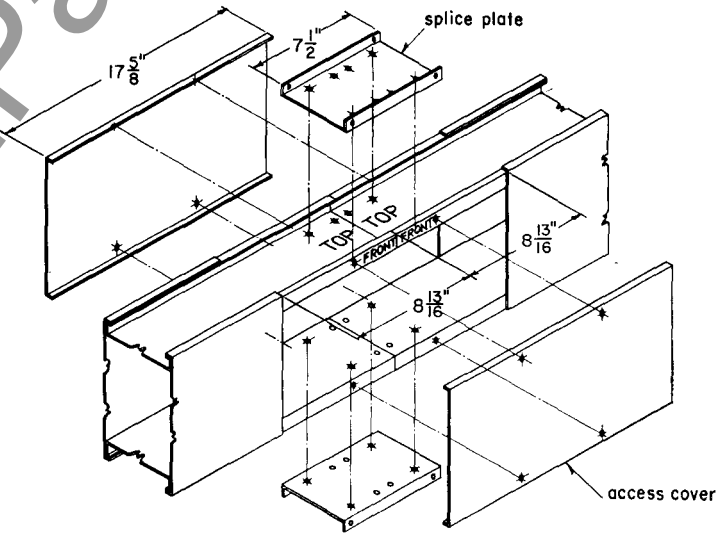
duct joint

For ease of inspection of bus bar joints and to facilitate installation, access openings to bolted joints are provided on two opposite sides of the duct. This affords ample room for bolting of bus bars. After they are bolted, an access cover 17⅝ inches wide for ventilated indoor and outdoor covers this opening.

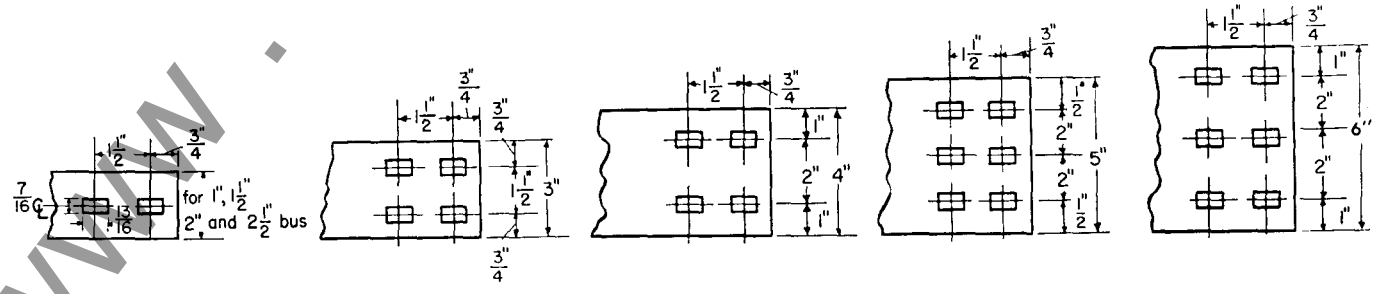
Bus bars are provided with threaded steel inserts at one end and slotted holes at the other for ease in making splices. Offsets near the end of each bar permit the making of neat lap slices.

Heavy 14-gauge steel splice plates telescope inside the top and bottom channels. They are attached by sems fasteners, insuring a strong mechanical connection between housings of adjoining sections.

duct joint details



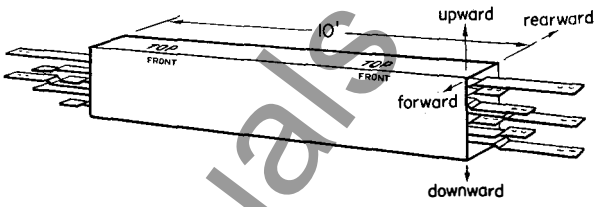
bus slots for bolting bus bars together



fittings

There are ten basic fittings to meet every application need. These include: flange ends, elbows, tees, offsets, crossovers, reducers, adapter cubicles, expansion sections, cable tap boxes, and end closers. They, along with standard and minimum dimensions, are described on the following pages. When making field measurements and layouts, it should be remembered that dimensions of fittings such as elbows, tees, offsets, and crossovers are given from the centerline of the duct.

key to relationship of fittings to straight lengths.

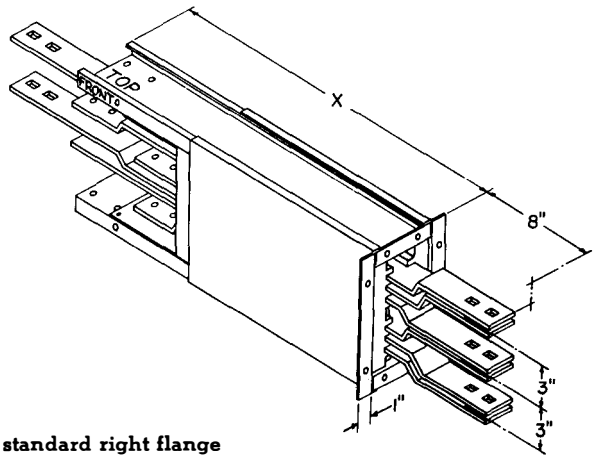


flange sections

Flanges join bus duct housing to the switchgear or other apparatus and include standardized bus extensions for electrical connection.

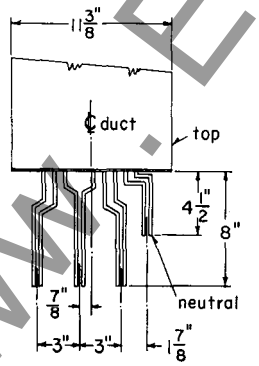
When bus duct extends out of switchgear the opening and flange drillings must be provided by the switchgear builder. In which case, the cutout dimensions and drilling plan must be followed. For proper coordination between bus duct and switchgear, detailed drawings must accompany the order.

Standard bus extensions are eight inches long. Like phase bars are collected in the housing before extending through the flange. Flange and bus extension sections are fabricated for either right or left connection to the duct system. Viewing the "FRONT" of the duct system with the "TOP" marking up, the right flange section joins to the right and the left joins to the left end of the system. **Example:** 2 bar per phase.

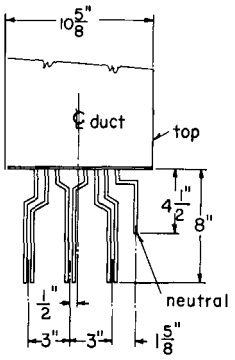


standard right flange

3∅/4W/FN



3∅/4W/½N



copper	aluminum	bus bar size	minimum "X" dimension	maximum "X" dimension	standard length
800	600	2-¼" x 1"	16½	54	24
1000	800	2-¼" x 1½"	17	54	24
1350	1000	2-¼" x 2"	17½	54	24
1600	*1350	2-¼" x 2½"	18	54	24
*2000	*1600	2-¼" x 3"	18½	54	24
*2500	*2000	2-¼" x 4"	19½	54	24
*3000	*2500	2-¼" x 5"	20½	54	24
	*3000	2-¼" x 6"	21½	54	24
*4000		4-¼" x 3"	22	65⅞	30
	*4000	4-¼" x 4"	24	67⅞	30
*5000		4-¼" x 5"	26	69⅞	30
	*5000	4-¼" x 6"	28	71⅞	30

* Flatwise mounting only

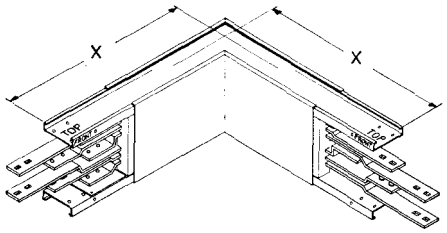
fittings

elbows

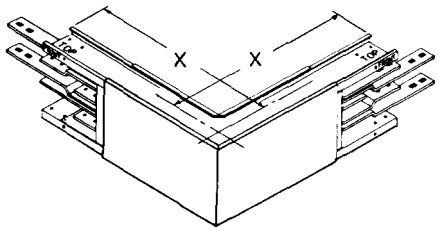
Elbows are used to make 90° changes in the direction of busway runs. There are four types available with each leg of the standard elbow being 24 inches long.

forward and rearward elbows

forward elbow



rearward elbow

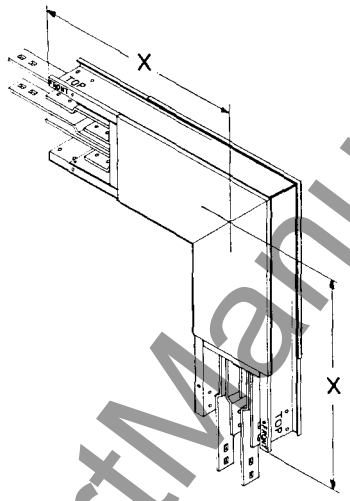


copper	aluminum	bus bar size	minimum "X" dim. left or right leg	maximum "X" dim. left or right leg
800	600	2-¼ x 1	11½	50
1000	800	2-¼ x 1½	12	50
1350	1000	2-¼ x 2	12½	50
1600	*1350	2-¼ x 2½	12¾	50
*2000	*1600	2-¼ x 3	13	50
*2500	*2000	2-¼ x 4	13½	50
*3000	*2500	2-¼ x 5	14	50
	*3000	2-¼ x 6	14½	50

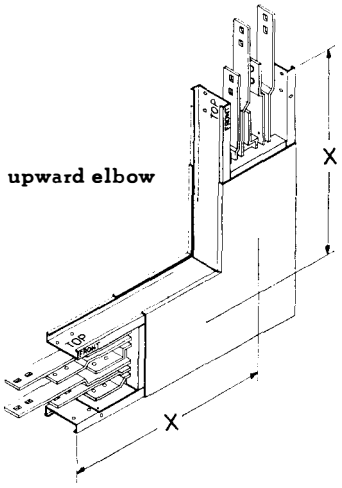
* For flatwise mounting only.

upward and downward elbows

downward elbow



upward elbow



2 bars per phase

Minimum "X" dimension is 15¾ inches.

Maximum "X" dimension is 49¾ inches.

4 bars per phase

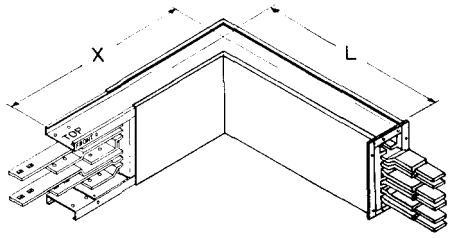
copper	aluminum	bus bar size	4 bars per phase					
			3Ø 3 wire		3Ø 4 wire ½ neut.		3Ø 4 wire full neut.	
			minimum "X" dimension	maximum "X" dimension	minimum "X" dimension	maximum "X" dimension	minimum "X" dimension	maximum "X" dimension
*4000		4-¼ x 3	20	59¼	21	60⅛	21	61⅞
*5000	*4000	4-¼ x 4	20	59¼	21	60⅛	21	61⅞
		4-¼ x 5	20	59¼	21	60⅛	21	61⅞
	*5000	4-¼ x 6	20	59¼	21	60⅛	21	61⅞

* For flatwise mounting only.

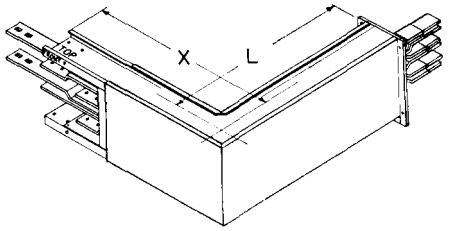
elbow flanges

forward and rearward elbow right or left flange

forward elbow right flange



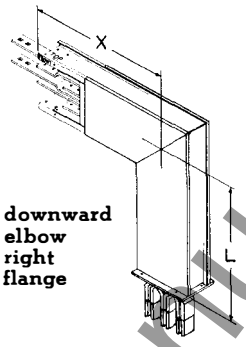
rearward elbow right flange

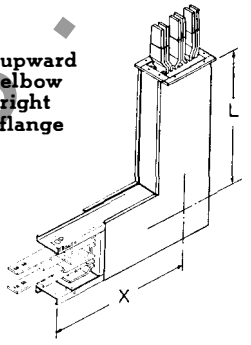


copper	aluminum	bus bar size	flange leg		elbow leg	
			minimum "L" dimension	maximum "L" dimension	minimum "X" dimension	maximum "X" dimension
800	600	2-¼ x 1	9	52⅜	11½	59⅞
1000	800	2-¼ x 1½	9½	52⅜	12	59⅞
1350	1000	2-¼ x 2	10	52⅜	12½	59⅞
1600	③1350	2-¼ x 2½	10½	52⅜	12¾	59⅞
③2000	③1600	2-¼ x 3	11	52⅜	13	59⅞
③2500	③2000	2-¼ x 4	12	52⅜	13½	59⅞
③3000	③2500	2-¼ x 5	13	52⅜	14	59⅞
	③3000	2-¼ x 6	14	52⅜	14½	59⅞

③ For flatwise mounting only.
Flanges will be supplied on end of right or left leg as required.
Refer to Westinghouse for 4 bar per phase.

upward and downward elbow flange

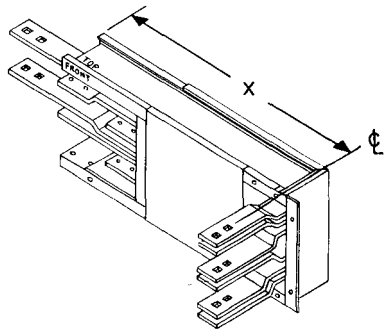




copper	aluminum	bus bar size	flange leg		elbow leg	
			minimum "L" dimension	maximum "L" dimension	minimum "X" dimension	maximum "X" dimension
800	600	2-¼ x 1	14¾	52⅛	15¾	45
1000	800	2-¼ x 1½	15¼	52⅛	15¾	45
1350	1000	2-¼ x 2	15¾	52⅛	15¾	45
1600	①1350	2-¼ x 2½	16¼	52⅛	15¾	45
①2000	①1600	2-¼ x 3	16¾	52⅛	15¾	45
①2500	①2000	2-¼ x 4	17¾	52⅛	15¾	45
①3000	①2500	2-¼ x 5	18¾	52⅛	15¾	45
	①3000	2-¼ x 6	19¾	52⅛	15¾	45

① For flatwise mounting only.
Refer to Westinghouse for 4 bar per phase.
Flange can be supplied on end of right or left leg as required.

flush elbow flange



copper	aluminum	bus bar size	minimum "X" dimension	maximum "X" dimension
800	600	2-¼ x 1	15¾	63½
1000	800	2-¼ x 1½	16	63½
1350	1000	2-¼ x 2	16¼	63½
1600	②1350	2-¼ x 2½	16½	63½
②2000	②1600	2-¼ x 3	16¾	63½
②2500	②2000	2-¼ x 4	17¼	63½
②3000	②2500	2-¼ x 5	17¾	63½
	②3000	2-¼ x 6	18¼	63½

② For flatwise mounting only.
For 4 bar per phase dimension refer to Westinghouse.

tees

Tees are busway fittings for making T connections to bus duct. The four standard tees for low-impedance duct are: forward, rearward, upward, and downward. Each leg of a standard tee is 24 inches long, measured from the centerline of the duct to the end of the top or bottom channels.

forward and rearward tees

Facing the "FRONT" with the marking "TOP" upward, a 24-inch leg extends forward on a forward tee and rearward on a rearward tee from the center of a four foot section of duct.

amp ratings		bar size	minimum leg lengths
copper	aluminum		
800	600	2-¼ x 1	13¼
1000	800	2-¼ x 1½	13½
1350	1000	2-¼ x 2	13¾
1600	①1350	2-¼ x 2½	14
①2000	①1600	2-¼ x 3	14¼
①2500	①2000	2-¼ x 4	14¾
①3000	①2500	2-¼ x 5	15¼
	①3000	2-¼ x 6	15¾
①4000		4-¼ x 3	24
①5000	①4000	4-¼ x 4	24
	①5000	4-¼ x 6	24

upward and downward tees

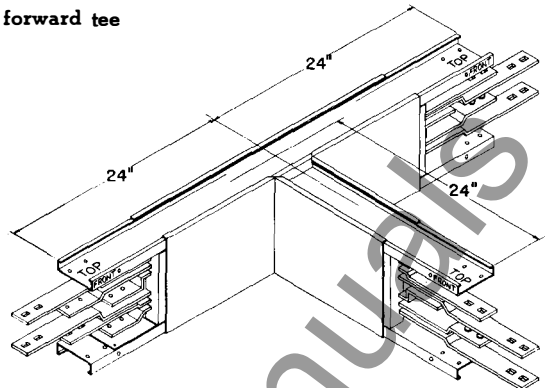
Upward tees have a 24-inch leg extending upward from the center of a 4-foot section of duct with the "TOP" marking up.

With the "TOP" marking up, downward tees have a 24-inch leg extending downward from the center of a 4-foot section of duct.

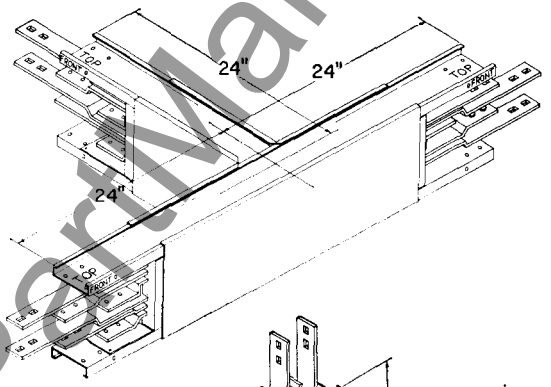
amp ratings		bar size	minimum leg dimension								
			3∅ 3W			3∅ 4W ½N			3∅ 4W F/N		
copper	aluminum		A	B	C	A	B	C	A	B	C
800	600	2-¼ x 1	16¼	15¼	11	16¼	16¼	11	17¼	16¼	13
1000	800	2-¼ x 1½	16¾		12	16¾		12	17¾		14
1350	1000	2-¼ x 2	17¼		13	17¼		13	18¼		15
1600	①1350	2-¼ x 2½	17¾		14	17¾		14	18¾		16
①2000	①1600	2-¼ x 3	18¼		15	18¼		15	19¼		17
①2500	①2000	2-¼ x 4	19¼		17	19¼		17	20¼		19
①3000	①2500	2-¼ x 5	24		19	24		19	24		21
	①3000	2-¼ x 6	24		21	24		21	24		23
①4000		4-¼ x 3									
①5000	①4000	4-¼ x 4	24" leg lengths								
	①5000	4-¼ x 6									

① For flatwise mounting only.

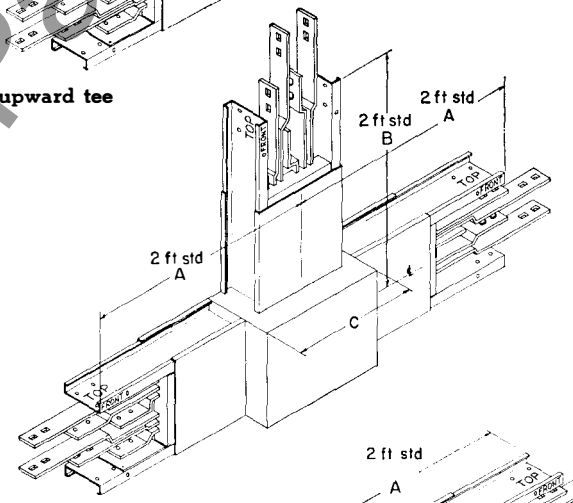
forward tee



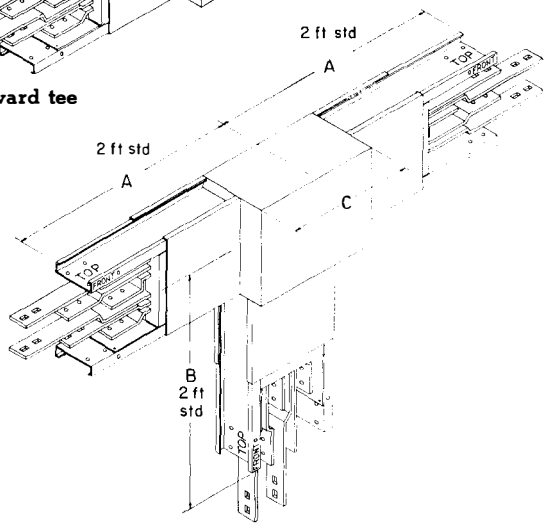
rearward tee



upward tee



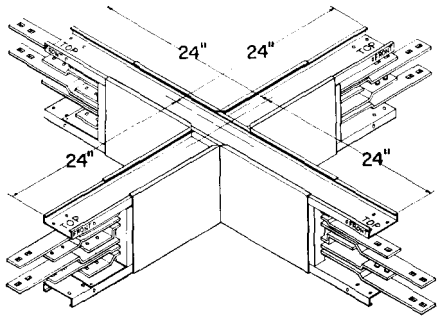
downward tee



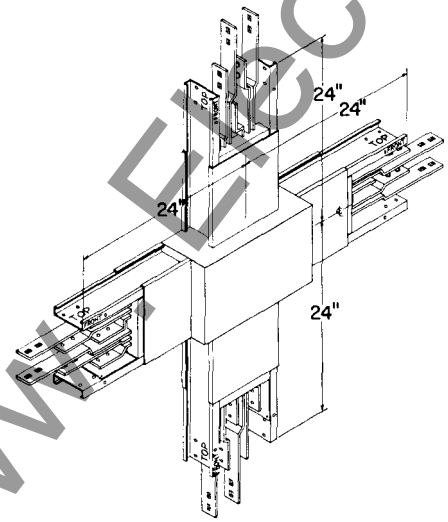
cross

A cross is a busway fitting suitable for connection in four directions. It is used where two runs of duct intersect each other in the same plane. There are two types: the forward-rearward and the upward-downward. Each leg is two feet long.

forward-rearward



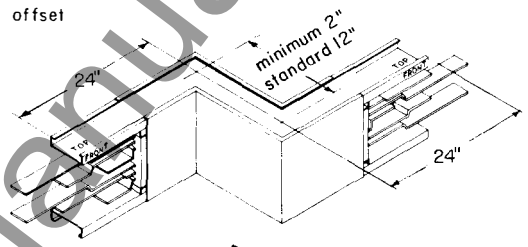
upward-downward

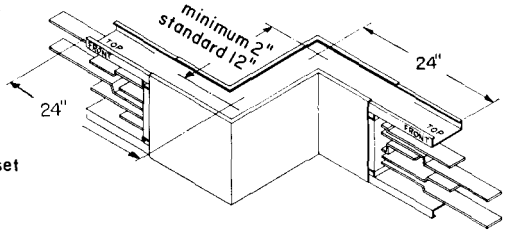


offsets

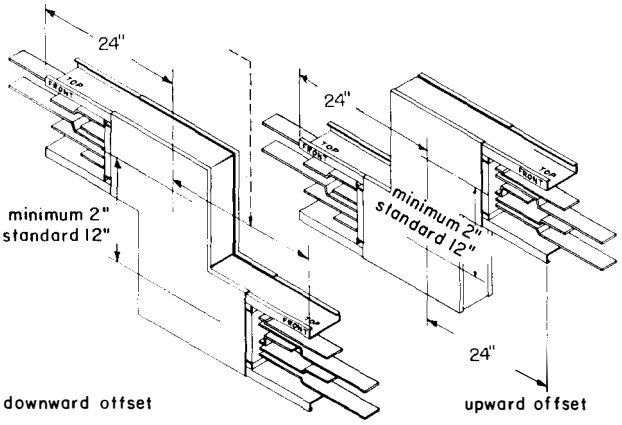
An offset is used to avoid obstacles and to conform with building structure. It is simply two elbows fabricated into one unit for use where it is impossible to use a standard elbow because of space restrictions. The minimum left and right leg dimensions are the same as those listed for similar type elbows.

forward offset





rearward offset

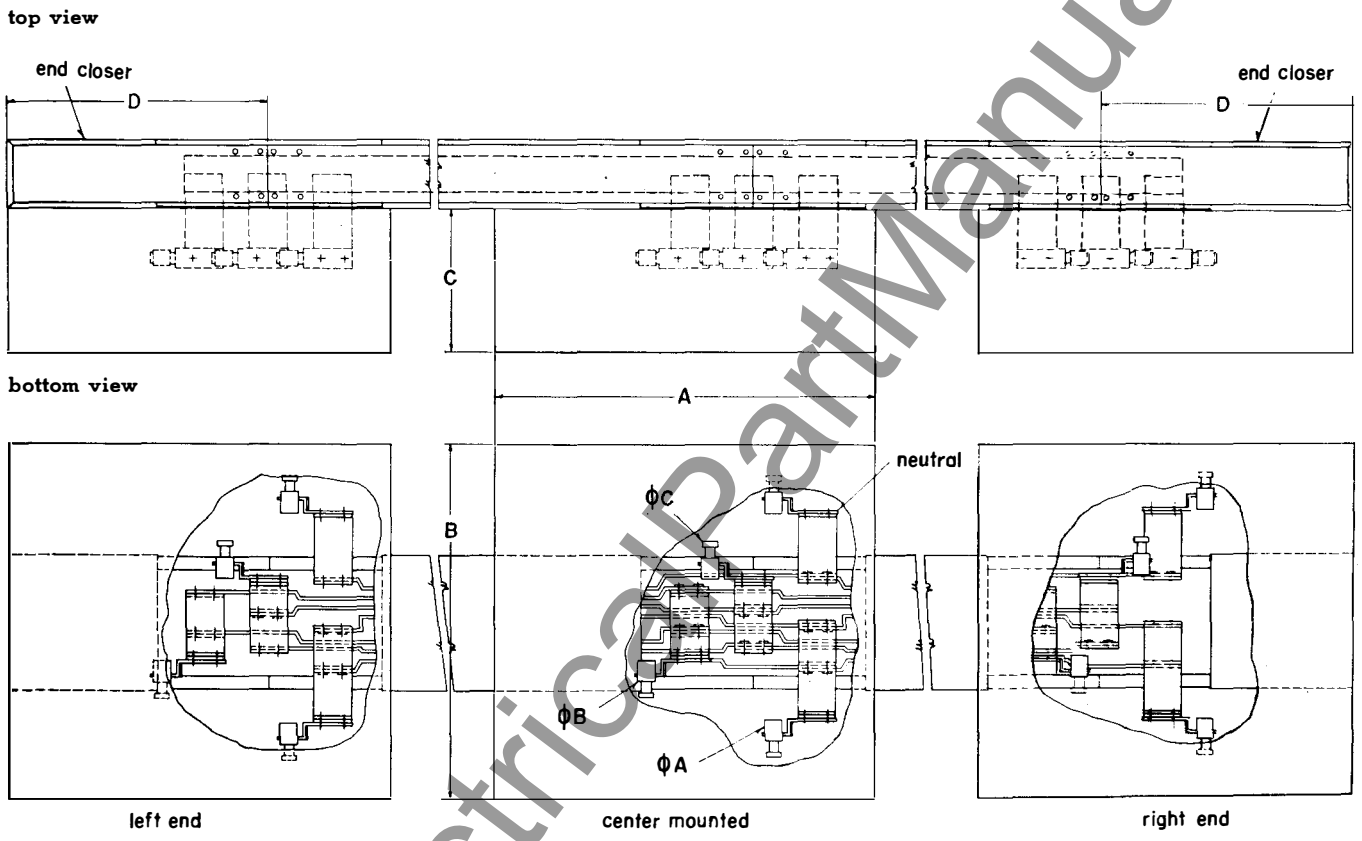


downward offset

upward offset

cable tap box bolt-on

This cable tap box is bolted to the front or rear of duct at the splice between duct sections or at the end of a run. When used at the end of a run, it must be in conjunction with a special end closer. The box itself houses the copper bar and solderless lug assembly and, since no copper is anchored to the box housing, greater flexibility is obtained. The front cover is removable for easy access to lugs. Number and size of the solderless lugs furnished are listed in the table below.



ampere rating	dimensions (in inches)								lugs used on std. boxes	
	3-wire				3∅, 4-wire half & full neutral				per phase & full neutral	half neutral
	A	B	C	D	A	B	C	D		
600	30	22	8	20½	30	28	8	20½	2-500 MCM	2-4/0
800	30	22	8	20½	30	28	8	20½	3-350 MCM	3-4/0
1000	36	22	8	26½	36	28	8	26½	3-500 MCM	3-4/0
1350	36	22	8	26½	36	28	8	26½	4-500 MCM	4-4/0
1600	40	22	11⅞	30½	40	28	11⅞	30½	5-500 MCM	5-4/0
2000	40	22	11⅞	30½	40	28	11⅞	30½	7-500 MCM	7-4/0
2250	40	22	11⅞	30½	40	28	11⅞	30½	8-500 MCM	8-4/0
2500	40	22	13½	30½	40	28	13½	30½	9-500 MCM	9-4/0
3000	40	22	13½	30½	40	28	13½	30½	10-500 MCM	10-4/0
4000	40	26	13½	30½	40	28	13½	30½	12-500 MCM	12-4/0
5000	40	26	16½	30½	40	28	16½	30½	16-500 MCM	16-4/0

cable tap boxes for panelboard connections

These cable tap boxes are designed for making connection from bus duct risers to power or lighting panelboards. There are two types. One bolts onto the joint between two sections of duct and covers those installations where the panelboard is mounted on the duct. The other type is mounted at the end of a bus duct run where bus duct enters a panelboard at either top or bottom. The drawings below show panelboards mounted on top of cable tap boxes with the cable entering the bottom of the panelboard. However, cable tap boxes may be mounted on top of panelboards, in which case the cable would enter the top of the panelboard. Westinghouse furnishes a clamp that is fastened to the panelboard mounting holes and is secured to the bus duct by the same universal clamps used on plug-in devices.

for panelboards types CDP, NDP, FDP, NLAB and NAIB

Figure 1

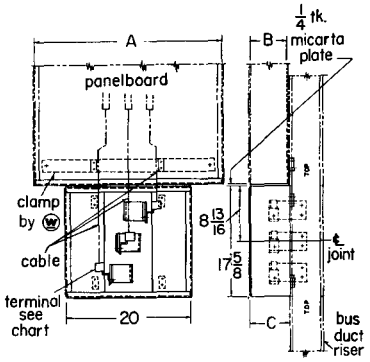
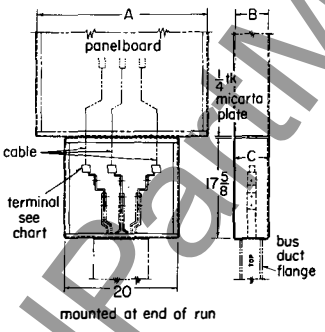
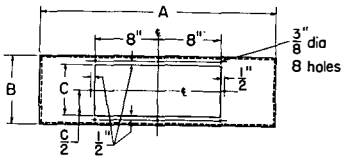


Figure 2





cutout and drilling plan in end of panelboard

A	B	C
30	8¾	6½
35	10	6½
38	10	6½
20	6½	4¼

dimensions, inches

type	A	B	C
CDP Fig. 1	30	8¾	9¼
	35	10	10½
	38	10	10½
CDP Fig. 2	30	8¾	9
	35	10	10¼
	38	10	10¼
NDP Fig. 1	20	6½	7
NDP Fig. 2	20	6½	6¾
FDP Fig. 1	30	2⅝	10⅛
	38	2⅝	10⅛
FDP Fig. 2	30	2⅝	9⅞
	38	2⅝	9⅞
NLAB NAIB Fig. 1	20	5¾	6¼
NLAB NAIB Fig. 2	20	5¾	6

type CDP and NDP

capacity & type	terminals in pullbox
100A main lugs	1-#8 to 1/0 1-#6 to 250 MCM lug per phase
225 main lug	1-1/0 to 600 MCM lug per phase
400A or 600A main lugs	2-1/0 to 600 MCM lugs per phase
600A or 400A main lugs	2-1/0 to 600 MCM . . . . . . 3-1/0 to 600 MCM
1000A or 1200A main lugs	3-4/0 to 500 MCM lugs per phase 4-1/0 to 600 MCM lugs per phase

bolt-on cubicles

There are three types of bolt-on cubicles available to take power off of low impedance duct: circuit breaker cubicles using types F, J, KL and LM breakers, fusible type COP in ratings of 100 and 200 amperes and fusible type TAP in ratings of 100 thru 600 amperes. These cubicles are used as a disconnecting means as well as providing overcurrent protection to branch runs. They are bolted onto duct at a joint.

Figure A shows the duct mounted edgewise with the plug-in openings located as close as possible to the low impedance run and all bus duct in the same elevation. Plug-in bus duct elbows are built into the load end of the cubicle. If the duct is mounted flatwise, power can be taken off using an arrangement similar to that described above but with cubicles mounted on the same side of the duct as shown in Figure B.

figure A

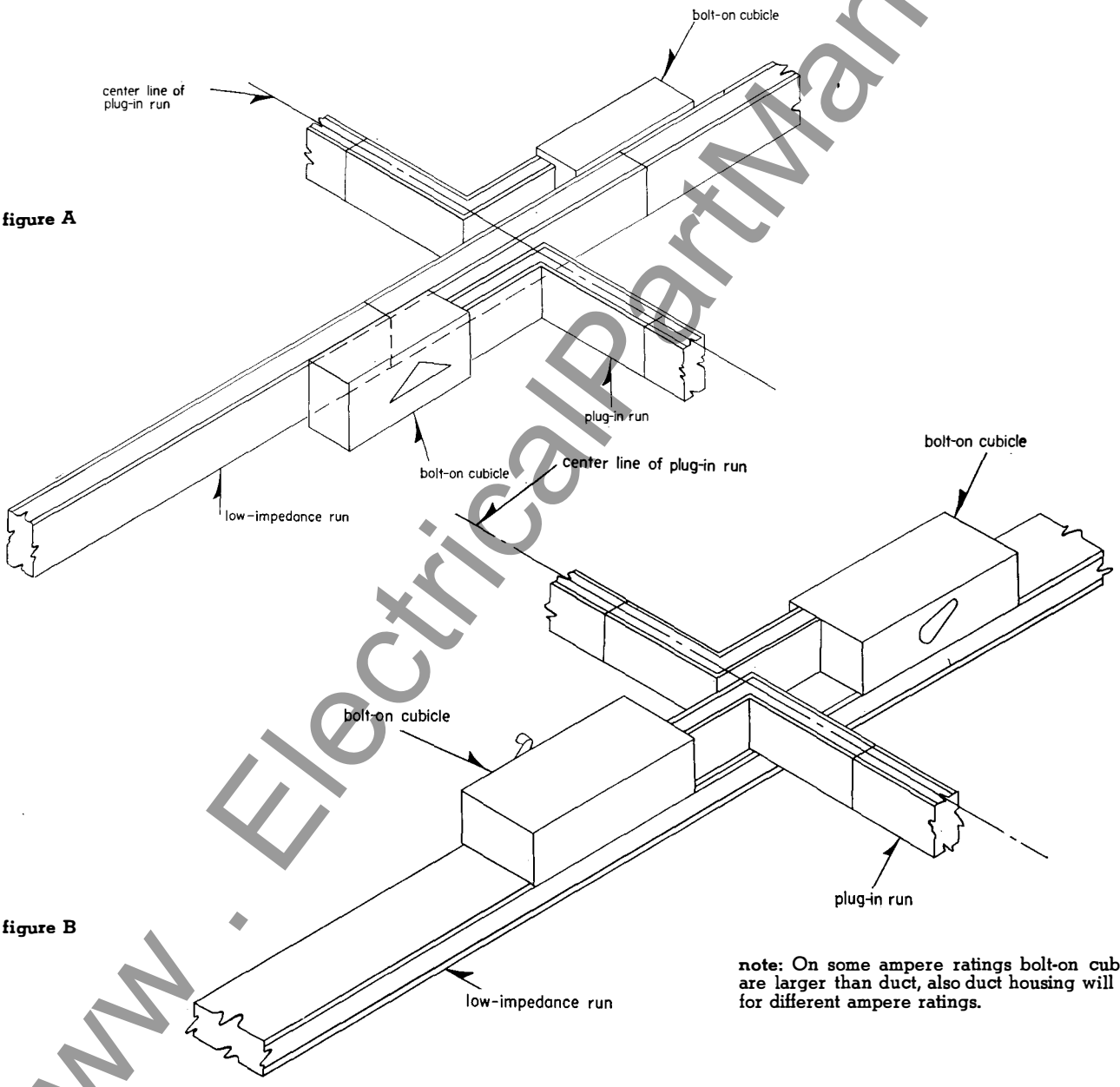
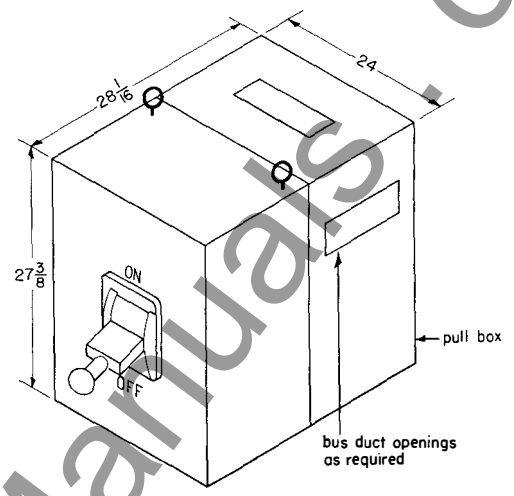


figure B

note: On some ampere ratings bolt-on cubicles are larger than duct, also duct housing will vary for different ampere ratings.

PA breaker cubicle

When a breaker with a rating higher than that of an 800 ampere type LM is needed, a type PA breaker or its equivalent is used. They are available in continuous ratings of 1000 to 2000 amperes with interrupting ratings as listed in table. They are usually used as a main breaker in a run of duct. They may be used in a branch circuit run where the larger rating duct connects to line side and the smaller rating connects to the load side of the breaker. These breaker cubicles are furnished as bus duct components and are complete with pull box and provision for incoming and outgoing bus duct.

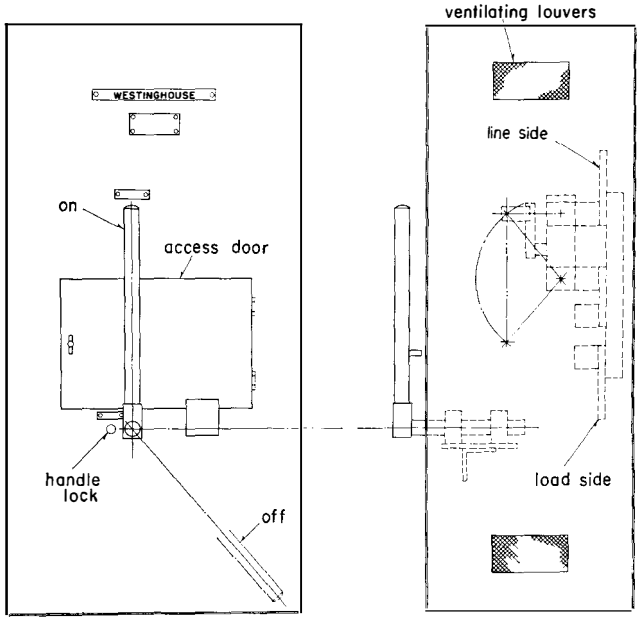


interrupting capacity amperes (RMS ASYM)	
240 volts	150,000
480 volts	100,000
600 volts	75,000

pressure type switch②

Used primarily for service entrance applications, these switches are available in capacities ranging from 1200 to 5000 amperes for 3-wire or 4-wire service, 600 volts maximum. They have bolted high pressure contacts and are used in conjunction with high interrupting capacity fuses to obtain I.C. of 100,000 amperes. The operating mechanism is so arranged that the first turn closes the blades and a continuing motion of the handle tightens the contact bolts at the hinge and jaw, thus actually bolting the blades and contacts together. They may be obtained in either a wall-mounted or a floor-mounted, free-standing enclosure. The switch enclosure is complete with internal bussing, duct entrance and exit stubs and external operating handle. Bus duct line and load connections may be located in the upper and lower sides, top of cubicle, and the upper and lower portions of the rear cover when the cubicle is free-standing. Provisions can be made for built-in current transformers and any other modifications which may be required.

② For dimensions refer to Westinghouse.



transformer tap openings

The drawings below show the most common type of transformer tap openings for outdoor duct. They are also typical of those used on plug-in and low impedance duct for indoor use. Bus bar extensions extend through the duct housing and connection to the transformer is made by cable in a drip loop. The bus extensions do not include drilling or lugs unless specified on the order.

As explained below, **full-size neutral** should be furnished in that portion of a bus duct run extending over three single phase transformers when connected in Wye for either 120/208 volts a-c or 277/480 volts a-c.

Many, when considering an application of this type, visualize the transformer connection as shown in Figure A. With this type of connection, in the event the load was balanced equally on all three phases, the resultant neutral current would be zero. It would appear that a half-size neutral in this portion of the bus duct run would be adequate for any unbalance which might normally occur. In actual practice, the physical set-up of a transformer bank in a bus duct run as described above looks like Figure B. The resultant current in the bus bar between transformers T-2 and T-3 is the vectoral sum of $I_1 + I_2$, which is the full line current of any single transformer. The current in the neutral bar between transformers T-1 and T-2 is, of course, full line current of transformer T-1. Therefore, for the portion of the bus duct included between transformers T-1 and T-3 it is necessary to provide a **full-size neutral**. The neutral can then be reduced to half size for the balance of the run.

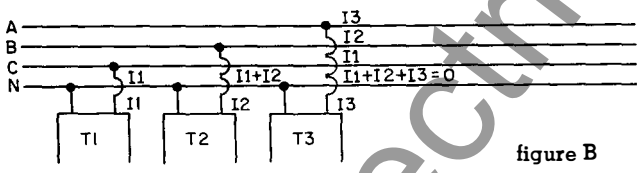


figure B

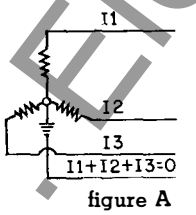
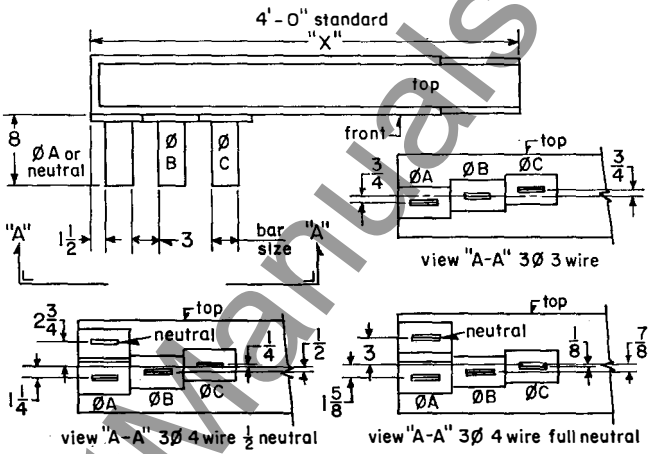


figure A

Transformer tap lengths with closed right or left end. Taps staggered.

2 bars per phase

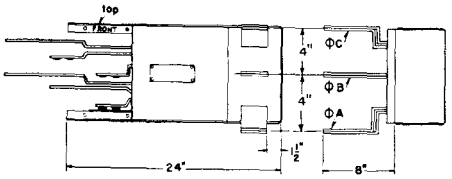


3 phase 3 wire; 3 phase 4 wire ½ neut; 3 phase 4 wire full neut.

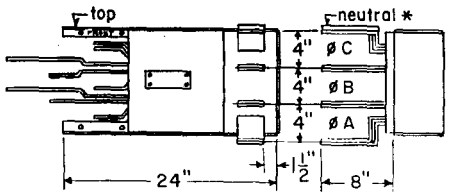
bus bar size	minimum "X" dimension
¼ x 1	21½
¼ x 1½	23
¼ x 2	24½
¼ x 2½	26
¼ x 3	27½
¼ x 4	30½
¼ x 5	33½
¼ x 6	36½

Transformer tap lengths with closed right or left end. Taps in line.

3 phase 3 wire

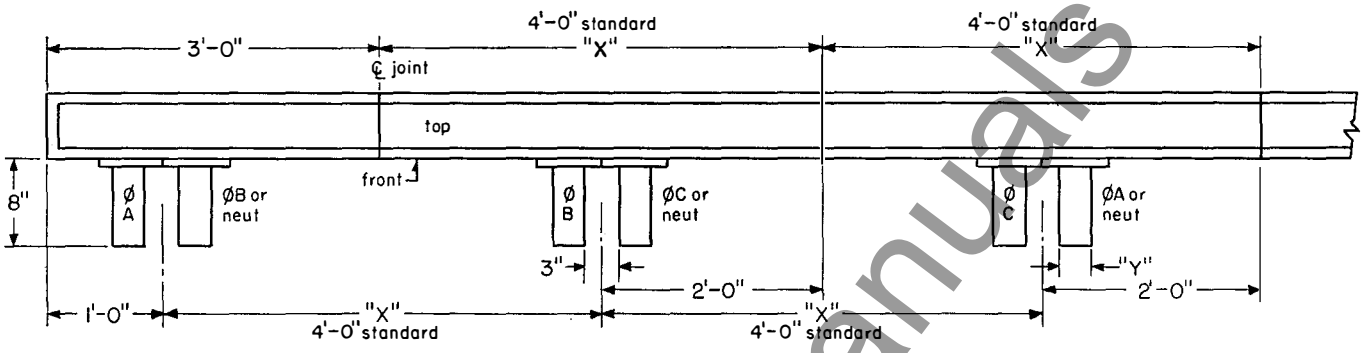


3 phase 4 wire



Note: All standard taps are undrilled and do not include lugs.

Transformer tap lengths with closed right or left end. 2 bars and 4 bars per phase.



3∅ 3 wire & 3 ∅ 4 wire full neut.

bus bar size	3∅ 3 wire "Y" dimension	3∅ 3 wire minimum "X" dimension	3∅ 4 wire full neut. "Y" dimension	3∅ 4 wire full neut. minimum "X" dimension
¼ x 1	1	37	1	37
¼ x 1½	1	37	1½	37½
¼ x 2	1½	37½	2	38
¼ x 2½	1½	37½	2½	38½
¼ x 3	2	38	3	39
¼ x 4	2½	38½	4	40
¼ x 5	3	39	5	41
¼ x 6	4	40	6	42

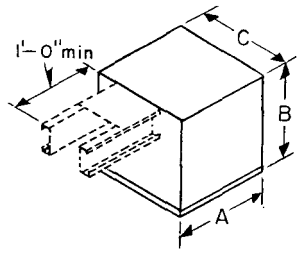
note: all standard taps are undrilled and do not include lugs.

weatherhead

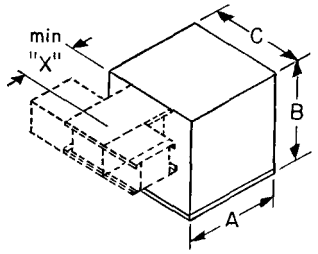
A weatherhead or weatherproof cable tap box is generally used to feed power into a building from a utility service drop or transformers.
The standard 2 bar per phase weatherhead (as shown) is supplied with a cutout in the back of the enclosure. This cutout will accept either end of any standard fitting. Terminals are attached to the bus bars to complete the assembly. Standard fittings are inserted 11 inches into the cutout in the rear of the weatherhead. All lugs face down.

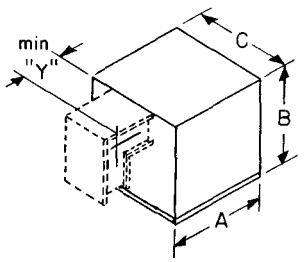
amp rating copper	amp rating aluminum	bar size	dimensions A	B	Y	3∅ 3W X	3∅ 3W C	3∅ 4W ½N X	3∅ 4W ½N C	3∅ 4W F/N X	3∅ 4W F/N C
800	600	2¼ x 1	21	13¾	3¼	6¼	12	6¾	13	7¼	14
1000	800	2¼ x 1½		14¼	3½		12		13		14
1350	1000	2¼ x 2		14¾	3¾		15		16		17
1600	1350▲	2¼ x 2½		15¼	4		15		16		17
2000▲	1600▲	2¼ x 3		15¾	4¼		15		16		17
2500▲	2000▲	2¼ x 4		18½	4¾		20		21		24
3000▲	2500▲	2¼ x 5		19½	5¼		20		21		24
	3000▲	2¼ x 6		20¾	5¾		27		28		30

▲ Flatwise mounting only



amp. rat.	number of 1/0 to 500 MCM lugs per phase	half neut.	full neut.
600	1	1	1
800	2	1	2
1000	2	1	2
1350	3	2	3
1600	3	2	3
2000	4	2	4
2500	5	3	5
3000	6	3	6



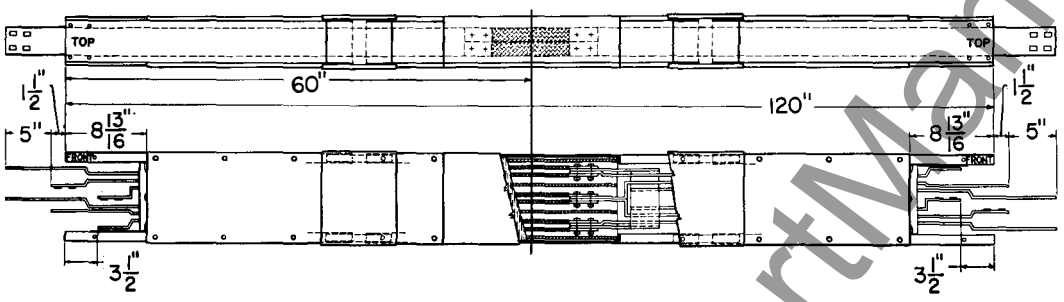


expansion sections

Expansion sections accommodate the expansion and contraction of bus bars with respect to the enclosure. They are necessary in long, straight runs to compensate for the difference in the coefficient of expansion of steel and copper or aluminum.

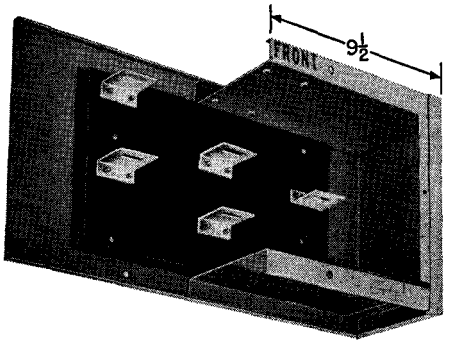
They are ten foot sections of duct in which the steel housings contain sliding telescopic joints to allow movement of the housings. Inside the telescopic joints lengths of rigid bus bars are replaced by flexible braid surrounded with ebony asbestos.

An expansion section should be installed in the center of any horizontal run of 150 feet or more of copper or of 100 feet or more of aluminum duct. If such a run has an end closer at one end, so that the bus bars are free to move, the expansion section may be omitted. When duct is installed in a vertical position, as in tall commercial buildings, expansion sections should be used at every 150 feet of vertical rise. Also, they *must* be used wherever a run of duct crosses an expansion joint in the building. The use of expansion sections should be engineered for individual installations.



end closers

The end closer is a fitting which terminates the busway and closes the open end of a run. When ordering end closers for 4-wire duct, be sure to specify on which end of the duct the unit is to be used. Facing the "FRONT" of a run with the "TOP" marking up, a left end closer would be used on the left end of the run; and a right end closer would be used on the right end of the run. For the 3-phase duct the end closers are interchangeable from right to left. End closers for the right end of the duct come complete with splice plates and access covers. Those for the left end are not so equipped since the splice plates and access covers come with the left end of the duct sections.



adapter cubicles

In many instances, it is economical to reduce the ampere rating of the duct as the load drops off. In this case, whenever the rating is reduced more than two-thirds of the rating of the overcurrent protection next back on the line or the length of the reduced run is over 50 feet an overcurrent protective device must be used to meet NEC requirements.

Adapter cubicles are available with either a circuit breaker or heavy duty fused safety switch to furnish overcurrent protection and serve as a disconnecting means. Reduction in bus capacity is made within the cubicle. The line side of the cubicle is connected to the large rating of duct and the load side to the reduced rating of duct. These cubicles may also be used when adapting from low impedance to plug-in bus duct.

circuit breaker adapter cubicles

Overall length of circuit breaker cubicles using the type LM breaker, with maximum bus duct rating of 800 to 1000 amperes respectively, is 60 inches. Facing the "FRONT" of a right cubicle with the marking "TOP" up, the larger size duct is on the left end or the line side and the smaller size duct is on the right end or load side of the cubicle. Viewing the "FRONT" of a left cubicle with the marking "TOP" up, the larger size duct is on the right end or the line side of the cubicle, while the smaller size duct is on the left end or load side.

fusible switch adapter cubicles

Fused disconnect cubicles consist of a non-automatic circuit breaker with fuse clips built into a 6'0" section of duct. These units are similar in appearance to the circuit breaker cubicle shown on this page. For complete information refer to Westinghouse.

reducers

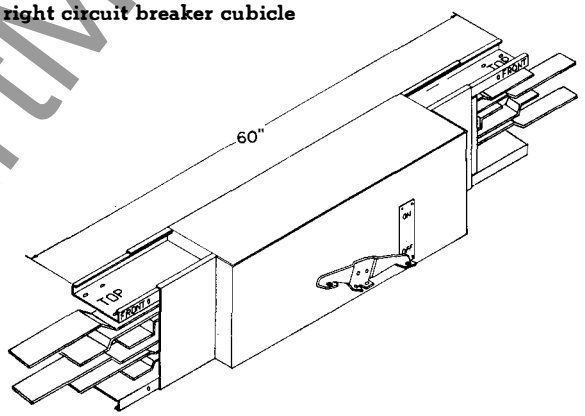
Reducers are used to reduce the capacity of bus duct without overcurrent protective devices. They are built into a 36-inch section of duct.

No overcurrent protection is required where bus duct is reduced in size provided the length of the smaller duct does not extend more than 50 feet and has a current rating at least 1/3 that of the breaker next back on the line.

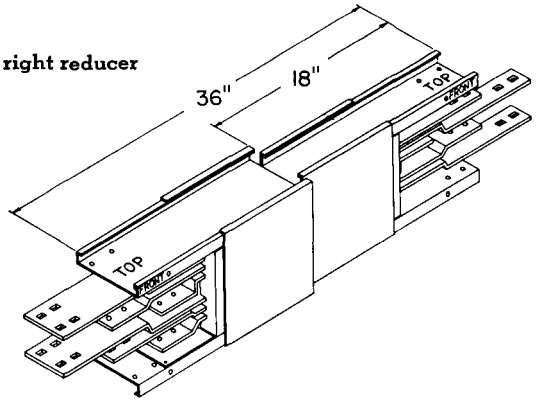
left reducer: If, when facing the "FRONT" of a bus duct run with marking "TOP" up, one desires to reduce the capacity of the run at its left end, a left reducer is used. Viewing the "FRONT" of a left reducer the larger size bus bars are on the right and the smaller size bars on the left.

right reducer: A right reducer is used to reduce the capacity of the run at its right end when viewing the "FRONT" of a bus duct run with marking "TOP" up. Facing the "FRONT" of a right reducer the bus bars are reduced from left to right.

right circuit breaker cubicle



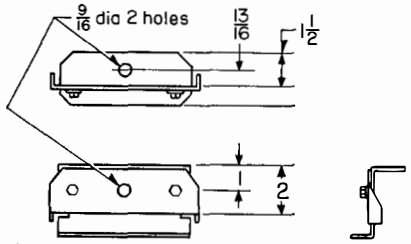
right reducer



hangers for low impedance duct

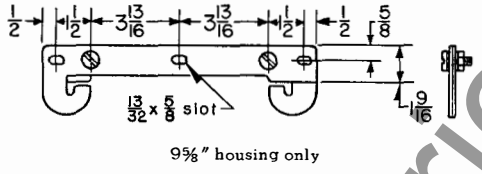
cantilever edgewise mounted duct

One cantilever hanger is supplied for every 10 feet of duct. This hanger can be used on all 2 bar per phase low impedance bus duct except 5 inch and 6 inch bus bar ratings. Drop rods and hardware are supplied by contractor.



"C" clamp flatwise or edgewise mounted duct

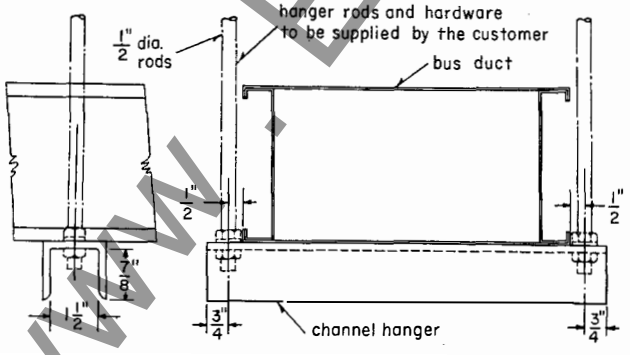
One "C" clamp hanger is supplied with every 10 feet of bus duct when required. This hanger can be used on 2 bar per phase 1 inch through 4 inch bus bar only.



9⅝" housing only

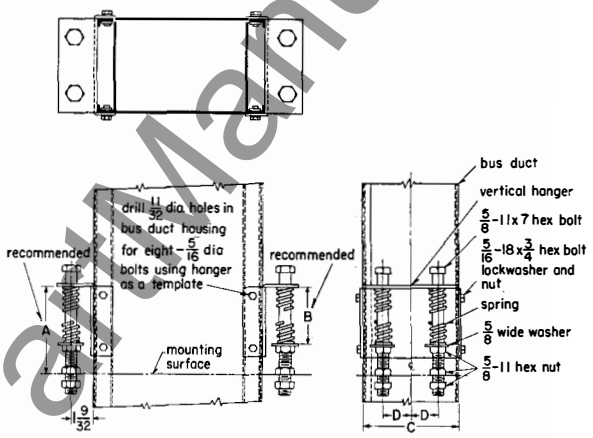
trapeze type flatwise or edgewise mounted duct

Used to hang duct in a flatwise position or in edgewise position when proper bar size is applied. General dimensions are shown below:

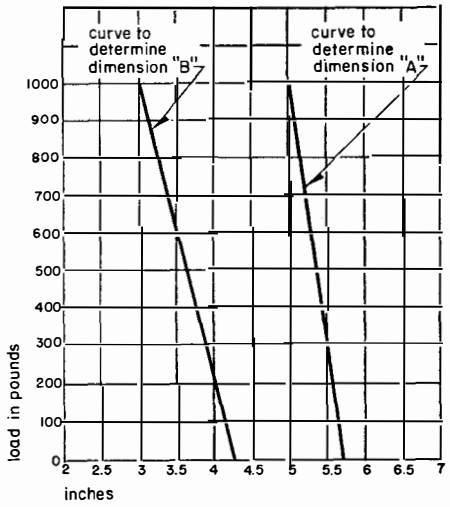


hanger for vertical mounting

This unique hanger equalizes the weight of vertically mounted duct among all supports. A vertical hanger should be used for every ten feet of duct. However, if floors are not over 14 feet apart one hanger per floor may be used. Although the tables and drawings apply to low-impedance duct, this hanger may be used with plug-in duct.



deflection diagram



dimensions (inches)

C	D
3⅜	15/16
3⅞	31/32
4⅜	1 3/32
4⅞	1 11/32
5⅜	1 19/32
6⅜	2 3/32
7⅜	2 19/32
8⅜	3 3/32
9⅜	3 19/32

typical specifications for low impedance bus duct

general

The bus duct shall be of the ventilated type with two or more { aluminum / copper) conductors per phase supported in a sheet steel housing. The complete installation shall be coordinated throughout, rigid in construction, of uniform size, and neat and symmetrical in appearance. As many sections as possible shall be ten-foot lengths. Special sections and/or fittings shall be provided only where necessary to suit the installation. Access openings to the bolted joints of conductors shall be provided on two opposite sides of the duct. Conductor joints shall be made in such a manner that no increase of enclosure size is required at the splice between adjoining sections. One Hanger shall be provided for every 10'-0" of horizontally-mounted duct. The duct shall be suitable for being supported on 10'-0" support spacing.

For vertically-mounted duct, one adjustable vertical hanger shall be provided for each floor. The bus duct shall be listed by Underwriters' Laboratories including mounting in either the horizontal or vertical position. The bus duct shall be as manufactured by Westinghouse or approved equal.

enclosure

The duct housing, which shall be made from 16-gauge steel or heavier, according to Underwriters' standards, shall be of the 4-channel interlocking type of construction. It shall be bonderized both inside and outside and given one coat of gray, baked-on enamel. At least two sides of the ventilated duct shall have perforations stamped out. Two removable access covers shall be provided at each splice to insure ease of inspection of bus bar joints and to facilitate the bolting-on of current take-off devices. Two splice plates shall also be provided at each splice to insure a strong, positive, mechanical connection being made between the housings of adjoining sections.

conductors

The conductors for aluminum shall be fabricated from high-strength, 55% minimum conductivity, extruded aluminum bus bars. Bars shall be of the rectangular type with full rounded edges. All aluminum bus bars shall be plated electrolytically with a minimum thickness of .0002" of silver where the lap joint is made. Except for the portion required for the lap joint, the bus bars shall be insulated their entire length with polyvinyl chloride tubing of not less than .030" total thickness or other approved insulating sheath. Bars shall be provided with threaded steel inserts at one end and slotted holes at the other for ease in making splices. Offsets in each bar shall be provided near its extremities to permit the making of neat lap splices. Joints shall be made with not less than two bolts which shall be of heat-treated, zinc chromate-plated steel and with a tensile strength of 100,000 lbs. per sq. inch.

The conductors for copper shall be fabricated from the best grade, 98% conductivity, pure copper bus bars. Bars shall be of the rectangular type with full, rounded edges. All copper bus bars shall be silver-plated where the lap joint is made. Except for the portion required for the lap joint, the bus bars shall be insulated their entire length with polyvinyl chloride tubing of not less than .030" total thickness or other approved insulating sheath. Bars shall be provided with threaded steel inserts at one end and slotted holes at the other for ease in making splices. Offsets in each bar shall be provided near its extremities to permit the making of neat lap splices. Joints shall be made with not less than two bolts which shall be of heat-treated zinc chromate-plated steel and with a tensile strength of 100,000 lbs. per sq. inch.

bus bar assembly

The bus bars shall be assembled on ¾" centers in such a manner that their flat sides shall be adjacent. In order to reduce reactance, bars of opposite polarity shall be interlaced to provide a repeating phase sequence. Four-wire systems shall have all neutral conductors assembled entirely to one side of the phase bars assembly. The bus bar assembly shall withstand short circuit stresses in accordance with Nema short circuit ratings for busways. Consequently, bus bar supports shall be located on not greater than 17" centers for 2 bars per phase duct and not greater than 21" when more than 2 bars per phase are used. Bus bar supports shall be of the clamp type, not integral with the housing, nor dependent upon the housing for either action or strength. Bus bar joints shall be so arranged that no additional insulation need be applied at installation on joints of opposite polarity.

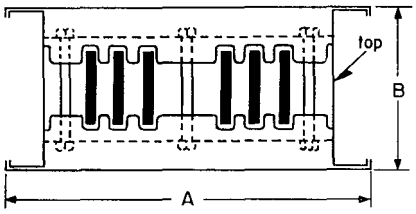
operating characteristics

The bus duct shall be so designed and tested that, at rating, no part shall exceed 55°C rise. The bus duct shall withstand for one minute without breakdown the application of 2200 volts of 60 cycle alternating potential between conductors and between conductors and enclosure.

engineering and test data

dimensions and weights

indoor and outdoor duct



indoor and outdoor ventilated

amp rating	bar size per phase	dimension A			dimension B	duct weight in lbs. per ft.		
		3 wire	½ neut.	F/N		3 wire	½ neut.	F/N
copper								
800	2-¼ x 1	9 5/8	10 5/8	11 3/8	3 3/8	13	15	16
1000	2-¼ x 1½	9 5/8	10 5/8	11 3/8	3 7/8	17	19	21
1350	2-¼ x 2	9 5/8	10 5/8	11 3/8	4 3/8	21	23	25
1600	2-¼ x 2½	9 5/8	10 5/8	11 3/8	4 7/8	24	27	30
①2000	2-¼ x 3	9 5/8	10 5/8	11 3/8	5 3/8	27	30	32
①2500	2-¼ x 4	9 5/8	10 5/8	11 3/8	6 3/8	34	39	43
①3000	2-¼ x 5	9 5/8	10 5/8	11 3/8	7 3/8	41	47	53
①4000	4-¼ x 3	17 5/32	18 29/32	22 15/32	5 13/32	53	58	64
①5000	4-¼ x 4	17 5/32	18 29/32	22 15/32	6 13/32	66	74	82
aluminum								
600	2-¼ x 1	9 5/8	10 5/8	11 3/8	3 3/8	10	11	12
800	2-¼ x 1½	9 5/8	10 5/8	11 3/8	3 7/8	11	12	13
1000	2-¼ x 2	9 5/8	10 5/8	11 3/8	4 3/8	14	15	15
①1350	2-¼ x 2½	9 5/8	10 5/8	11 3/8	4 7/8	15	16	16
①1600	2-¼ x 3	9 5/8	10 5/8	11 3/8	5 3/8	16	17	17
①2000	2-¼ x 4	9 5/8	10 5/8	11 5/8	6 3/8	17	19	21
①2500	2-¼ x 5	9 5/8	10 5/8	11 3/8	7 3/8	20	23	30
①3000	2-¼ x 6	9 5/8	10 5/8	11 3/8	8 3/8	23	28	31
①4000	4-¼ x 4	17 5/32	18 29/32	22 15/32	6 13/32	32	35	37
①5000	4-¼ x 6	17 5/32	18 29/32	22 15/32	8 13/32	43	46	59

① Flatwise mounting only.

interrupting capacity

duct rating	amperes (RMS ASYM)	
	NEMA standard	Westinghouse standard
600	25,000	50,000
800	25,000	50,000
1000	50,000	75,000
1350	50,000	75,000
1600	50,000	100,000
2000	75,000	100,000
2500	75,000	100,000
3000	75,000	100,000
4000	100,000	100,000
5000	.....	100,000

line to line voltage drop per 100 feet distributed loading

ampere rating	load power factor—percent											
	0	10	20	30	40	50	60	70	80	90	95	100
copper												
800	1.43	1.59	1.73	1.80	1.87	1.94	2.01	2.01	1.94	1.87	1.73	1.39
1000	1.37	1.47	1.56	1.65	1.71	1.75	1.77	1.77	1.72	1.61	1.50	1.13
1350	1.39	1.51	1.61	1.71	1.77	1.82	1.85	1.86	1.81	1.72	1.60	1.23
1600	1.29	1.40	1.47	1.55	1.59	1.65	1.65	1.63	1.61	1.50	1.39	1.04
2000	1.30	1.42	1.51	1.59	1.65	1.70	1.71	1.73	1.68	1.59	1.47	1.13
2500	1.32	1.41	1.52	1.60	1.67	1.71	1.73	1.73	1.71	1.60	1.47	1.13
3000	1.35	1.45	1.56	1.64	1.71	1.74	1.77	1.77	1.71	1.64	1.51	1.14
4000	1.42	1.56	1.63	1.73	1.84	1.88	1.91	1.91	1.91	1.77	1.66	1.28
5000	1.43	1.56	1.65	1.69	1.78	1.86	1.86	1.86	1.82	1.69	1.60	1.21
aluminum												
600	1.08	1.21	1.33	1.44	1.54	1.62	1.69	1.74	1.75	1.71	1.64	1.38
800	1.08	1.23	1.35	1.46	1.57	1.66	1.73	1.78	1.80	1.77	1.71	1.44
1000	1.00	1.17	1.26	1.37	1.46	1.55	1.63	1.68	1.70	1.66	1.61	1.37
1350	1.11	1.27	1.38	1.51	1.61	1.71	1.78	1.84	1.86	1.81	1.77	1.48
1600	1.00	1.15	1.27	1.40	1.50	1.59	1.69	1.73	1.77	1.75	1.70	1.47
2000	1.16	1.30	1.44	1.52	1.61	1.71	1.78	1.82	1.82	1.77	1.70	1.40
2500	1.20	1.34	1.47	1.58	1.69	1.80	1.84	1.88	1.91	1.86	1.80	1.49
3000	1.12	1.27	1.45	1.51	1.61	1.71	1.77	1.85	1.87	1.82	1.74	1.48
4000	0.87	1.00	1.14	1.25	1.35	1.49	1.56	1.63	1.66	1.66	1.63	1.42
5000	0.78	0.91	1.04	1.13	1.21	1.30	1.34	1.43	1.47	1.47	1.43	1.26