

Custom Designed Bus Systems

Global Leader in LV and MV Bus Duct Solutions



Powered by Safety®

"Can-Do" Attitude

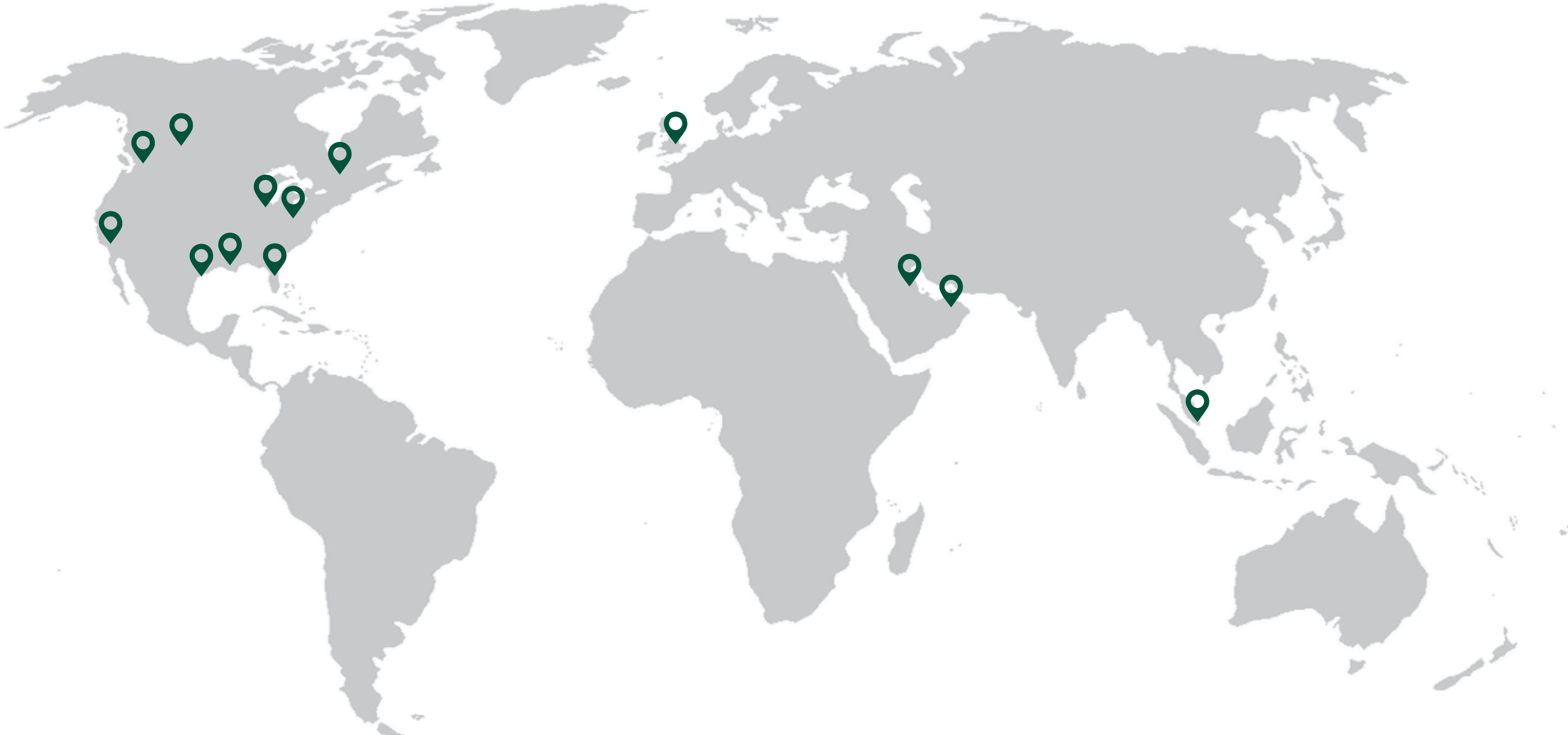
Our "can-do" spirit symbolizes who we are; a world-class producer that embraces complexity through our custom-engineered solutions. We view challenges as opportunities to excel. Our nature is to "make it right" for our customers.

Powell provides an extensive product scope, designed and manufactured, to the exact requirements you need.

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OUR LOCATIONS





Unmatched Experience

In 1984 Delta-Unibus Corp. became a subsidiary of Powell Industries, Inc. of Houston, Texas. Powell brought the financial and corporate strength that allowed the operation to grow into the nation's leading supplier of isolated phase bus systems. In 1986, we acquired the Westinghouse Electric Corporation's isolated phase bus product line. This strategic acquisition, combined with our already strong operation, resulted in an unparalleled combination of product experience and capabilities that is unmatched in the industry, including expansion of the installed base. Powell made the decision in mid-2004 to merge all bus operations within the company into a single organization. Thus, the former non-segregated phase bus and cable bus product lines and production facilities of the sister operation of Unibus Inc. were consolidated with Delta-Unibus Corp., and by the end of that year all products of the former two operations were combined to create a breadth of product and wealth of technical experience.



A Global Leader in Bus Technology

Powell is the major designer, manufacturer and supplier of a comprehensive line of isolated phase bus, non-segregated and segregated phase bus duct, cable bus and complementary bus accessories. We serve the electric utilities, major EPC's, IPP's and co-generation, petrochemical and heavy industrial industries. These offerings facilitate the direct connection of large power generators to transformers and other high-power devices and provide the interconnection of control and distribution equipment for low and medium voltage applications. The bus duct offering from Powell traces its roots to the purchase of the "Delta-Star" isolated phase bus product line from H.K. Porter Co.'s Chicago Works in 1982. From the early 1900's, H.K. Porter had been one of the prime isolated phase bus suppliers during the growth of the United States' great electrical power system, successfully providing "Delta-Star" products to hundreds of generating stations throughout the country. Delta-Unibus Corp. started operations in Franklin Park, Illinois and retained the key experienced operations and technical H.K. Porter personnel as well as a base of reliable suppliers in order to maintain the high quality reputation of the "Delta-Star" products.



Powell operations are today housed in a modern, state-of-the-art, ISO 9001:2015 certified manufacturing facility designed and built to optimize the design and manufacturing processes for its products. Opened in May, 2002, this new 100,000 square foot facility located in the Chicago suburb of Northlake, Illinois, is yet another testament to Powell's commitment to the industry and its continuing efforts to improve its leadership role. With a long history rich in product, design, and manufacturing expertise as well as proven quality at thousands of installations throughout the U.S. and worldwide, Powell is the world's foremost producer of custom-designed bus systems and can be counted on to provide a fully integrated, totally coordinated system of the highest quality and reliability. When your requirements are for the very best, turn with confidence to Powell for the equipment, technical expertise, and service your project demands.

Experience

Thousands of power generating units and industrial applications all over the world depend on the reliability of Powell bus systems. Over 75% of U.S. generating stations have selected designs within the scope and control of Powell since the early 1900's. With installations in more than forty countries, the claim that Powell is a global leader is validated on a daily basis.

Engineering Studies

Our Engineering and Technical Services personnel can assist you in making decisions regarding current equipment at your facility. Whether the consideration is for an upgrade of existing equipment, replacement of aged and outdated equipment, or the need for modifications to allow installation of additional equipment, call on Powell to give the guidance and expert analysis at the outset of a project. Bus duct systems are tested in strict accordance with ANSI/IEEE, NEMA and NEC standards.

We Focus on Solutions

From the highest rated bus duct system in the industry for a nuclear station in the United States, to the largest combined-cycle plant ever built, to one of the largest domestic hydro stations, Powell has been and continues to be the choice supplier in the power generation industry. Design parameters for our products include conformance to ANSI, BS and DIN standards, giving Powell the ability to completely satisfy the needs of our customers. Powell is available to offer custom solutions based on analysis of a new or existing system. To provide these solutions, Powell can furnish modifications and upgrades to existing ratings as well as designs to meet new application needs. These changes may include replacement or modification of the existing cooling unit. Powell is the industry expert for field engineering services, whether this is for product previously supplied by us or equipment supplied by others. Our products are designed to minimize the time required for field installation, and our track record of quality proves our ability to provide a straightforward, user-friendly product. In the event that assistance is needed in the field, however, our staff has the background and experience to provide the Field Service that you may need as the situation arises.



Powell custom designs and engineers bus systems, switches, metering packages and an extensive line of quality accessories for the world's leading power generation and heavy industrial applications. With a complete and fully proven product line and unmatched technical expertise, Powell should continue to be the choice for designers and engineers around the globe.

Service with the Customer in Mind

Our team is dedicated to providing the customer with a positive customer experience and timely responses. From the moment a need for a quotation arises, to the time of the delivery of our product at your site, Powell representatives will handle the details and facilitate your order to make procurement of your customized bus system a streamlined, trouble-free experience. We are dedicated to supplying an entire portfolio of bus duct products to meet the specific needs of your application and to ensure that customers and end users receive equipment that is of the highest quality and reliability. Our Northlake, Illinois facility has invested in state-of-the-art processes and CNC equipment, ensuring that our certified technicians can fabricate your bus duct to exacting standards. We go the extra mile to provide a design that meets the electrical needs of the application and the mechanical fit for a smooth installation in the field. Our technical staff is ready and available for consultation to establish the final product configuration that will conform to your most specialized needs. Whether the requirement is isolated phase bus, non-segregated phase bus duct, segregated phase bus duct, cable bus, or special auxiliary equipment, count on Powell to lead the way in providing innovative designs, backed by testing, that are the standard for excellence in the industry.



Isolated Phase Bus Design Details

Powell serves the electric utility and the cogeneration industries with a complete range of products, systems and services for direct connection of large power generators to transformers and other large apparatus. The inherent design features built into Powell products provide a high degree of reliability and maximum protection for the generator and for other connected equipment providing innovative designs, backed by testing, that are the standard for excellence in the industry.

Ratings

- Current: 1,200 through 42,000 amps
- Voltage: Up to 38,000 volts
- Insulation Levels: 110 through 150kV (BIL)
- Momentary Current: through 900,000 amps asymmetrical

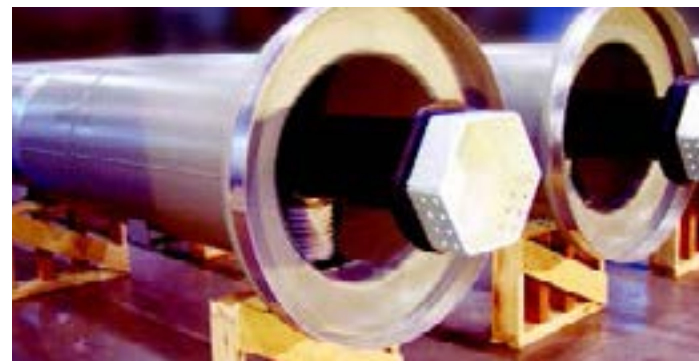
Design Considerations

- Ampacity
- Voltage Rating
- Basic Impulse Level
- Allowable Temperature Rise over a given Ambient
- Momentary Rating
- Self-cooled Requirement
- Forced-air cooled Requirement
- Allowable Losses
- Interface to Equipment
- Site Conditions (seismic, wind, snow, etc.)
- Support System Requirements & Restrictions

Application

- Primarily used as Generator main leads extending to
- GSU Transformers and Station Service/ Auxiliary Transformers
- Can handle very high ampacities, such as 42,000 amps continuous
- Maximum reliability
- Virtually eliminates the possibility of phase-to-phase faults
- Reduced heating effects to other equipment in the vicinity of Iso Phase Bus
- Can withstand very high short circuit levels
- Reduced watt losses
- Weather tight construction
- Longer sections provide lower overall installation costs

Powell's vast experience and flexible approach is available at the time of station design or can be called on when life extension or modernization projects are being planned.



View of conductor and enclosure assembly



Conductor expansion and alignment joint

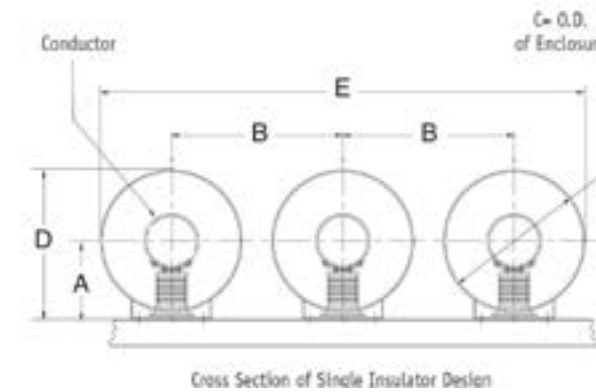


Custom triple fitting

Isolated Phase Bus Dimensional Data

An isolated phase bus is one in which each phase conductor is enclosed by an individual metal housing separated from adjacent conductor housings by an air space.

The following tables show the cross section data for isolated phase bus for the 110kV, 125kV and 150kV BIL ratings. Dimensions of associated equipment such as potential transformer cubicles, surge compartments, etc., are generally special for each application. A request to the factory with project information will enable the Powell Team to provide applicable information.



Isolated Phase Bus 125kV BIL 65° C Rise

Self Cooled Rating Amps	Dimensions (inches)					Approx. 3-Ph Wt. (lbs./ft.)
	A	B	C	D	E	
1200	13-1/2	28	22-3/8	24-11/16	78-3/8	63
2000	14-1/2	30	22-3/8	25-11/16	82-3/8	66
3000	14-1/2	30	22-3/8	25-11/16	82-3/8	69
4000	15-1/2	31	23-3/8	27-3/16	85-3/8	78
5000	15-1/2	32	24-3/8	27-11/16	88-3/8	87
6000	15-1/2	32	26-3/8	28-11/16	90-3/8	99
7000	17-1/2	36	28-3/8	31-11/16	100-3/8	114
8000	17-1/2	36	28-3/8	31-11/16	100-3/8	135
9000	17-1/2	38	30-3/8	32-11/16	106-3/8	135
10000	19-1/2	38	30-3/8	34-11/16	106-3/8	150
11000	19-1/2	38	30-3/8	34-11/16	106-3/8	177
12000	19-1/2	42	34-3/8	36-11/16	118-3/8	180
13000	20-1/2	46	36-3/8	38-11/16	128-3/8	192
14000	21-1/2	46	36-3/8	39-11/16	128-3/8	216
15000	21-1/2	46	38-3/8	40-11/16	130-3/8	234
16000	22-1/2	50	42-3/8	43-11/16	142-3/8	240
17000	23-1/2	50	42-3/8	44-11/16	142-3/8	267
18000	25-1/2	52	44-3/8	47-11/16	148-3/8	285
19000	25-1/2	54	46-3/8	48-11/16	154-3/8	300
20000	25-1/2	56	48-3/8	49-11/16	160-3/8	318
21000	26-1/2	60	52-3/8	52-11/16	172-3/8	366
22000	27-1/2	60	52-3/8	53-11/16	172-3/8	384
23000	29-1/2	62	54-3/8	56-11/16	178-3/8	405
24000	29-1/2	62	54-3/8	56-11/16	178-3/8	417
25000	29-1/2	62	54-3/8	56-11/16	178-3/8	450

Isolated Phase Bus 110kV BIL 65° C Rise

Self Cooled Rating Amps	Dimensions (inches)					Approx. 3-Ph Wt. (lbs./ft.)
	A	B	C	D	E	
1200	12-1/2	27	20-3/8	22-11/16	74-3/8	60
2000	13-1/2	28	20-3/8	23-11/16	76-3/8	63
3000	13-1/2	28	20-3/8	23-11/16	76-3/8	66
4000	14-1/2	30	21-3/8	25-3/16	81-3/8	72
5000	14-1/2	30	22-3/8	25-11/16	82-3/8	78
6000	14-1/2	32	24-3/8	26-11/16	88-3/8	93
7000	16-1/2	34	26-3/8	29-11/16	94-3/8	108
8000	16-1/2	34	26-3/8	29-11/16	94-3/8	126
9000	16-1/2	36	28-3/8	30-11/16	100-3/8	126
10000	18-1/2	36	28-3/8	32-11/16	100-3/8	141
11000	18-1/2	36	28-3/8	32-11/16	100-3/8	159
12000	18-1/2	40	32-3/8	34-11/16	112-3/8	168
13000	19-1/2	42	34-3/8	36-11/16	118-3/8	186
14000	20-1/2	42	34-3/8	37-11/16	118-3/8	210
15000	20-1/2	42	36-3/8	38-11/16	120-3/8	210
16000	20-1/2	46	40-3/8	40-11/16	132-3/8	258
17000	21-1/2	46	40-3/8	41-11/16	132-3/8	285
18000	22-1/2	50	42-3/8	43-11/16	142-3/8	285
19000	24-1/2	52	44-3/8	46-11/16	148-3/8	294
20000	24-1/2	52	46-3/8	47-11/16	150-3/8	309
21000	25-1/2	56	50-3/8	50-11/16	162-3/8	342
22000	26-1/2	56	50-3/8	51-11/16	162-3/8	355
23000	28-1/2	60	52-3/8	54-11/16	172-3/8	366
24000	28-1/2	60	52-3/8	54-11/16	172-3/8	408
25000	28-1/2	60	52-3/8	54-11/16	172-3/8	435

Isolated Phase Bus 150kV BIL 65° C Rise

Self Cooled Rating Amps	Dimensions (inches)					Approx. 3-Ph Wt. (lbs./ft.)
	A	B	C	D	E	
1200	15-1/2	34	26-3/8	28-11/16	94-3/8	75
2000	15-1/2	34	26-3/8	28-11/16	94-3/8	78
3000	15-1/2	34	26-3/8	28-11/16	94-3/8	81
4000	15-1/2	36	27-3/8	29-3/16	99-3/8	90
5000	15-1/2	36	28-3/8	29-11/16	100-3/8	99
6000	19-1/2	38	30-3/8	34-11/16	106-3/8	108
7000	19-1/2	40	32-3/8	35-11/16	112-3/8	126
8000	19-1/2	40	32-3/8	35-11/16	112-3/8	147
9000	21-1/2	42	34-3/8	38-11/16	118-3/8	147
10000	21-1/2	42	34-3/8	38-11/16	118-3/8	162
11000	21-1/2	42	34-3/8	38-11/16	118-3/8	186
12000	22-1/2	46	38-3/8	41-11/16	130-3/8	195
13000	22-1/2	48	40-3/8	42-11/16	136-3/8	207
14000	23-1/2	48	40-3/8	43-11/16	136-3/8	234
15000	23-1/2	50	42-3/8	44-11/16	142-3/8	252
16000	24-1/2	54	46-3/8	47-11/16	154-3/8	279
17000	25-1/2	54	46-3/8	48-11/16	154-3/8	315
18000	25-1/2	56	48-3/8	49-11/16	160-3/8	336
19000	27-1/2	58	50-3/8	52-11/16	166-3/8	351
20000	27-1/2	60	52-3/8	53-11/16	172-3/8	369
21000	28-1/2	64	56-3/8	56-11/16	184-3/8	381
22000	29-1/2	64	56-3/8	57-11/16	184-3/8	411
23000	31-1/2	66	58-3/8	60-11/16	190-3/8	418
24000	31-1/2	66	58-3/8	60-11/16	190-3/8	422
25000	31-1/2	66	58-3/8	60-11/16	190-3/8	456

Isolated Phase Bus Construction Features

Other design and construction features of Powell Isolated Phase Bus are as follows:



Contamination Protection

The conductor and insulating surfaces are completely protected from a contaminating atmosphere. Moisture accumulation within the housing is prevented by installation of filter-type drain plugs. Resistance heaters and air pressurization systems are also available to aid in keeping out contamination.

Insulator Support

High-creep, single insulator support of proven mechanical and electrical design results in fewer insulators required.

Flux Shielding

All but a small percentage of the total flux is contained within the housing, virtually eliminating induced heating in nearby metal.

Reduced Installation Time

Field installation time is reduced because the bus is supplied in the longest lengths practical. Simplified structural design, coupled with the light weight of aluminum, permits easy handling and installation.

Aluminum Construction

Both the housing and the conductors are fabricated from aluminum, providing high conductivity, corrosion-free operation, and optimal costs. (Copper conductors are also available, depending on the bus rating.)

Terminations

Due to the many possible configurations and differing requirements, connections to generators and transformers are, with few exceptions, custom-designed for each installation and application. Flexible braided straps are provided for ease of installation and to provide isolation from the vibration of connected equipment.

Isolated Phase Bus Accessories

Designers of new and modernized generating stations select the broad scope of isolated phase bus accessories offered by Powell to meet the technology challenges of today's power market. In addition, existing stations can be more easily modernized and upgraded at lower overall costs through the selection of Powell bus accessories. This unique range of products includes:

Potential Transformer and Surge Protection Cubicles

The integrity of isolated phase construction is continued in the design of Powell surge protection and potential transformer cubicles. The surge equipment and each transformer are located in individual phase compartments. These compartments are connected to the main bus by isolated phase bus. Potential transformer compartments are of the draw-out type. Draw-out potential transformer compartments are constructed so that they are not accessible in the operating position. In the fully opened position, the primary and secondary contacts of the transformer are disconnected and the primary terminal is automatically grounded.

Disconnect Switches

Powell can provide double side break or knife type disconnect switches for application with isolated phase, segregated phase, non-segregated phase bus duct systems. The product line includes switches with continuous ratings up to 14,000 amperes self-cooled. Higher amp ratings are achieved by forced air cooling.

Forced-Air Cooling Equipment

Isolated phase bus rated 25,000 amps and above is generally offered as a forced-air cooled system. Air from a blower flows through a heat exchanger and into the bus enclosure, usually entering the center phase. After flowing through the bus enclosure of the center phase, the air passes through air crossovers at the end of the bus run and returns to the heat exchanger through the outer two phases.

Other Accessories

Additional items available from Powell include:

- Generator neutral tie connections and enclosures
- Generator line-side cubicles
- Bus pressurization equipment
- Temperature monitoring devices
- Hydrogen seals and hydrogen gas detection equipment
- Space heaters



Powell's extensive range of bus accessories allows generating station designers maximum flexibility when developing new facilities and generation systems.

Bus Duct Design Details

Technical data for Powell standard non-segregated and segregated bus duct configurations is presented for design and layout purposes. Ratings have been tested in accordance with industry standards for a high level of reliability and to meet specification requirements. For further information or for ratings greater than 15kV or 5000 Amps, please contact our factory sales representatives.

Enclosures

Aluminum enclosures are standard for Powell. Mild steel and stainless steel enclosures are available to meet a variety of environmental requirements. Outdoor housings are weatherproof with gasketed and peaked top covers, screened breathers, and heaters for control of condensation. Typical indoor housings are totally enclosed, although ventilated bus is available with open top and bottom covers. The standard finish color is ANSI 61 gray, but special colors can be provided to match connected equipment. The enclosure usually serves as the ground conductor for the system, with ground bars, internal or external to the enclosure, available as an option.

Conductors

Copper conductors are standard. Silver-plated contact surfaces are provided at all joints and terminations. For all ratings, aluminum conductors can be supplied. Tin plated joints are standard when aluminum conductors are used.

Conductor Insulation

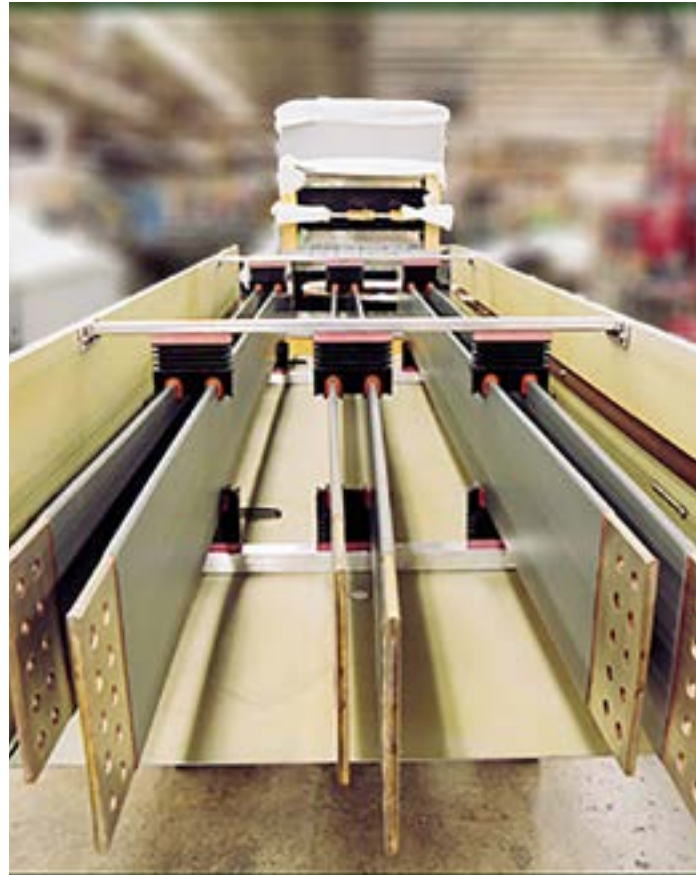
Bars on 5kV and higher ratings are insulated with electrostatically applied powder epoxy to provide an insulation quality unmatched in the industry. Bus bars are normally uninsulated for 600-volt service. Specially designed insulating boots aid in the installation of Powell equipment.

Conductor Supports

Molded fiberglass reinforced polyester blocks are utilized in standard ratings to provide the insulator support for conductors. Support spacing is determined based on short-circuit requirements and is established to withstand the electromagnetic forces during fault conditions. For special applications, molded epoxy blocks, wet-process porcelain or epoxy post insulators can be provided.

4-Pole Bus and Other Designs

Systems including half-neutrals, full neutrals, DC designs and other configurations are available from Powell. Information for enclosure sizes and ratings shown are standard Powell designs for a typical ambient temperature of 40°C. The housing is designed for a maximum temperature rise of 40°C and the conductors are designed for a maximum rise of 65°C over a 40°C ambient. Additional custom ambient designs are available.



Certifications and Standards

- UL approved designs
- Meets or exceeds IEEE, IEC, and CSA standards, including ANSI C37.23 for safety and performance
- Seismic certified to zip code (ASCE 10, CBC 2010, IBC 2009, IEEE 693-2005, UBC 1997)

Non-Segregated Bus Duct Dimensional Data

600V Designs

Copper Conductors

Amps	Figure	lbs/ft	Dimensions (inches)							Resistance	Watt Loss	Reactance	Impedance
			A	B	C	D	E	F	G	Microhms per phase per foot*	Per three phase foot*	Microhms per phase per foot*	Microhms per phase per foot*
1200A	1	29	10.00	18.50	10.18	6.00	21.00	21.68	10.93	11.2	60	48	49
1600A	1	36	10.00	18.50	10.18	6.00	21.00	21.68	10.93	8.9	85	47	48
2000A	1	47	12.00	18.50	12.18	6.00	21.00	21.68	12.93	6.0	89	38	39
2500A	1	56	12.00	18.50	12.18	6.00	21.00	21.68	12.93	5.0	116	38	38
3000A	1	72	16.00	18.50	16.18	6.00	21.00	21.68	16.93	4.0	133	38	38
3200A	1	72	16.00	18.50	16.18	6.00	21.00	21.68	16.93	4.0	152	38	38
4000A	2	103	20.00	18.50	20.18	6.00	21.00	21.68	20.93	3.0	158	17	17
5000A	3	126	20.00	40.00	20.18	12.00	42.50	43.25	21.00	2.0	193	40	40

*Typical Data at 60Hz

5 & 15 kV Designs

Copper Conductors

Amps	Figure	lbs/ft	Dimensions (inches)							Resistance	Watt Loss	Reactance	Impedance
			A	B	C	D	E	F	G	Microhms per phase per foot*	Per three phase foot*	Microhms per phase per foot*	Microhms per phase per foot*
1200A	1	40	12.00	27.00	12.18	8.00	29.50	30.18	12.93	12.2	58	55	57
1600A	1	40	12.00	27.00	12.18	8.00	29.50	30.18	12.93	8.9	75	53	54
2000A	1	50	14.00	27.00	14.18	8.00	29.50	30.18	14.93	6.7	83	53	54
2500A	1	59	14.00	27.00	14.18	8.00	29.50	30.18	14.93	4.7	91	53	53
3000A	1	75	16.00	33.00	16.18	11.00	35.50	36.18	16.93	3.7	126	48	48
3500A	1	87	18.00	33.00	18.18	11.00	35.50	36.18	18.93	3.1	148	42	42
4000A	1	97	20.00	40.00	20.25	12.00	42.50	43.25	21.00	3.1	176	45	45
5000A	3	126	20.00	40.00	20.25	12.00	42.50	43.25	21.00	2.0	193	40	40

*Typical Data at 60Hz

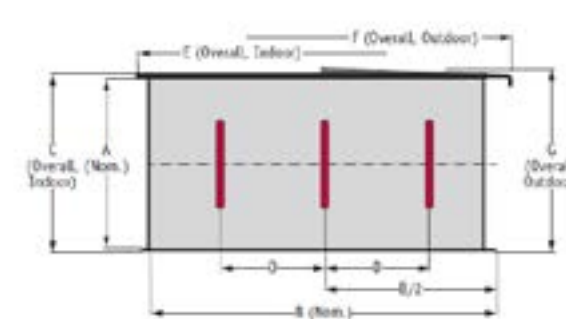


Figure 1

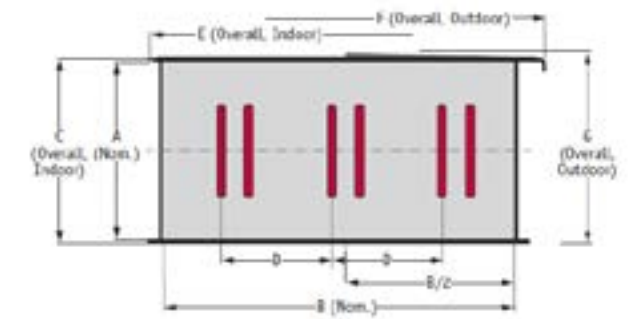


Figure 3

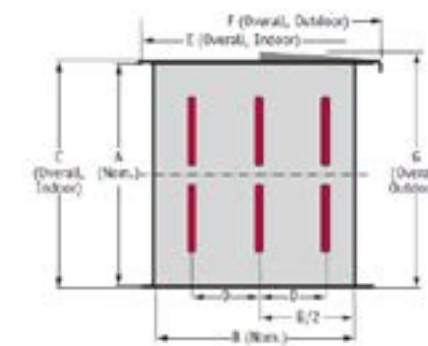


Figure 2

Bus Duct Wall Openings

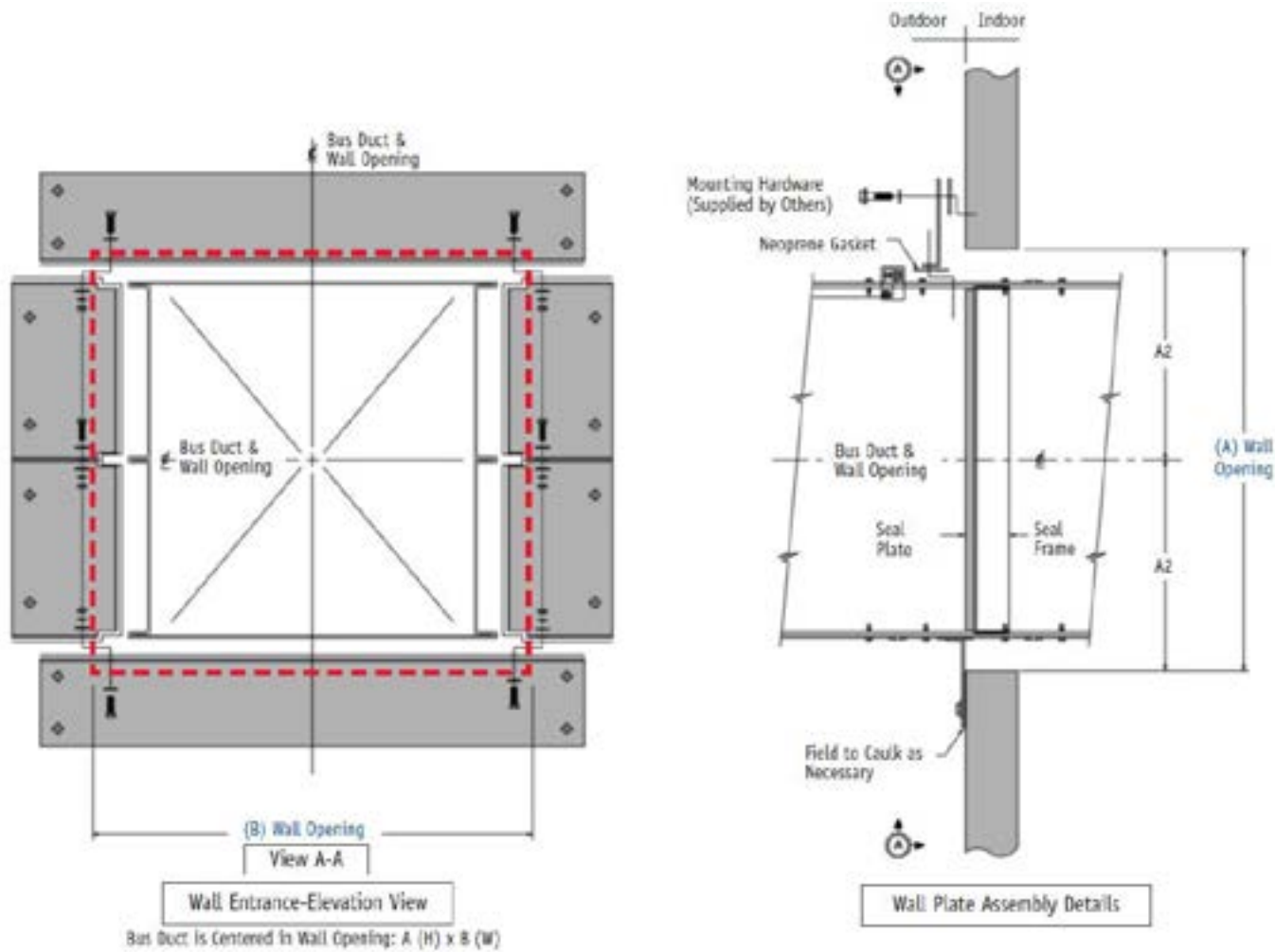
Non-Segregated Standard Bus Duct Components

600V Designs
Copper Conductors

	Amps	Bar/Phase	lbs/ft	Dimensions (inches)									
				A	B	C	D	E	F	G	H	J	K
3-phase 3-wire	1200	1	29	10	18.5	21	35.375	20.305	24.090	32	144	24.875	19.00
	1600	1	36	10	18.5	21	35.375	20.305	24.090	32	144	24.875	19.00
	2000	1	47	12	18.5	21	35.375	20.305	26.090	32	144	24.875	20.00
	2500	1	56	12	18.5	21	35.375	20.305	26.090	32	144	24.875	20.00
	3000/3200	1	72	16	18.5	21	35.375	20.305	30.090	32	144	24.875	22.00
3-phase 4-wire	1200	1	36	10	25	27.5	41.875	23.000	24.090	32	144	28.125	19.00
	1600	1	45	10	25	27.5	41.875	23.000	24.090	32	144	28.125	19.00
	2000	1	59	12	25	27.5	41.875	23.000	26.090	32	144	28.125	20.00
	2500	1	71	12	25	27.5	41.875	23.000	26.090	32	144	28.125	20.00
	3000/3200	1	91	16	25	27.5	41.875	23.000	30.090	32	144	28.125	22.00
4000	2	129	20	25	27.5	41.875	23.000	34.090	32	144	28.125	24.00	

5 & 15kV Designs
Copper Conductors

	Amps	Bar/Phase	lbs/ft	Dimensions (inches)									
				A	B	C	D	E	F	G	H	J	K
5 & 15kV 95 BIL	1200/1600	1	40	12	27	29.5	46.250	26.200	26.090	32	140	31.50	20.00
	2000	1	50	14	27	29.5	46.250	26.200	28.090	32	140	31.50	21.00
	2500	1	59	14	27	29.5	46.250	26.200	28.090	32	140	31.50	21.00
	3000/3200	1	75	16	33	35.5	52.250	28.685	30.090	32	140	34.50	22.00
	3500	1	87	18	33	35.5	52.250	28.685	32.090	32	140	34.50	23.00
	4000	1	97	20	40	42.5	59.250	31.585	34.125	32	140	38.00	24.00
	5000	2	126	20	40	42.5	59.250	31.585	34.125	32	140	38.00	24.00
15kV 110 BIL	5200	2	155	20	40	42.5	59.250	31.585	34.125	32	140	38.00	24.00
	6000	2	180	22	43	45.5	62.250	32.830	36.125	33	140	39.50	25.00
	1200/1600	1	40	14	27	29.5	46.250	26.200	28.090	32	140	31.50	21.00
	2000	1	50	16	27	29.5	46.250	26.200	30.090	32	140	31.50	22.00
	2500	1	59	16	27	29.5	46.250	26.200	30.090	32	140	31.50	22.00
	3000/3200	1	75	18	33	35.5	52.250	28.685	32.090	32	140	34.50	23.00
	3500	1	87	22	33	35.5	52.250	28.685	36.090	32	140	34.50	25.00
4000	1	97	22	40	42.5	59.250	31.585	36.125	32	140	38.00	25.00	
5000	2	126	22	40	42.5	59.250	31.585	36.125	32	140	38.00	25.00	
5200	2	155	22	40	42.5	59.250	31.585	36.125	32	140	38.00	25.00	
6000	2	180	24	43	45.5	62.250	32.830	38.125	32	140	39.50	26.00	



Wall penetrations:

Powell wall penetration accessories are available to complete the installation of the bus duct at the entrance to a building. The wall plates are designed to allow the installing contractor to seal the building off from the outdoor elements.

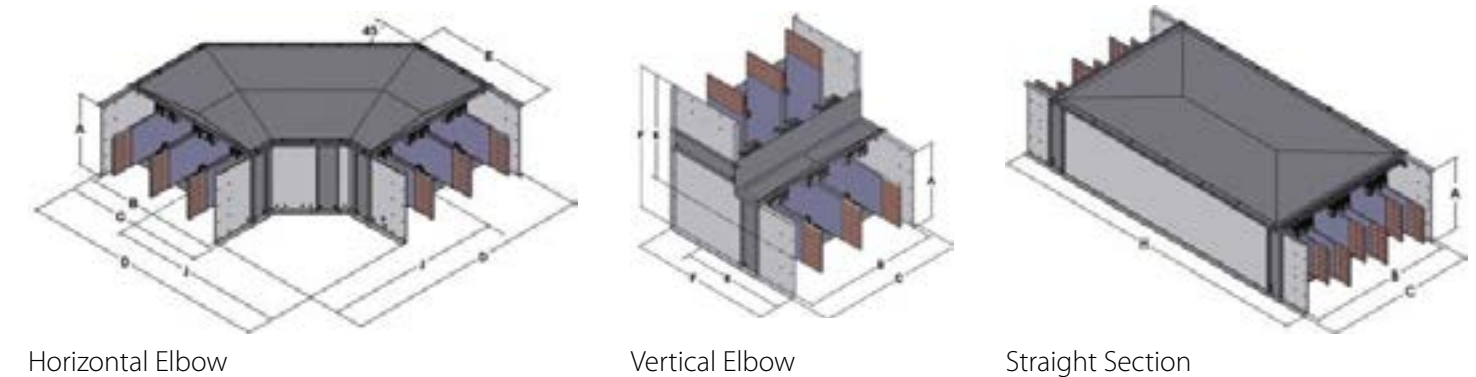
Fire Ratings and Vapor Barriers:

Powell offers a range of vapor and fire ratings for wall penetration applications. Fire ratings of 1/2 hour, 1 hour, 2 & 3 hours, and 4 hours are available depending on the specific application.

Typical Wall Opening Sizes:

Nominal Housing Size (H x W)	Dimensions	
	A	B
10.00" x 18.50"	14"	25"
12.00" x 18.50"	16"	25"
12.00" x 27.00"	16"	33.5"
14.00" x 27.00"	18"	33.5"
16.00" x 18.50"	20"	25"
16.00" x 33.00"	20"	39.5"
18.00" x 33.00"	22"	39.5"
20.00" x 40.00"	24"	46"

Sizes and dimensions typical for 600V, 5kV, and 15kV bar bus applications.



Cable Bus Design Details

Data regarding cross section dimensions, cable size and number of cables required for standard ratings is presented for design and layout purposes. Please contact our factory sales representatives for ratings or features not shown in the attached chart.

Typical enclosures for cable bus systems are fabricated by forming aluminum side members and coupling these with formed sheet aluminum covers. Standard designs have ventilated top and bottom covers. Optionally, outdoor cable bus can have ventilated side members and ventilated bottom covers with enclosed top covers that have a peaked configuration to aid weather resistance. Standard enclosures have no finish coat, although bus can be coated to meet application requirements or to match connected equipment.

Conductors

Insulated copper cable conductors are supplied as required. Insulated neutral phase conductors and ground conductors (bare or insulated) can be an added option. Cable insulation and jacketing material is selected based on the application and purchaser's specifications.

Cable Supports

Cables are firmly secured in place using molded fiberglass or hard maple supports. Supports and brackets are situated approximately every 36" along horizontal lengths of bus and approximately every 18" in vertical runs to provide the required short circuit strength.

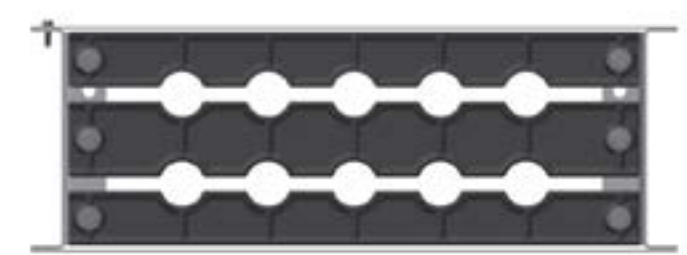
Interleaving

Longer bus runs with two or more cables per phase are designed for the proper interleaving of conductors. This is done to achieve the best current balance between phases and the lowest system impedance.

Other Accessories

Field installation, cable termination kits, lugs and supporting structures can be provided as part of our package. Equipment terminations are custom designed to match requirements of the customer's switchgear, transformers, generators and motor control centers.

Our vast experience in bus allows us the ability to deviate from standard cable bus specifications. We even offer stainless steel and anodized aluminum enclosures.



Certification and Standards

- *CSA certified to C22.2 #27 and C22.2 #201 (busway and metal enclosed HV busway)*
- *UL approved for equipment grounding.*

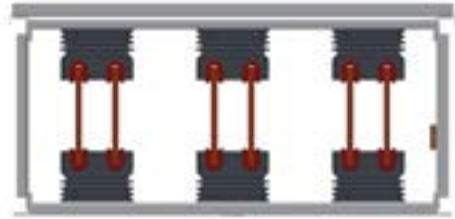
Cable Bus Design Configurations

Copper cable for 600V and 5kV can be shielded or non-shielded. Copper cable for 15kV ratings is provided with shielded construction.

Maximum Current Rating	Cable Options		Total # of Cables	Rows x Cables	Nom Housing Dim (in)	Min Cable OD (in)	Max Cable OD (in)	Weight per foot (lbs)	600V			5kV			15kV		
	# per phase	Type							Nom Housing Dim (in)	Min Cable OD (in)	Max Cable OD (in)	Weight per foot (lbs)	Nom Housing Dim (in)	Min Cable OD (in)	Max Cable OD (in)	Weight per foot (lbs)	Nom Housing Dim (in)
40°C Ambient Design	800A	1	750MCM	3	1 x 3	6 x 15	1.13	1.37	17.5	6 x 15 6 x 18.5	1.44 1.57	1.56 1.61	18.5 21.0	6 x 18.5	1.59	1.89	22.0
	1200A	2	500MCM	6	2 x 3	8 x 15	0.92	1.16	22.0	8 x 15	1.25	1.41	24.0	8 x 15 10 x 18.5	1.41 1.57	1.56 1.63	25.5 28.5
	1600A	2	750MCM	6	2 x 3	8 x 15	1.13	1.37	37.0	8 x 15 10 x 18.5	1.44 1.57	1.56 1.61	29.0 32.5	10 x 18.5	1.59	1.89	35.0
	2000A	3	750MCM	9	2 x 5	8 x 21	1.13	1.37	37.0	8 x 21 10 x 25	1.44 1.57	1.56 1.61	40.5 44.0	10 x 25	1.59	1.89	47.5
	2500A	4	500MCM	12	2 x 6	8 x 25	.92	1.16	36.5	8 x 25	1.25	1.41	41.0	8 x 25 10 x 29	1.41 1.57	1.56 1.63	44.0 47.5
	3000A	4	750MCM	12	2 x 6	8 x 25	1.13	1.37	47.0	8 x 25 10 x 29	1.44 1.57	1.56 1.61	51.5 55.0	10 x 29	1.59	1.89	60.0
	3500A	4	1000MCM	12	2 x 6	8 x 25	1.28	1.52	56.0	10 x 29	1.58	1.80	65.0	10 x 29	1.73	2.04	71.0
	4000A	6	750MCM	18	3 x 6	12 x 25	1.13	1.37	66.0	12 x 25 14 x 29	1.44 1.57	1.56 1.61	72.5 77.0	14 x 29	1.59	1.89	85.0
	5000A	6	1000MCM	18	3 x 6	12 x 25	1.28	1.52	80.0	14 x 29	1.58	1.80	92.5	14 x 29	1.73	2.04	102.0

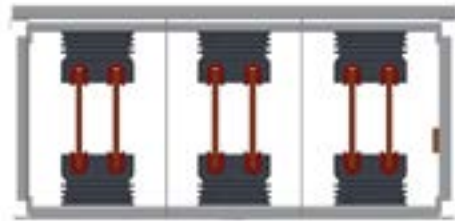
Maximum Current Rating	Cable Options		Total # of Cables	Rows x Cables	Nom Housing Dim (in)	Min Cable OD (in)	Max Cable OD (in)	Weight per foot (lbs)	600V			5kV			15kV		
	# per phase	Type							Nom Housing Dim (in)	Min Cable OD (in)	Max Cable OD (in)	Weight per foot (lbs)	Nom Housing Dim (in)	Min Cable OD (in)	Max Cable OD (in)	Weight per foot (lbs)	Nom Housing Dim (in)
50°C Ambient Design	1200A	3	750MCM	9	2 x 5	8 x 21	1.13	1.37	37.0	8 x 21 10 x 25	1.44 1.57	1.56 1.61	40.5 44.0	10 x 25	1.59	1.89	47.5
	1600A	3	750MCM	9	2 x 5	8 x 21	1.13	1.37	37.0	8 x 21 10 x 25	1.44 1.57	1.56 1.61	40.5 44.0	10 x 25	1.59	1.89	47.5
	2000A	4	500MCM	12	2 x 6	8 x 25	0.92	1.16	36.5	8 x 25	1.25	1.41	41.0	8 x 25 10 x 29	1.41 1.57	1.56 1.63	44.0 47.5
	2500A	4	750MCM	12	2 x 6	8 x 25	1.13	1.37	47.0	8 x 25 10 x 29	1.44 1.57	1.56 1.61	51.5 55.0	10 x 29	1.59	1.89	60.0
	3000A	5	750MCM	15	3 x 5	12 x 21	1.13	1.37	56.0	12 x 21 14 x 25	1.44 1.57	1.56 1.61	61.5 66.0	14 x 25	1.59	1.89	72.0
	3200A	5	750MCM	15	3 x 5	12 x 21	1.13	1.37	56.0	12 x 21 14 x 25	1.44 1.57	1.56 1.61	61.5 66.0	14 x 25	1.59	1.89	72.0
	4000A	7	750MCM	21	3 x 7	12 x 29	1.13	1.37	75.5	12 x 29	1.44	1.56	83.0	14 x 33	1.59	1.89	97.0
										14 x 33	1.57	1.61	88.0				

Application Cross Sections



Non-Segregated Phase Bus

Non-segregated phase bus duct is available for voltages ranging from 600 volts through 38kV, with ampere ratings up to 8000 amps. Non-segregated phase bus has all phase conductors in a common enclosure with an air space between phases. There are no metallic barriers between conductors of adjacent phases. Conductors may be mounted on custom molded fiberglass reinforced polyester blocks or on post insulators. Enclosures that are totally enclosed are preferred, but ventilated enclosures can be provided in indoor applications. Typical applications include connections between transformers and switchgear, tie connections between motor control centers and large motors, and as the main power lead from small generators.



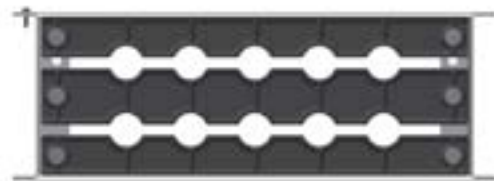
Segregated Phase Bus

Segregated phase bus duct is available for voltages ranging from 600 volts through 38kV, with ampere ratings up to 8000 amps. Segregated phase bus has all phase conductors in a common enclosure with metal barriers between adjacent phases. Conductors may be mounted on molded fiberglass reinforced polyester blocks or on post insulators. This design is primarily used as a generator lead in power plants, but it is also used in heavy industrial applications and as a switchgear tie in metal-enclosed substations.



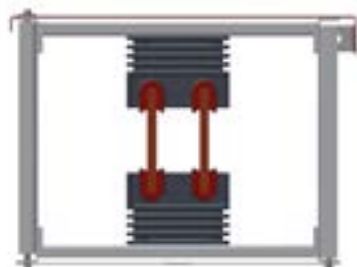
Bus with Porcelain Support Insulators

For voltages higher than 15kV and currents above 5000 amps, porcelain post insulators are the preferred means of support for the phase conductors. However, these post supports may be used as the main conductor support at any lower voltage or current. Applications are similar to those listed for non-segregated phase and segregated phase bus duct.



Cable Bus

Cable bus consists of a metal enclosure containing conductors that are fully insulated copper cables. Using support blocks, the cables are maintained at spacings slightly greater than two cable diameters between centers to achieve maximum operating current for each cable. Cable bus can be supplied at voltages up to 38kV and currents up to 5000 amps. Applications include connections between transformers and switchgear, ties between switchgear and switchgear, and connections between motor control centers and large motors.



DC Bus

DC bus can be supplied to meet the needs of most direct current applications. Powell manufactures DC bus in two basic configurations: with both poles contained in the same enclosure, or with each pole contained in a separate enclosure. Applications include generator exciter systems, power feeds for electric furnaces, and various connections in traction power installations.

Service and Maintenance of Bus Systems

Rely on the Experts for Repair

At Powell, we provide engineering services and field services to help you identify and analyze equipment that is in need of repair. Once the analysis is completed, our team will put together a repair plan for you. With our comprehensive approach, we will get equipment repaired and back up and running again.

A Comprehensive Plan for Replacement

The replacement plan can accommodate complete system replacement or replacement of individual parts, to avoid costly down time for your facility. Powell is also able to provide a range of specialty and custom-fit parts to meet the unique needs of each facility. This includes the provision of specialty cubicles and accessories.

Refurbishment: Updating your System to Function Like New

Often the best course of action at a facility is to upgrade existing equipment to meet higher ratings and industry standards. At Powell, the final facet of the RRR plan is the refurbishment and upgrade of a system to help your facility remain operational in today's power market.



Before



After

OUTSTANDING VALUE

We own and support legacy product lines including Delta-Star, HK Porter, Unibus and Westinghouse as well as our current product line, Delta/Unibus. We adhere to high standards of quality on every job we perform, and we design our products with safety in mind.



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