



Power  
Switchgear

## Porcel-line™ metal-clad switchgear with type DH-P air circuit breakers

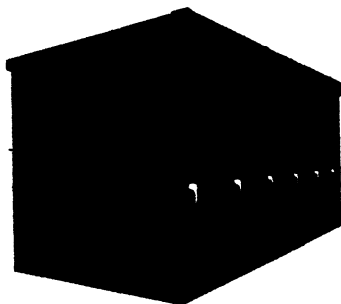
application  
data

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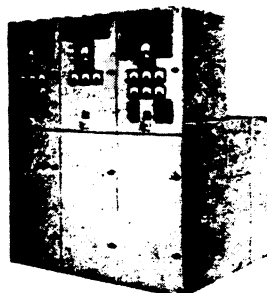
page 1

75 to 750 mva interrupting capacity • 4160 to 13800 volts  
1200 and 2000 amps • indoor and outdoor

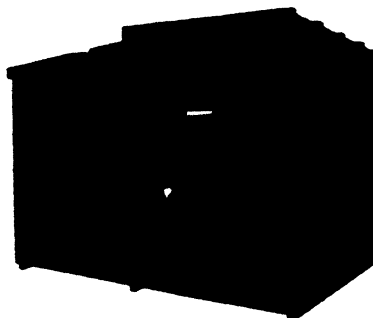
type DH-P magnetic air circuit  
breaker—for indoor or outdoor  
Porcel-line metal-clad switchgear



outdoor Aisle-less



indoor



outdoor Shelterfor-M

### application

Westinghouse Porcel-line metal-clad switchgear with type DH-P air circuit breakers provides centralized control and protection for generators, motors, transformers, capacitors, and all types of feeder circuits. It is available in ratings of 4160 and 13,800 volts with maximum interrupting capacities of 250 mva and 750 mva, respectively. It is available for both indoor and outdoor applications.

### typical applications

Electric utility systems, industrial plants, commercial buildings, municipal pumping stations, transportation systems, unit substations.

### description

Porcel-line metal-clad switchgear is an assembly of circuit breaker housings and auxiliary housings arranged to suit the specific requirements of a purchaser. Each housing is self-contained with Westinghouse components. These components include bus, instruments transformers, potential transformers, relays, instruments, meters and control devices—all assembled into a compact, completely metal enclosed structure.

The circuit breaker housing includes a horizontal drawout type DH-P air circuit breaker. It also includes high voltage equipment, primary connections, low voltage equipment, and control devices. A hinged instrument panel is located on the front of the housing. The auxiliary housing has no provisions for a circuit breaker. It does include miscellaneous equipment and such equipment that cannot be contained in a circuit breaker housing. A hinged instrument panel is also located on the front of the housing.

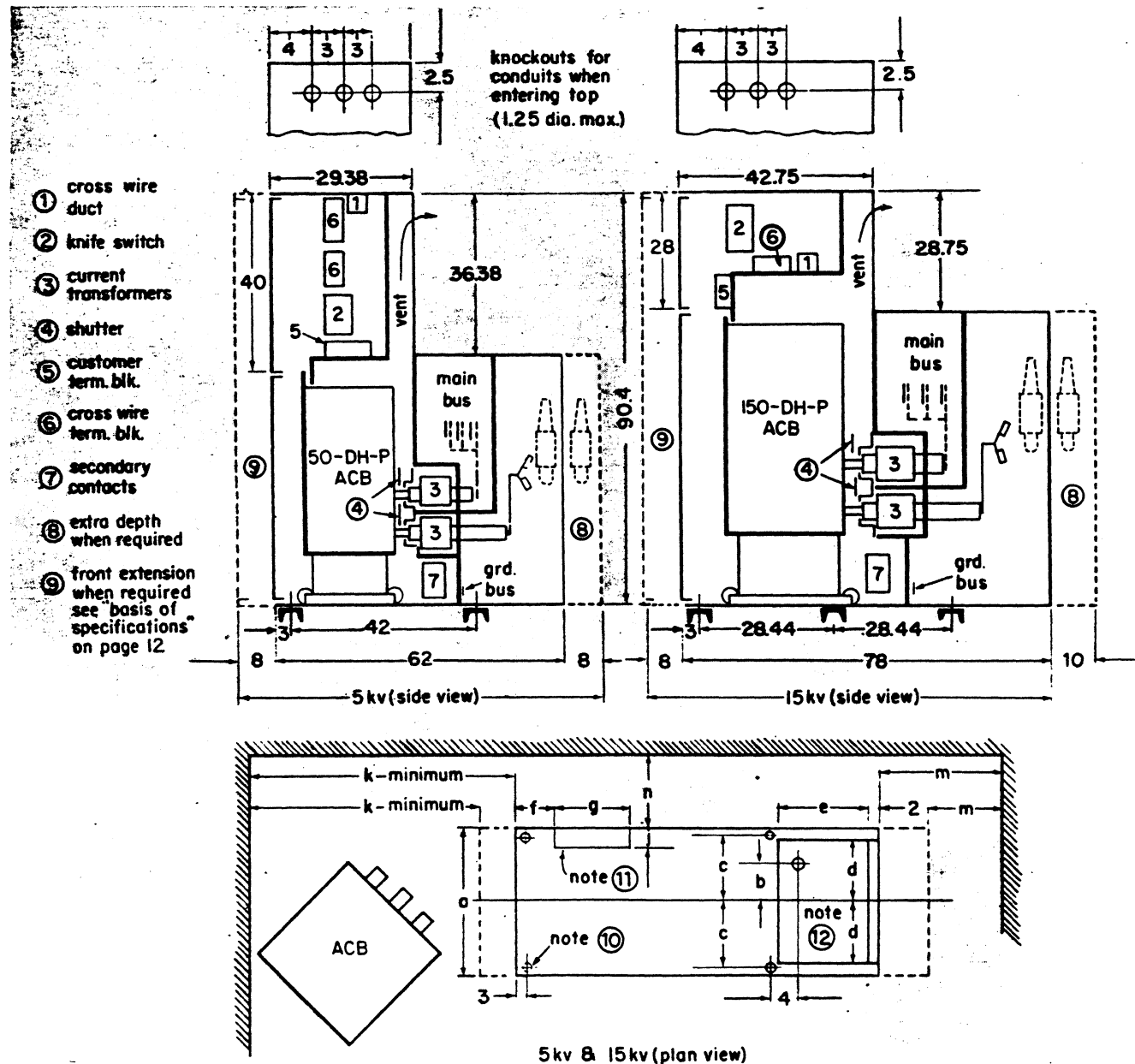
Porcel-line metal-clad switchgear is available for both indoor and outdoor applications. The circuit breakers and design features are similar whether the installation be indoor or outdoor. In general, outdoor metal-clad switchgear is constructed by assembling a weatherproof enclosure onto and around standard indoor housings.

Outdoor Shelterfor-M switchgear is an assembly of a weatherproof enclosure onto and around indoor housings and including an operating or maintenance aisle where equipment is accessible without exposure to weather. The aisle permits interchanging type DH-P circuit breakers. A weatherproof door is located at each end of the aisle and each is equipped with "crash" mechanisms permitting quick release from the inside when the door is padlocked on the outside. Aisle lights, switches, and service receptacles are provided. Foundation requirements are simple—the structure is supported by three base channels. Pier mounting is possible. No breaker drawout pad is required and indoor accessories may be used.

Outdoor Aisle-less switchgear is an assembly of a weatherproof enclosure onto and around indoor housings but not including an operating or maintenance aisle. Weatherproof doors are located on the breaker drawout side of each housing. A light and service receptacle is available in each housing. Aisle-less switchgear is similar to Shelterfor-M without the aisle but with a weatherproof front module. Foundation requirements are simple—the structure is supported by two base channels. A breaker drawout pad and outdoor accessories should be used.



outline dimensions: indoor

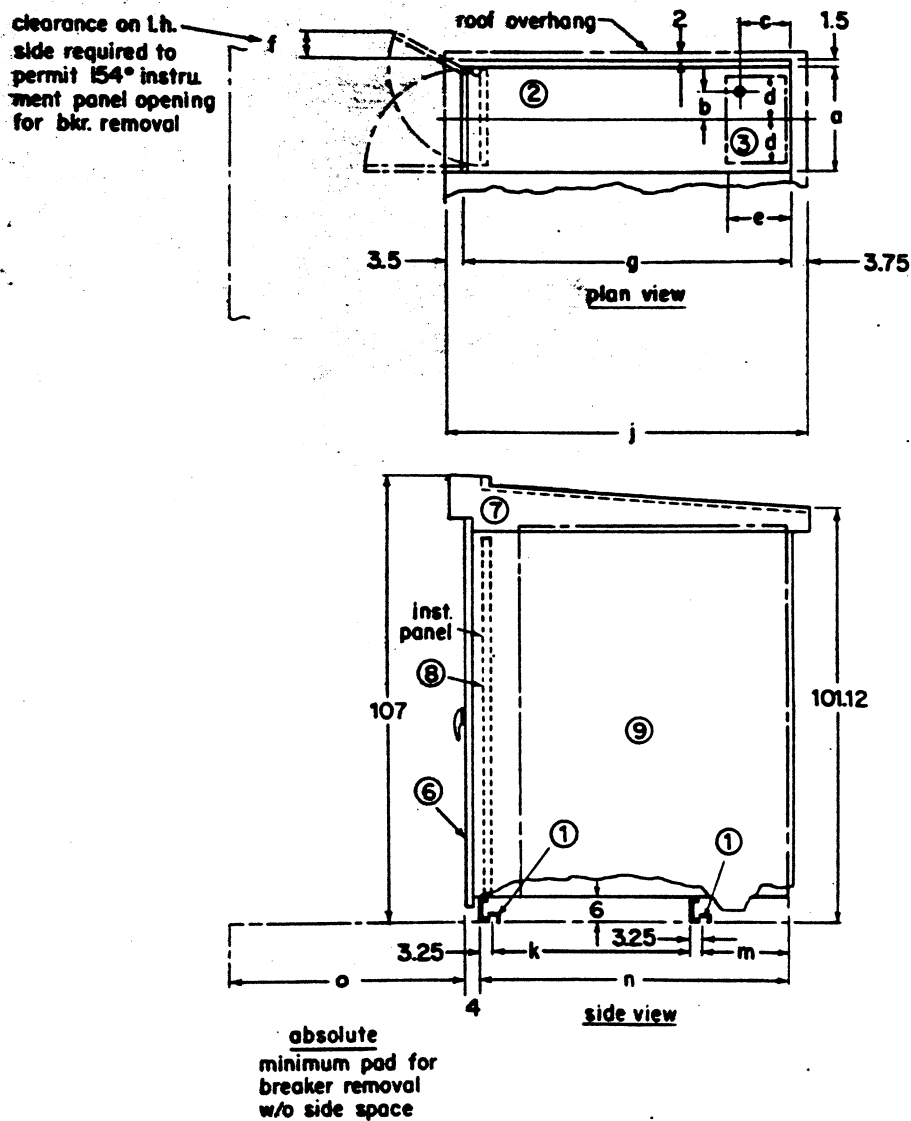


type of housing	amps	indoor dimensions: inches											approximate weight (lbs) housing only <sup>Ⓐ</sup>
		a	b	c	d	e	f	g	j	k	m	n	
5 kv-hkr	1200 2000	26	7.38	11.81	10.5	12.88	5.25	15	3.12	36	26	18	1600 1800
5 kv-aux	....	26	7.38	11.81	10.5	12.88	5.5	3.5	14.06	36	26	18	2200
15 kv-hkr	1200 2000	36	10.62	16.81	15.5	14	5.25	15	3.12	49	36	24	2000 2200
15 kv-aux	....	36	10.62	16.81	15.5	14	5.5	3.5	14.06	49	36	24	2800

- Ⓐ .75 x 1 slot for .5 bolts or welding (no bolting or welding to middle 15 kv channel).  
<sup>Ⓑ</sup> space for 2 in. secondary conduits (max. projection 2 in. above foundation).  
<sup>Ⓒ</sup> space for primary conduits and ground connection.  
<sup>Ⓓ</sup> see table a, page 6, for type DHP circuit breaker weights.

75 to 750 mva interrupting capacity • 4160 to 13800 volts  
1200 and 2000 amps • indoor and outdoor

**outline dimensions: Aisle-less**

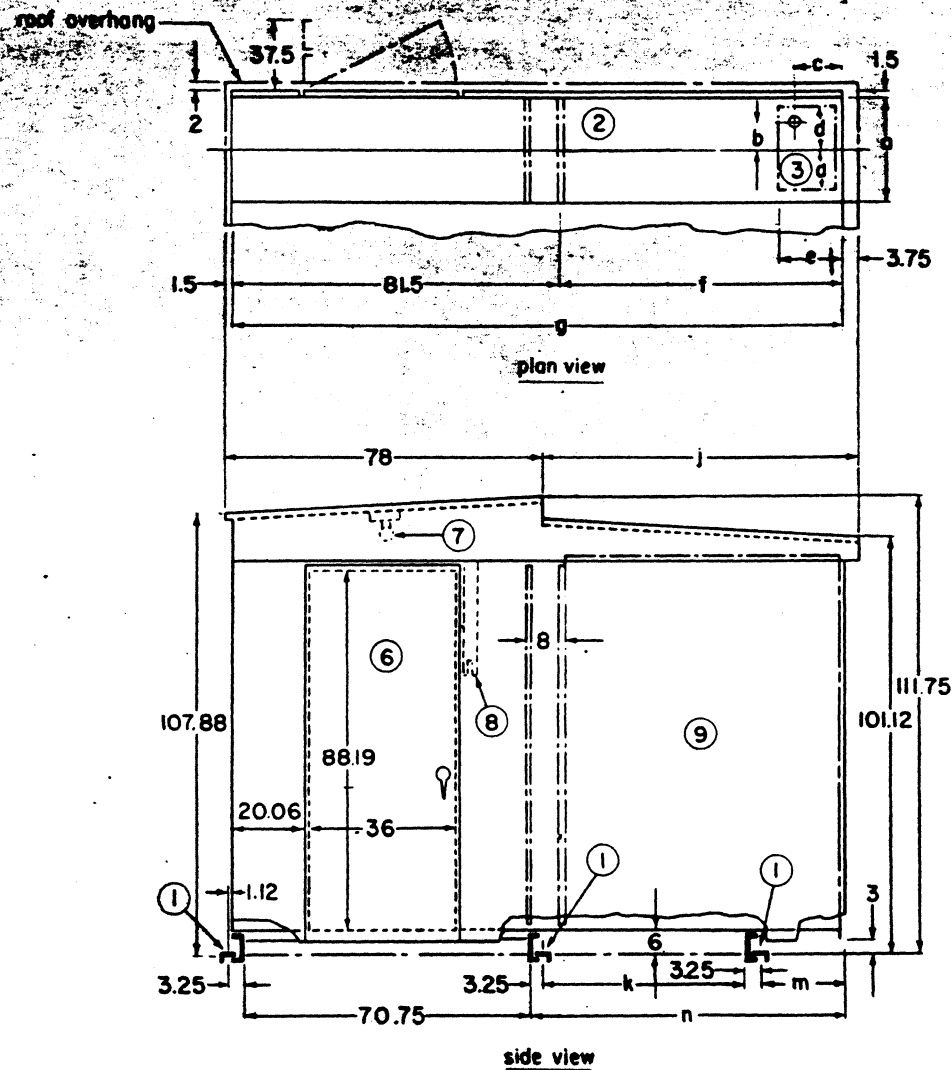


type of housing	amps	aisle-less dimensions: inches												approximate weight (lbs) <sup>①</sup> housing only <sup>②</sup>
		a	b	c	d	e	f	g	j	k	m	n	o	
5 kv-bkr	1200 2000	26	7.38	14.5	10.5	15.75	16.5	82.62	89.88	49.12	23	78.62	59	1950 2150
5 kv-aux	.....	26	7.38	14.5	10.5	15.75	16.5	82.62	89.88	49.12	23	78.62	59	2550
15 kv-bkr	1200 2000	36	10.62	17.5	15.5	18.88	23.5	100.62	107.88	64	26.12	96.62	80	2400 2600
15 kv-aux	.....	36	10.62	17.5	15.5	18.88	23.5	100.62	107.88	64	26.12	96.62	80	3200

- ① tie down clips for foundation bolts.
- ② space for secondary conduits same as indoor on page 2.
- ③ space for primary conduits and ground connection.
- ④ see table a, page 6, for type DH-P circuit breaker weights.
- ⑤ includes one indoor housing plus weatherproofing.
- ⑥ weatherproof door on each housing.
- ⑦ light in each unit.
- ⑧ receptacle on each instrument panel.
- ⑨ housing details same as indoor on page 2.



outline dimensions: Shelterfor-M (single row)

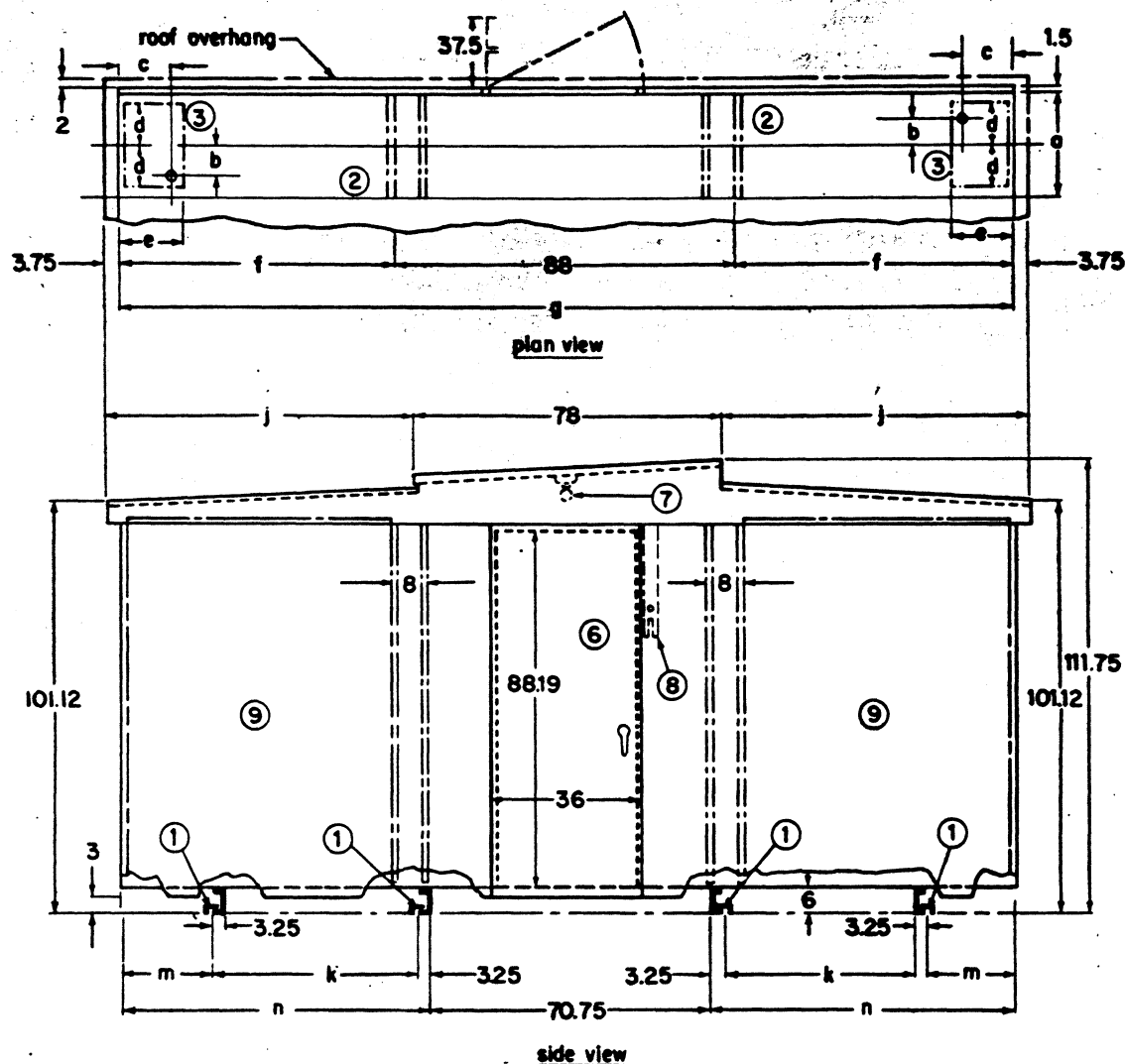


type of housing	amps	shelterfor-M (single row) dimensions: inches											approximate weight (lbs) ① housing only ②
		a	b	c	d	e	f	g	j	k	m	n	
5 kv-hkr	1200	26	7.38	14.5	10.5	15.75	70	151.5	78.75	49.12	23	78.62	2150
	2000	26	7.38	14.5	10.5	15.75	70	151.5	78.75	49.12	23	78.62	2350
5 kv-aux	1200	26	7.38	14.5	10.5	15.75	70	151.5	78.75	49.12	23	78.62	2750
	2000	36	10.62	17.5	15.5	18.88	88	169.5	96.75	64	26.12	96.62	2700
15 kv-hkr	1200	36	10.62	17.5	15.5	18.88	88	169.5	96.75	64	26.12	96.62	2900
	2000	36	10.62	17.5	15.5	18.88	88	169.5	96.75	64	26.12	96.62	3500

- ① tie down clips for foundation bolts.
- ② space for secondary conduits same as indoor on page 2.
- ③ space for primary conduits and ground connection.
- ④ see table a, page 6, for type DH-P circuit breaker weights.
- ⑤ includes one indoor housing plus weatherproofing plus aisle.
- ⑥ aisle door at each end of aisle.
- ⑦ aisle light at every second unit.
- ⑧ aisle light switch and receptacle at each end of aisle.
- ⑨ housing details same as indoor on page 2.

75 to 750 mva interrupting capacity • 4160 to 13800 volts  
1200 and 2000 amps • indoor and outdoor

outline dimensions: Shelterfor-M (double row)



type of housing	amps	shelterfor-M (double row) dimensions: inches											approximate weight (lbs) ① housing only ②
		a	b	c	d	e	f	g	j	k	m	n	
5 kv-bkr	1200 2000	26	7.38	14.5	10.5	15.75	70	228	78.75	49.12	23	78.62	4000 4400
5 kv-aux	.....	26	7.38	14.5	10.5	15.75	70	228	78.75	49.12	23	78.62	5200
15 kv-bkr	1200 2000	36	10.62	17.5	15.5	18.88	88	264	96.75	64	26.12	96.62	5000 5400
15 kv-aux	.....	36	10.62	17.5	15.5	18.88	88	264	96.75	64	26.12	96.62	6600

- ① tie down clips for foundation bolts.
- ② space for secondary conduits same as indoor on page 2.
- ③ space for primary conduits and ground connection.
- ④ see table a, page 6, for type DH-P circuit breaker weights.
- ⑤ includes two indoor housings plus weatherproofing plus aisle.
- ⑥ aisle door at each end of aisle.
- ⑦ aisle light at every second unit.
- ⑧ aisle light switch and receptacle at each end of aisle.
- ⑨ housing details same as indoor on page 2.



## technical data

table a: air circuit breakers—type DH-P • 60 cycles

type	3-phase inter- rupting rating in mva	voltage ratings in kilovolts			current ratings in amperes			interrupting rating in amperes		approximate weight in pounds	
		rated	max.	min. for rated mva	contin- uous at 60 cycles	momen- tary	four second	at rated voltage	max.	dead only	impact only
50DH-P75	75	4.16	4.76	3.5	1200	20000	12500	10400	12500	567	283
150DH-P250	250	4.16	4.76	3.85	1200	60000	37500	38000	37500	737	363
150DH-P250	250	4.16	4.76	3.85	2000	60000	37500	38000	37500	754	376
150DH-P500	500	13.8	15.0	11.5	1200	40000	25000	21000	25000	1400	700
150DH-P500	500	13.8	15.0	11.5	2000	40000	25000	21000	25000	1420	710
150DH-P800	800	13.8	15.0	11.5	1200	60000	25000	21000	25000	1400	700
150DH-P800	800	13.8	15.0	11.5	2000	60000	25000	21000	25000	1420	710
150DH-P750	750	13.8	15.0	11.5	1200	60000	37500	31000	37500	1580	780
150DH-P750	750	13.8	15.0	11.5	2000	60000	37500	31000	37500	1600	800

table b: control power requirements

rated control volts	closing range volts	tripping range volts	ind. light amps	trip coil "TC" amps	solenoid A.C.B.				stored energy A.C.B.			
					close coil "CC" E/R amps				spring release coil "SR" amps	motor		sec- onds to charge
					50DH-P 75/250	150DH-P 500 40000 A mom.	150DH-P 500 60000 A mom.	150DH-P 750		run amps 5 kv A.C.B.	15 kv A.C.B.	
48 v. dc	40- 50	28- 60	.032	7.8	...	...	...	...	7.8	5.5	7.5	5
125 v. dc	105-130	70-140	.032	4.15	57.5	75.8	119.0	119.0	4.15	3.0	4.0	5
250 v. dc	210-260	140-280	.032	1.68	34.8	50.0	60.5	60.5	1.68	1.4	1.5	5
115 v. ac	95-125	95-125	.032	6.6	...	...	...	...	6.6	3.9	3.6	5
230 v. ac	190-250	190-250	.032	2.35	...	...	...	...	2.35	1.9	1.8	5

table c: control power transformers • disconnect type • 1 phase • 60 cycles

line no.	primary volts①			secondary volts	kva	kv class
	taps					
	+7½%	rated	-7½%			
1	2580	2400	2220	240/120	5, 10, 15	5
2	4470	4160	3850	240/120	5, 10, 15	5
3	5160	4760	4400	240/120	5, 10, 15	5
4	12900	12000	11100	240/120	5, 10, 15	15
5	14300	13300	12300	240/120	5, 10, 15	15

① If connected, line to neutral system must be solidly grounded.

75 to 750 mva interrupting capacity • 4160 to 13800 volts  
1200 and 2000 amps • indoor and outdoor

## technical data

table d: potential transformers • type PTM • 50/60 cycles

line no.	system volts line to line	pot. transf. connec- tion	primary rating (ASA std)	ratio	BIL kv	maximum no. of pts. per unit width		accuracy classification					thermal va 55°C
								W	X	Y	Z	ZZ	
						5 kv 26 in	15 kv 36 in	12.5 va 0.10 pf	25 va 0.70 pf	75 va 0.85 pf	200 va 0.85 pf	400 va 0.85 pf	
1	2400	Δ	2400/4180Y	20	60	2	..	0.3	0.3	0.3	1.2	..	600
2	4200	Δ	4200/4200Y	35	60	2	..	0.3	0.3	0.3	1.2	..	600
3	4760	Δ	4800/4800Y	40	60	2	..	0.3	0.3	0.3	1.2	..	600
④ 4	2400	Y	4180GY/2400	20	60	3	...	0.3	0.3	0.3	1.2	..	600
⑤ 5	4160	Y	4180GY/2400	20	60	3	...	0.3	0.3	0.3	1.2	..	600
⑥ 6	4200	Y	4200GY/2425	35	60	3	...	0.3	0.3	1.2	..	..	380
⑦ 7	4760	Y	4800GY/2771	40	60	3	...	0.3	0.3	1.2	..	..	380
8	4800	Δ	4800/8320Y	40	95	..	2	0.3	0.3	0.3	0.3	1.2	1000
9	7200	Δ	7200/12470Y	60	95	..	2	0.3	0.3	0.3	0.3	1.2	1000
10	12000	Δ	12000/12000Y	100	95	..	2	0.3	0.3	0.3	0.3	1.2	1000
11	14400	Δ	14400/14400Y	120	95	..	2	0.3	0.3	0.3	0.3	1.2	1000
⑪ 12	4800	Y	8320GY/4800	40	95	..	3	0.3	0.3	0.3	0.3	1.2	1000
⑫ 13	7200	Y	8320GY/4800	40	95	..	3	0.3	0.3	0.3	0.3	1.2	1000
⑬ 14	12000	Y	12000GY/6928	100	95	..	3	0.3	0.3	0.3	1.2	..	880
⑭ 15	12470	Y	12470GY/7200	60	95	..	3	0.3	0.3	0.3	0.3	1.2	1000
⑮ 16	14400	Y	14400GY/8314	120	95	..	3	0.3	0.3	0.3	1.2	..	880
⑯ 17	14560	Y	14560GY/8400	70	95	..	3	0.3	0.3	0.3	0.3	1.2	1000

① When connected Y, accuracy va is 1/2 and thermal va is 55%.

② When connected Y must be used on solidly grounded system.

③ Fluxed for line to line volts.

④ For technical data see TD 44-060.

table e: current transformers • type RCT • 50/60 cycles

line no.	kv class	primary amps 55°C ambient	sec. amps	ratio	accuracy			
					metering			relaying
					B0.1	B0.5	B2.0	10H
① 1	5 & 15	50	5	10	1.2	2.4	..	10
2	5 & 15	75	5	15	0.6	2.4	..	20
3	5 & 15	100	5	20	0.6	2.4	..	20
4	5 & 15	150	5	30	0.6	2.4	..	20
5	5 & 15	200	5	40	0.6	2.4	..	20
6	5 & 15	300	5	60	0.6	2.4	2.4	20
7	5 & 15	400	5	80	0.3	1.2	2.4	50
8	5 & 15	600	5	120	0.3	0.3	2.4	50
9	5 & 15	800	5	160	0.3	0.3	1.2	50
10	5 & 15	1000	5	200	0.3	0.3	0.3	100
11	5 & 15	1200	5	240	0.3	0.3	0.3	100
12	5 & 15	1500	5	300	0.3	0.3	0.3	100
13	5 & 15	2000	5	400	0.3	0.3	0.3	100
14	15	2500	5	500	0.3	0.3	0.3	100
⑮ 15	5	2800	5	500	0.3	0.3	0.3	100
16	5	2000	4	500	0.3	0.3	0.3	100
17	15	3000	5	600	0.3	0.3	0.3	100
⑮ 18	5	3000	5	600	0.3	0.3	0.3	100
19	5	2000	3.33	600	0.3	0.3	0.3	100
20	15	4000	5	800	0.3	0.3	0.3	100
⑮ 21	5	4000	5	800	0.3	0.3	0.3	100

① Two 100/5 rct's with secondaries in parallel.

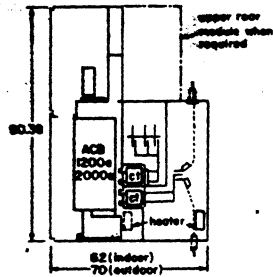
② Mounted in special location in line compartment.

Refer to nearest Westinghouse sales office.

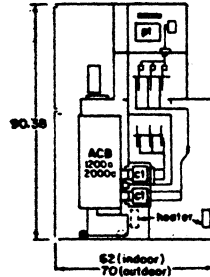
③ For technical data see Westinghouse TD 44-060.



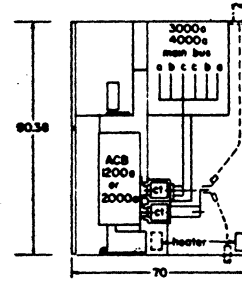
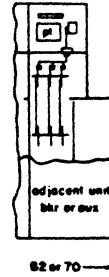
standard sections: 5 kv



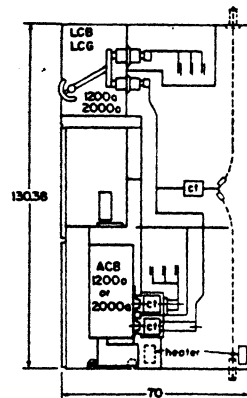
Feeder or Incoming Line



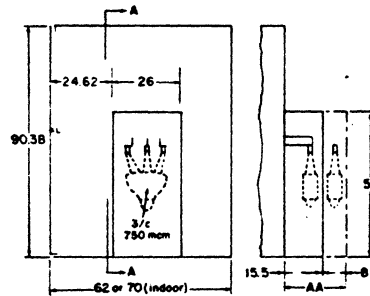
Bus Sectionalizing



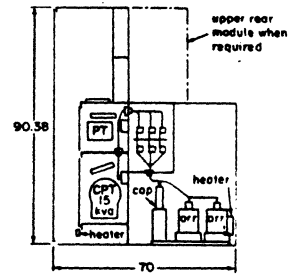
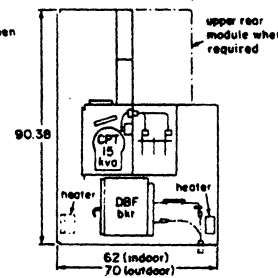
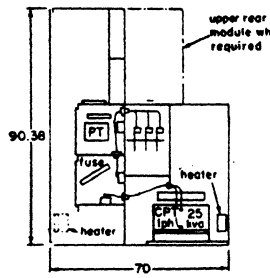
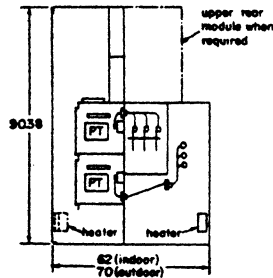
3000/4000 Amp Main Bus



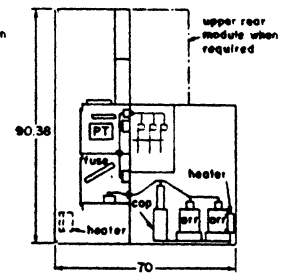
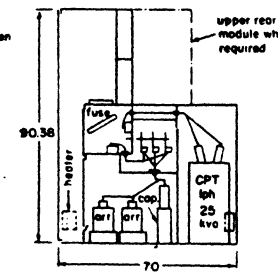
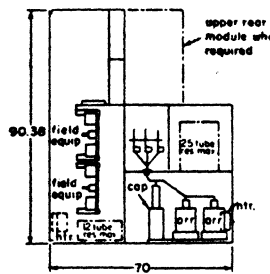
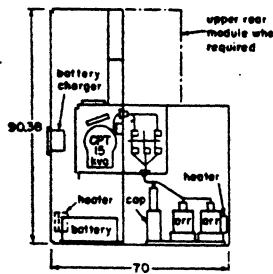
Transfer Bus with Disconnect Switch



End Entrance Compartment



Auxiliary Units



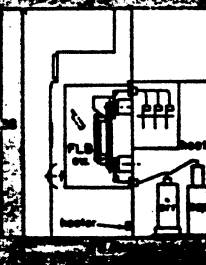
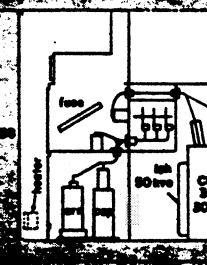
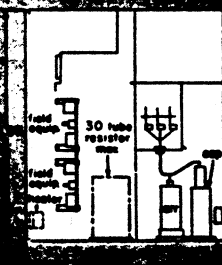
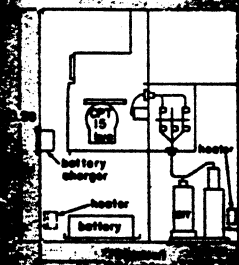
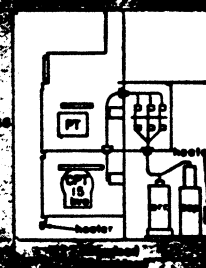
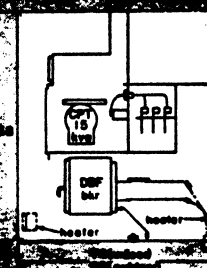
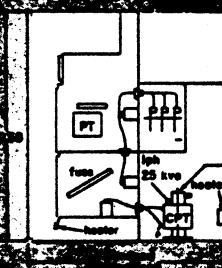
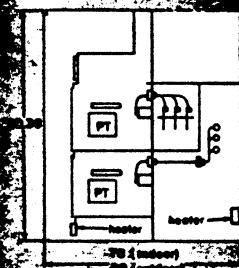
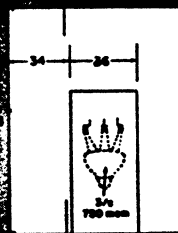
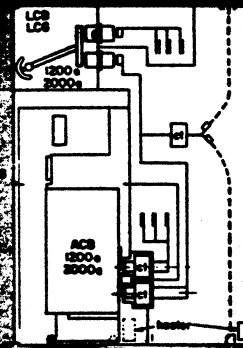
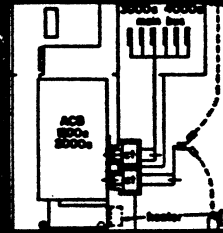
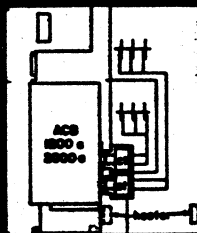
Auxiliary Units

## application data

**75 to 750 mva interrupting capacity • 4160 to 13800 volts  
1200 and 2000 amps • indoor and outdoor**

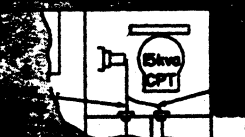
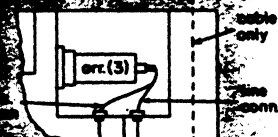
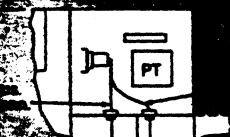
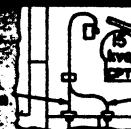
**page 9**

The diagram shows a control unit labeled 'ACS 2000/2000+' connected to a three-phase switch and a motor. The switch is controlled by a three-phase supply and a stop button. The motor is connected to the switch and a stop button.

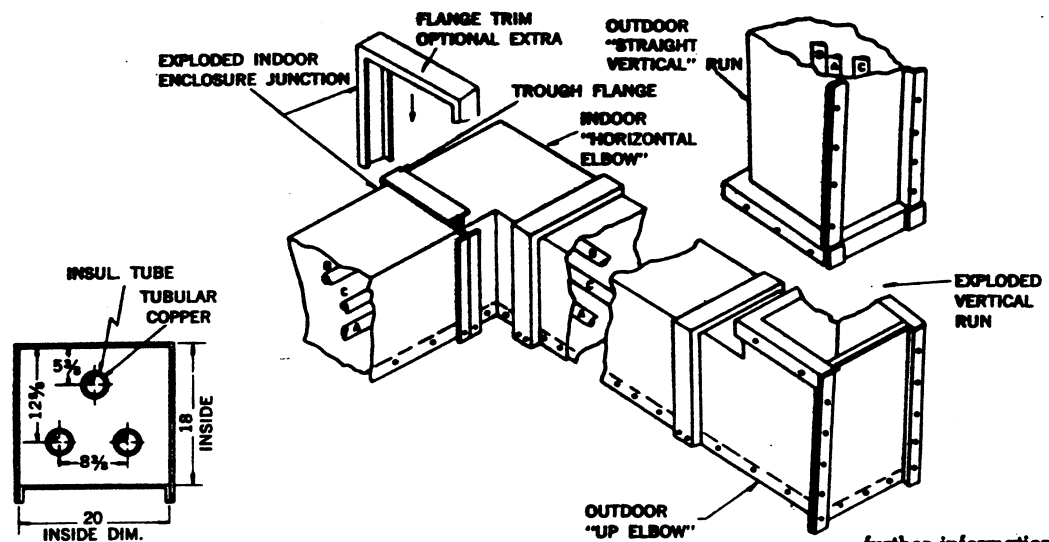




standard upper rear modules

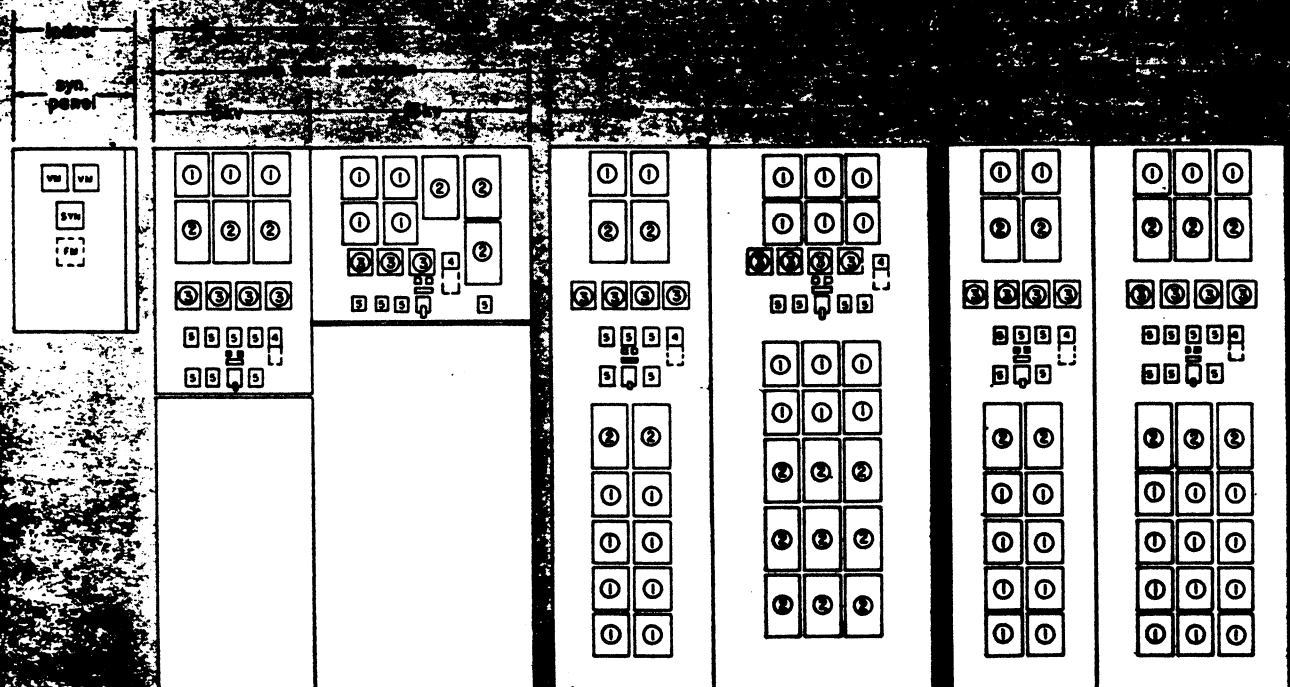


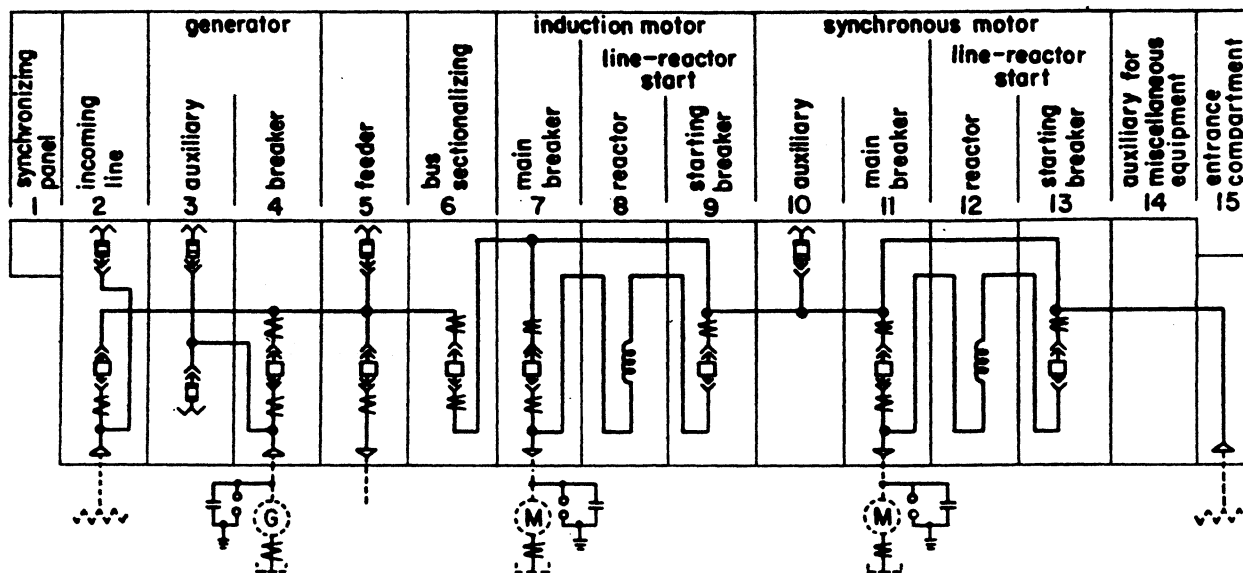
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1200 and 2000 amps • indoor and outdoor



further information: DB H-32-255

### maximum panel arrangement



**standard DE-P assemblies: indoor and outdoor****how to order standard Porcel-line assemblies****information to be furnished with orders**

1. Application: Indoor, Outdoor Shelterfor-M, or Outdoor Aisle-less
2. Circuit breaker mechanism: stored energy or solenoid
3. Control voltages: closing, tripping, and motor if stored energy.
4. Order entry check sheet form 30038 which should include:
  - a. physical arrangement, service voltage, and one line diagram.
  - b. complete primary and secondary cable information.
  - c. current transformer ratios.
  - d. circuit nameplate wording.
  - e. shipping limitations
  - f. generator and motor data (forms 30039 and 30042)
5. special requirements

**basis of specifications**

Westinghouse continually develops new materials and methods to improve the reliability of metal-clad switchgear. Such technical progress may result in minor deviations between the following specifications and the finished product. Questions regarding details of manufacture should be referred to the nearest Westinghouse Sales Office.

The following specifications are based on 3-phase service with ungrounded or solidly grounded neutral. The arrangements are the most common for this class of switchgear. Other arrangements are also available such as the transfer bus with disconnect switch as shown on pages 8 and 9. All other bus arrangements or special requirements should be referred to the nearest Westinghouse Sales Office for recommendations.

The following specifications are based on standard housings that accommodate a main bus of 1200 or 2000 amperes. However, a main bus of 3000 or 4000 amperes is also available as shown on pages 8 and 9 but should be referred to the nearest Westinghouse Sales Office for recommendations.

Circuit breakers are available with either stored energy or solenoid mechanisms. However, the control voltages must be in line with table b on page 6. The table shows that stored energy motors and closing controls are available in a variety of dc and ac voltages. The table also shows that solenoid closing controls are available for 125 and 250 volts dc.

The specified panel equipment is the minimum essential for the various circuits. The specified panel equipment may be easily arranged upon the upper formed hinged panel used on Indoor

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and Shelterfor-M standard switchgear. This can be determined by reference to page 11. Optional panel equipment may or may not be arranged on the upper panel due to space limitations. This can be determined again by reference to page 11. If necessary, because of optional panel equipment, full height formed hinged panels with front extensions may be used on Indoor and Shelterfor-M switchgear. Full height formed hinged panels are standard for Aisle-less gear.

## typical specifications

### general

The Porcel-line metal-clad switchgear described in this specification will be an assembly of breaker housings, auxiliary housings, and horizontal drawout circuit breakers arranged to suit the specific requirements of the purchaser. It will be of (indoor) (Aisle-less) (Shelterfor-M) construction and will be rated (4160) (13800) volts. It will be for use on a (2400) (4160) (4800) (7200) (13800) (etc) volt, 3 phase (3) (4) wire, (grounded) (ungrounded), 60 cycle system. The switchgear will be designed, manufactured and tested in accordance with the latest standards of CSA, CEMA, ASA and NEMA.

The breaker housings and auxiliary housings will be bolted to each other to form a rigid metal enclosed switchgear assembly. Each housing will consist of functional components or modules. They will be the breaker/bus, control, and line modules (and, if required, an upper rear module). Metal side pans will isolate adjacent housings and metal barriers will isolate the primary major sections of each circuit. Removable metal barriers will provide access to the primary major sections of each circuit. Rear covers will be bolted-on sheets.

### weatherproofing: aisle-less

Each shipping group will be mounted upon an integral base frame. A weatherproof enclosure will be assembled onto the complete metal enclosed switchgear assembly. A weatherproof door will be provided on the breaker drawout side of each housing.

### weatherproofing: Shelterfor-M

Each shipping group will be mounted upon an integral base frame. A weatherproof enclosure will be assembled onto the complete metal enclosed switchgear assembly. The weatherproof enclosure will extend on the breaker drawout side of the complete assembly to form an operating and/or maintenance aisle large enough to permit interchange of circuit breakers. A weatherproof door with an inside quick-release latch mechanism will be located at each end of the aisle to permit opening door even when locked from outside.

### panels: indoor and Shelterfor-M

An upper and lower formed hinged panel will enclose the breaker drawout side of each housing. The upper panel will be used for control devices, relays, meters, and instruments. The lower panel will cover the circuit breaker portion of the housing and will have an access port to permit levering the breaker between the operating and test positions with the panel closed. When necessary a

front extension and full height formed hinged panel without an access port will be used.

### panels: aisle-less

A full-height formed hinged panel will be located behind the outer weatherproof door and will be used for control devices, relays, meters, and instruments.

### breaker/bus module

The main bus will be of aluminum and will have flame retardant insulation. Porcelain main bus supports will cover the bus opening between housings to provide a non-combustible fire wall. All bus joints will be silver-plated, bolted, and insulated. The stationary primary contacts will be silver-plated and recessed within porcelain supports. An automatic shutter will cover the stationary primary disconnecting contacts when the breaker is in the disconnected position or out of the housing. The stationary secondary contacts will be silver-plated multiple sockets. A stationary guide rail, levering-in screw, and safety interlocks will be provided to function with the circuit breaker. A ground contact will ground the breaker between and including the operating and test positions. Breaker/bus modules of the same rating will be interchangeable and will house any circuit breaker of the same rating.

### control module

One set of terminal blocks will be provided for secondary connections to external circuits. One control circuit cutout device will be provided in each circuit breaker housing. Switchgear secondary wire will be #14 AWG.

### line module

The ground bus will be of aluminum and will extend the length of the switchgear assembly. The ground bus joints will be silver-plated and will be bolted to each housing and to each breaker ground contact. A clamp-type terminal will be furnished for terminating a ground cable. (Clamp-type terminals) (potheads) will be furnished for terminating power cables entering from (top) (bottom).

### instrument transformers

Ring-type current transformers will be furnished with ratios as indicated in the detail specification. Their thermal and mechanical ratings will be coordinated with the circuit breakers. Their accuracy rating will be at least equal to NEMA Standard requirements.

Potential transformers will be furnished with ratios as indicated in the detail specifications. They will be of the disconnect-type and will be equipped with current limiting fuses.

### finish

Steel will be cleaned and phosphatized. The final indoor finish will be light grey ASA No. 61. The final outdoor finish will be equipment green CEMA No. 1-Y, applied over a coat of red oxide primer. An undercoating compound will be applied to outdoor switchgear.

**typical specifications continued****circuit breaker**

The circuit breakers will be horizontal drawout type (50) (150) DH-P (75) (250) (500) (750) rated (1200) (2000) amperes, (4160) (13800) volts, 3 phase, 60 cycles, and (75) (250) (500) (750) MVA interrupting capacity. The breakers will be operated by a dc ac stored energy (dc solenoid) mechanism. The stored energy mechanism will be charged normally by a universal electric motor and in an emergency by a manual handle. The primary contacts will be silver-plated and supported in porcelain pole units. The primary disconnecting fingers will be silver-plated and retained to the primary contacts with individual leaf springs. Hinged tilting arc chutes with center coil blowout magnets will be provided in "Limitrak" enclosures. A vertical metal barrier in front of the arc chutes will form a shield from primary parts.

The secondary disconnecting contacts will be silver-plated multiple plugs of the trainline coupler type. The plugs will automatically engage the housing sockets in the breaker operating position and manually in the breaker test position. A guide channel will provide lateral alignment with the housing guide rail. Horizontal levering will be provided by rotating and engaging a shaft and nut assembly onto the housing screw. Interlocks will be provided to prevent levering of a closed breaker, to prevent closing of a breaker between operating and test positions, to trip breakers upon insertion or removal from housing, and to discharge stored energy mechanisms upon insertion or removal from the housing. The breaker will be secured positively in the housing between and including the operating and test positions. Circuit breakers of the same rating will be interchangeable and will fit any housing of the same rating.

**unit 1: synchronizing panel**

The metal-clad switchgear will consist of one swinging metal panel mounted on the (left) (right) end of the assembly and will be equipped as follows:

- 2—type KA-241 ac voltmeters, 0-( ) scale
- 1—type KI-241 synchroscope
- 2—lamps
- 1—(optional) type KX-241 frequency meter

**unit 2: incoming line**

The metal-clad switchgear will consist of one breaker unit ( ) inches high, ( ) inches wide, ( ) inches deep and equipped as follows:

- 1—breaker housing
- 1—set of insulated bus, ( ) amperes
- 1—type ( ) DH-P ( ) circuit breaker, ( ) amperes, ( ) volts close, ( ) volts trip, ( ) mechanism
- 3—current transformers, ( )-5 ratio

- 1—set of terminations for power cable entering from ( )
- 1, 2, or 3—(optional) potential transformers, ( )-120 ratio (Note: 15 kv power cable entering from top or outdoor gear will displace potential transformers to an adjacent auxiliary unit or to a superstructure.)

- 1—circuit nameplate
- 1—type W-2 breaker control switch with indicating lights
- 1—type W-2 ammeter switch
- 1—type KA-241 ac ammeter, 0-( ) scale
- 3—type CO overcurrent relays in FT-11 case
- 1—(optional) type W-2 voltmeter switch
- 1—(optional) type W-2 synchronizing switch
- 1—(optional) type KA-241 ac voltmeter, 0-( ) scale
- 1—(optional) type KY-241 wattmeter, 0-( ) scale
- 1—(optional) type D2B-2F watt-hour meter in FT-21 case

**units 3 and 4: generator**

The metal-clad switchgear will consist of one auxiliary unit and one breaker unit as follows:

unit 3: the generator auxiliary unit will be ( ) inches high, ( ) inches wide, ( ) inches deep and equipped as follows:

- 1—auxiliary housing
- 1—set of insulated bus, ( ) amperes
- 1—set of terminations for exciter cable entering from ( )
- 2 or 3—potential transformers, ( )-120 ratio, for generator metering
- 1—potential transformer, ( )-120 ratio, for generator regulator
- 1—type DB field breaker, electrically operated
- 1—provision for field discharge resistor
- 1—circuit nameplate
- 1—type W-2 regulator transfer switch
- 1—exciter field rheostat control either (a) handwheel only for maximum of two 15 inch diameter plates or (b) type W-2 switch for electrically operated mechanism
- 1—type KX-241 dc ammeter and shunt, 0-( ) scale
- 1—type SRA ( ) voltage regulator
- 1—(optional) type W-2 temperature indicator switch
- 1—(optional) type KX-241 temperature indicator, 0-150 degrees C scale
- 1—(optional) type KX-241 dc voltmeter, 0-( ) scale
- 1—(optional) type WL relay for differential relaying
- 3—(optional) type CA differential relays in FT-21 case

unit 4: the generator breaker unit will be ( ) inches high, ( ) inches wide, ( ) inches deep, and equipped as follows:

- 1—breaker housing
- 1—set of insulated bus, ( ) amperes

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- 1—type ( ) DH-P ( ) circuit breaker, ( ) amperes, ( ) volts close, ( ) volts trip, ( ) mechanism
- 3—current transformers ( )-5 ratio
- 1—current transformers, ( )-5 ratio for voltage regulator, for parallel operation, if required
- 1—set of terminations for power cable entering from ( )
- 3—(optional) current transformers, ( )-5 ratio, for differential relaying
- 3—(optional) current transformers, ( )-5 ratio, for differential relaying and connection in generator neutral, unmounted
- 1—(optional) set of surge capacitors and lightning arresters for connection at generator terminals, unmounted
- 1—circuit nameplate
- 2—type W-2 breaker control switches with indicating lights
- 1—type W-2 ammeter switch
- 1—type W-2 voltmeter switch
- 1—type W-2 synchronizing switch
- 1—type W-2 governor motor control switch
- 1—type KA-241 ac ammeter, 0-( ) scale
- 1—type KY-241 wattmeter, 0-( ) scale
- 1—type KY-241 varmeter, 0-( ) scale
- 3—type COV overcurrent voltage controlled relays in FT-21 case
- 1—(optional) type W-2 generator rheostat control switch
- 1—(optional) type D2B-2F watt-hour meter in FT-21 case

#### unit 5: feeder

The metal-clad switchgear will consist of one breaker unit ( ) inches high, ( ) inches wide, ( ) inches deep and equipped as follows:

- 1—breaker housing
- 1—set of insulated bus, ( ) amperes
- 1—type ( ) DH-P ( ) circuit breaker, ( ) amperes, ( ) volts close, ( ) volts trip, ( ) mechanism
- 3—current transformers, ( )-5 ratio
- 1—set of terminations for power cable entering from ( )
- 1, 2, 3—(optional) potential transformers, ( )-120 ratio  
(Note: 15 kv power cable entering from top or outdoor gear will displace potential transformers to an adjacent unit or to a superstructure).
- 1—circuit nameplate
- 1—type W-2 breaker control switch with indicating lights
- 1—type W-2 ammeter switch
- 1—type KA-241 ac ammeter, 0-( ) scale
- 3—type CO overcurrent relays in FT-11 case
- 1—(optional) type D2B-2F watt-hour meter in FT-21 case

#### unit 6: bus sectionalizing

The metal-clad switchgear will consist of one breaker unit ( ) inches high, ( ) inches wide, ( ) inches deep, and equipped as follows:

- 1—breaker housing
- 1—set of insulated bus and transition bus, ( ) amperes
- 1—type ( ) DH-P ( ) circuit breaker ( ) amperes ( ) volts close, ( ) volts trip, ( ) mechanism
- 6—(optional) current transformers, ( )-5 ratio as required for bus metering, relaying, etc.
- 1—circuit nameplate
- 1—type W-2 breaker control switch with indicating lights
- 1—(optional) set of panel equipment as required for bus metering, relaying, etc.

#### unit 7: induction motor • full voltage start

The metal-clad switchgear will consist of one breaker unit ( ) inches high, ( ) inches wide, ( ) inches deep and equipped as follows:

- 1—breaker housing
- 1—set of insulated bus, ( ) amperes
- 1—type ( ) DH-P ( ) circuit breaker ( ) amperes, ( ) volts close, ( ) volts trip, ( ) mechanism
- 3—current transformers, ( )-5 ratio
- 1—set of terminations for power cable entering from ( )
- 3—(optional) current transformers, ( )-5 ratio for differential relaying
- 3—(optional) current transformers, ( )-5 ratio for differential relaying and connection in motor neutral, unmounted
- 1—(optional) set of surge capacitors and lightning arresters for connection at motor terminals, unmounted
- 1—circuit nameplate
- 1—type W-2 breaker control switch with indicating lights
- 1—type W-2 ammeter switch
- 1—type KA-241 ac ammeter, 0-( ) scale
- 1—type BL-1 thermal relay in FT-21 case
- 1—type CO overcurrent relay in FT-11 case
- 1—type CV ac undervoltage relay in FT-11 case
- 1—(optional) type D2B-2F watt-hour meter in FT-21 case
- 1—(optional) type CO overcurrent ground relay in FT-11 case
- 1—(optional) type WL relay for differential relaying
- 3—(optional) type CA differential relays in FT-21 case

**typical specifications continued****units 7, 8, and 9: induction motor • line-reactor start**

The metal-clad switchgear will consist of two breaker units and one reactor unit as follows:

unit 7: The main (or running) breaker unit will be ( ) inches high, ( ) inches wide, ( ) inches deep, and equipped as follows:

1—set of equipment identical to the equipment for "unit 7: induction motor—full voltage start" plus

1—type TK timing relay in FT-21 case

unit 8: The line reactor unit will be ( ) inches high, ( ) inches wide, ( ) inches deep, and equipped as follows:

1—reactor housing

1—set of insulated bus, ( ) amperes

1—set of connections to reactor

1—reactor, 3 phase, ( ) amperes, ( ) volts

unit 9: The starting breaker unit will be ( ) inches high, ( ) inches wide, ( ) inches deep, and equipped as follows:

1—breaker housing

1—set of insulated bus, ( ) amperes

1—type ( ) DH-P ( ) circuit breaker, ( ) amperes, ( ) volts close, ( ) volts trip, ( ) mechanism

3—(optional) current transformers, ( )-5 ratio for differential relaying

**units 10 and 11: synchronous motor • full voltage start**

The metal-clad switchgear will consist of one auxiliary unit and one breaker unit as follows:

unit 10: the auxiliary unit will be ( ) inches high, ( ) inches wide, ( ) inches deep, and equipped as follows:

1—auxiliary housing

1—set of insulated bus, ( ) amperes

1—set of terminations for field cable entering from ( )

1—field discharge resistor

1—field contactor or electrically operated type DB field breaker for field currents over 240 amperes

1—field application relay

1—field failure relay

1, 2, or 3—(optional) potential transformers, ( )-120 ratio

1—circuit nameplate

1—exciter field rheostat control either (a) handwheel only for maximum of two 15 inch diameter plates or (b) type W-2 switch for electrically operated mechanism

1—type KX-241 dc ammeter and shunt, 0-( ) scale

1—type TK timing relay in FT-21 case

1—(optional) type WL relay for differential relaying

3—(optional) type CA differential relays in FT-21 case

unit 11: the breaker unit will be ( ) inches high, ( ) inches wide, ( ) inches deep, and equipped as follows:

1—breaker housing

1—set of insulated bus ( ) amperes

1—type ( ) DH-P ( ) circuit breaker, ( ) amperes, ( ) volts close, ( ) volts trip, ( ) mechanism

3—current transformers, ( )-5 ratio

1—set of terminations for power cable entering from ( )

3—(optional) current transformers, ( )-5 ratio, for differential relaying

3—(optional) current transformers, ( )-5 ratio, for differential relaying and connections in motor neutral, unmounted.

1—(optional) set of surge capacitors and lightning arresters for connection at motor terminals, unmounted

1—circuit nameplate

1—type W-2 breaker control switch with indicating lights

1—type W-2 ammeter switch

1—type KA-241 ac ammeter, 0-( ) scale

1—type KY-241 ac varmeter, 0-( ) scale

1—type BL-1 thermal relay in FT-21 case

1—type CO overcurrent relay in FT-11 case

1—type CV ac undervoltage relay in FT-11 case

1—(optional) type D2B-2F watt-hour meter in FT-21 case

1—(optional) type CO overcurrent ground relay in FT-11 case

**units 10, 11, 12 and 13: synchronous motor line-reactor start**

The metal-clad switchgear will consist of one auxiliary unit, two breaker units, and one reactor unit as follows:

unit 10: the auxiliary unit will be ( ) inches high, ( ) inches wide, ( ) inches deep, and equipped as follows:

1—set of equipment identical to the equipment for "unit 10: synchronous motor—full voltage start"

unit 11: the main (or running) breaker unit will be ( ) inches high, ( ) inches wide, ( ) inches deep and equipped as follows:

1—set of equipment identical to the equipment for "unit 11: synchronous motor—full voltage start"

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unit 12: the line reactor unit will be ( ) inches high, ( ) inches wide, ( ) inches deep, and equipped as follows:

- 1—reactor housing
- 1—set of insulated bus, ( ) amperes
- 1—set of connections to reactor
- 1—reactor, 3 phase, ( ) amperes, ( ) volts

unit 13: the starting breaker unit will be ( ) inches high, ( ) inches wide, ( ) inches deep and equipped as follows:

- 1—breaker housing
- 1—set of insulated bus, ( ) amperes
- 1—type ( ) DH-P ( ) circuit breaker, ( ) amperes, ( ) volts close, ( ) volts trip, ( ) mechanism
- 1—type TK timing relay in FT-21 case
- 3—(optional) current transformers, ( )-5 ratio for differential relaying

#### unit 14: auxiliary unit

The metal-clad switchgear will consist of one auxiliary unit ( ) inches high, ( ) inches wide, ( ) inches deep, and equipped as follows:

- 1—auxiliary housing
- 1—set of insulated bus, ( ) amperes
- 1—set of equipment as required such as potential transformers, control power transformers, surge protection equipment, etc.

#### unit 15: entrance compartment

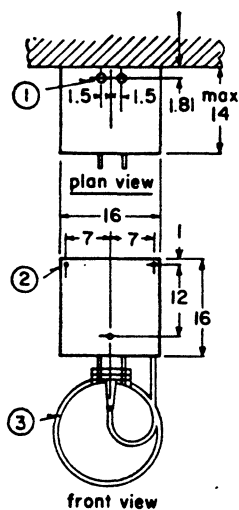
The metal-clad switchgear will consist of one entrance compartment mounted on the (left) (right) end of the assembly and equipped as follows:

- 1—end housing
- 1—set of insulated bus, ( ) amperes
- 1—set of terminations for power cable entering from ( )

## accessories: standard

One set of accessories for test, inspection, maintenance, and operation, including:

- 1—Maintenance handle for manually closing circuit breaker when not in housing.
- 1—Levering crank for moving circuit breaker between test and connected positions.
- 1—Spanner nut wrench for removing, replacing, or checking tightness of main disconnect contacts when de-energized.
- 1—Set of test plugs for use with Flexitest relays and meters.
- 1—Spring charge handle for manually charging closing spring. For stored energy circuit breaker.
- 1—Arc chute lifter to assist in tilting of arc chutes. For 15 KV circuit breaker.
- 1—Transport truck for handling circuit breaker outside housing. For Aisle-less gear.
- 1—Turning dolly for handling circuit breaker outside housing. For indoor and Shelterfor-M gear.
- 1—Test cable for electrically operating circuit breaker outside housing. For Shelterfor-M and Aisle-less gear.
- 1—Test cabinet for electrically operating circuit breaker outside housing. For indoor gear. Dimensions below:



- ① 1 in. or 1.25 in. cond. k.o.'s (top & bottom)
- ② 0.5625 dia. mtg. holes
- ③ 150 in. of cable

## optional equipment

### 125 volt control battery

The control battery will provide power for electrical operating mechanisms and may be used for indicating lamps, alarm circuits, and control relays:

- 1—60-cell storage battery, lead-acid type, in sealed plastic jars. Discharge rate will not be less than .... amperes for one minute, or .... amperes for 8 hours to 1.75 volts per cell. There will also be furnished electrolyte, inter-connectors, rack, cell numbers, portable hydrometer, and vent hole thermometer.

### 48 volt tripping battery

The tripping battery will provide power for the shunt trip coils:

- 1—24-cell storage battery, lead-acid type, in sealed plastic jars. Discharge rate will not be less than .... amperes for one minute or .... amperes for 8 hours to 1.75 volts per cell. There will also be furnished electrolyte and interconnectors.

### battery chargers

non-automatic:

- 1—static battery charger, .... volt, 60 cycles, a-c, and .... amperes to .... amperes d-c, with dial switch, ammeter, and voltmeter.

self-regulating:

- 1—self-regulating battery charger, .... volts, 60 cycles, a-c, and .... amperes to .... amperes d-c, with indicating and control devices.

### a-c closing

The stored energy circuit breaker is available for a-c closing. In lieu of a reliable external a-c source, one ..../250/120 volt operating transformer may be required on the line side for each incoming line, generator unit, and bus section.

### a-c tripping

In lieu of battery tripping, which is recommended, specify a capacitor trip device for each circuit breaker. In addition, a potential transformer or operating transformer may be required on the line side of each incoming line, generator unit, and bus section.

### surge and lightning protection

Where there are exposed lines, it is recommended that the purchaser provide adequate surge and lightning protection. If desired, this protective equipment can be supplied in the metal-clad gear.

### grounding devices

Grounding devices are drawout elements that are inserted into a housing in place of a circuit breaker to provide a means to (a) ground the primary circuit, (b) apply potential for cable testing, and (c) provide access to primary circuits for phasing-out. Only qualified and authorized personnel should operate grounding devices.

**standard:** The standard grounding device includes six insulated bushings arranged with ground bus connections. The bus, line, and ground connections are isolated from each other. Grounding, cable testing, or phasing-out is manually performed by connecting to the bushings suitable cables or equipment as determined by the purchaser.

**complete:** The complete grounding device includes six insulated bushings arranged with ground bus connections. The bus, line, and ground connections are isolated from each other. A manually operated selector switch is included. A grounding switch with a solenoid or stored energy closing mechanism capable of closing against a "live" circuit is also included. Ⓢ Grounding, cable testing, or phasing-out is performed by setting and/or locking required switches while device is outside of housing. After inserting device into housing tests are performed.

- ① Interlocks and safety features are provided.

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### drawings and instruction books

Every Porcel-line metal-clad switchgear order includes a set of general assembly and floor plan drawings, a series of installation and field assembly drawings, and a job instruction book. This information provides complete details for laying planning. This information also provides detailed instructions as to the shipping and receiving, handling, storing, and installation of the metal-clad switchgear. No field operations should be attempted without first consulting the drawings and instruction books.

### shipping and receiving

Porcel-line metal-clad switchgear is shipped in groups of one or more units. Each group is ruggedly designed and braced to withstand shipment by truck, rail, or ship. Indoor groups are bolted to skids and enclosed in a protective covering. Because of their structural base outdoor groups do not need skids. DH-P circuit breakers, accessories, and installation materials are packed and crated separately. Appendages such as bus runs and synchronizing panels and large internal equipment such as oil-filled transformers may also be packed and crated separately. When received the purchaser should check the material against the shipping list. If loss or damage is discovered, file claims with the transportation company and notify the nearest Westinghouse representative.

### handling

Porcel-line metal-clad switchgear is equipped for handling by crane. In addition, it is provided with shipping braces and jack supports. It is recommended that the groups be lifted into position by crane. However, if no crane is available they may be skidded into place on rollers using jacks to raise and lower the group.

Porcel-line type DH-P breakers are crated so as to be handled by crane or industrial "York" truck. After uncrating but before installing arc chutes, breakers may be lifted by crane. On smooth floors they may be rolled easily on their own wheels.

### storing

Porcel-line metal-clad switchgear which cannot be installed and put into service immediately must be stored so as to maintain the equipment in a clean and dry condition. Storage in a heated building is recommended. If stored outdoors, special precautions must be taken: indoor switchgear must be covered and temporary heating equipment installed, outdoor switchgear must be supplied with temporary power for operation of the space heaters. During storage the shipping groups should be placed on a level surface to prevent unnecessary strain.

### installation and field assembly

Westinghouse Porcel-line metal-clad switchgear is factory-tested and factory-assembled from accurately tooled parts upon true and level bed-plates. A minimum of installation and field assembly time will be required if the procedures described on the drawings and in the instructions are adhered to.

Careful preparation of the foundation will simplify erection and will assure good switchgear performance and reliability. The foundation must have sufficient strength to withstand the weight of the structure and breakers plus the impact resulting from breaker operation. Pages 2, 3, 4, 5, and 6 tabulate the approximate weights of standard switchgear.

The foundation for indoor switchgear should consist of rugged steel channels imbedded in a concrete floor. The steel channels must be flat, level, and in a true plane with each other. The finished floor must be in a true plane with the steel channels and must not project above the level of the steel channels. (See page 2).

The foundation for outdoor switchgear may be a concrete pad, footers, or pillars. For any condition, the aisle-less switchgear requires a reasonably level and smooth pad for breaker drawout. The integral base furnished with outdoor switchgear should be supported in a level and true plane. (See page 3, 4, and 5.)

During field assembly of the Shelterior-M some weather-proofing maybe required. The parts are standardized and tool-made to simplify and expedite their assembly. The details of assembly are described in the job instruction book and associated drawings.



**further information:** description: db H-32-252, 11 H-32-253, 11 H-32-253-1

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