



WESCOLA[®]
WAHAH Electric Supply Co. of Saudi Arabia Ltd.
(WESCOLA)

PRODUCT INFORMATION





Product Information

Product List

Low Voltage Distribution Equipment

- Metal Enclosed Switchgear NEMA / ANSI Standard
- Metal Enclosed Switchgear IEC Standard
- Motor Control Centers NEMA/ANSI Standard
- Motor Control Centers IEC Standard
- Distribution Panelboards
- Switchracks
- Enclosed Control Panels
- Enclosed Circuit Breakers
- Transfer Switches
- WESCOSA – Tabula IEC Switchboards

Medium Voltage Distribution Equipment

- Medium Voltage up to 15kV Indoor Metal Clad Switchgear to NEMA/ANSI Standards.
- Medium Voltage 17.5kV Class Indoor Metal Clad Switchgear to IEC Standards.
- Indoor Metal Enclosed Motor Contrallers up to 5kV – Fixed Mounted Contactors
- Indoor Metal Enclosed Motor Controllers up to 5kV – Draw out Contactors
- Medium and Low Voltage Indoor and Outdoor Non-Segregated / Segregated Busduct rated up to 5kV and up to 5000 Amperes.
- Cable Bus rated up to 15kV and up to 5000 Amperes

Cable Trays and Accessories

- Cable Trays, Ladders, Trunking, Supports and Accessories.
- Communication Cable Runways
- Rolled Formed Cable Trays
- Steel Grating Panels – Catch Basin Covers

Services and Distribution Protection Equipment

- Relay and Breaker Control Panels
- Annunciator Panel
- Synchronization Panel and Load Shedding Panel
- Marshalling Cabinets

- Fuse Cutouts Series “C”
- Design, Supply and Modification of Transformers and Electrical Distribution Equipment
- Site Service of Distribution Equipment and Testing & Commissioning
- Supervision of Erection for Electrical Equipment

Calibration

- Calibration of Electrical Test Equipment such as:
 - ◆ **Electrical** (Digital Multimeters, Hipots (0-200kV), Power Factor Meters, Sensors, Frequency Counter, Ammeter/Voltmeter, Voltage Standards and Voltage Divider).
 - ◆ **Calibrator** (Frequency, Multifunction, Pressure, Process, Simulators, Temperature, Oscilloscopes & Resistance Standards).
 - ◆ **Temperature** (Controllers, Indicators, PRT/SPRT, Chart Recorders, RTD's, Transducers & Thermocouples).
 - ◆ **Electronics** (Counters, Decade Boxes, Power Supplies, Signal Generators, Oscilloscopes and Stop Watches).
 - ◆ **Dimensional** (Calipers, Dial Indicators & Micrometers).
 - ◆ **Force/Mass** (Balance/Scales, Torque Wrenches and Crimping Tools).
 - ◆ **Other Instruments** (Recorders, Relative Humidity, Welding Machines & Epstein Tester).
- Repair of Non-Conforming Test Equipment.

Transformers

- Unit Substation (Package / Compact Substations) up to 1600kVA in 15kV Class with Transformers, Low Voltage and Medium Voltage Compartment.
- Three Phase Distribution Transformers conforming to IEC – 76 and ANSI – C57 standard up to 2000kVA with voltage up to 36kV.
- Three Phase Power Transformers conforming to IEC – 76 and ANSI – C57 standards up to 10000kVA with voltage up to 69kV.
- Dry Type Transformers up to 2000kVA with voltage up to 15kV.
- Cast Resin Transformers up to 5000kVA with voltage up to 24kV.

Low Voltage Distribution Equipments

FREEDOM SERIES 2100

WESCOSA / EATON ELECTRICAL

LOW VOLTAGE MOTOR CONTROL CENTER

Cutler-Hammer / Westinghouse (Subsidiary of Eaton) introduced the first motor control center in 1935 and has advanced the technology to provide motor control centers that meet or exceed the requirement of electrical distribution systems. Freedom 2100 MCC's also provide easier installation and maintenance, in increased safety, and reduced size.

Freedom series 2100, the fourth generation motor control center, features modular plug-in motor control units and components. They are extremely flexible and can be engineered to meet any motor control center requirements.

Standard unit interrupting rating and structural bus withstand bracing is unique at 65,000 amperes. They eliminate costly fault calculations or the increased cost of integrally fused or current limiting circuit breakers. These standard ratings allow larger KVA substation transformers to be applied, resulting in substantial total system cost savings.

Freedom series 2100 Motor Control Centers have the highest standard bus ratings in the industry: horizontal up to 32000 amperes and vertical up to 1,200 amperes.

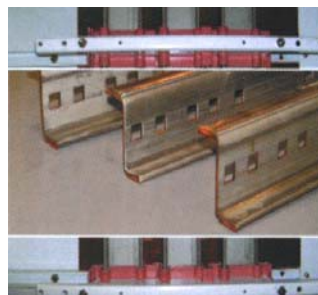
These motor control centers are available with incoming metering devices, adjustable frequency controllers, programmable logic controllers and a complete selection of solid state and electromechanical starters. A wide range of additional components such as feeders, circuit breakers/switches, Panelboards, transformers, analog and digital meters, and special devices may be easily applied to meet expansion requirements.



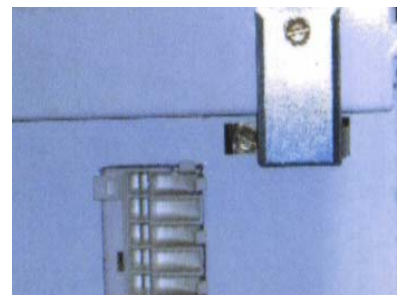
The Freedom Series 2100 Motor Control Center has a smaller configuration than those of other manufacturer (depending on individual ratings). The structure is rigid, self-supporting and is capable of meeting most seismic requirements. Additional structures may easily be added to existing motor control center lineups in the field.



The standard Cutler-Hammer Westinghouse Series C HMCP Molded Case Motor Control Circuit Protector family provides the motor control centers with 65,000 amperes standard interrupting capacity. Series C eliminates the need for current limiters, thus saving valuable space.



Unique angular bus configurations ("L" shape for front mounted structures) have independent mechanical strength to withstand fault stresses. Consequently 65,000 RMS symmetrical amperes bus bracing is standard.



The molded polyester barrier from a labyrinth around the bus bars to prevent fault propagation. Shutters automatically cover slab openings when a unit is removed for extra safety.

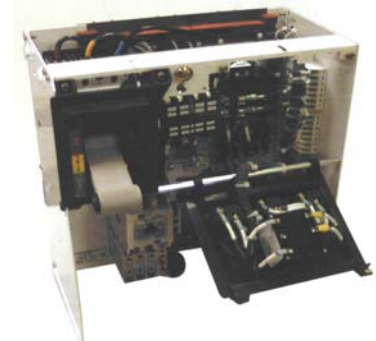
CONTROL CENTER UNIT

The heart of the Freedom Series 2100 is the control center unit. It includes the standard Series C HMCP Motor Circuit Protector, Freedom Starter, and other components. The control unit center has been designed for durability, safety and ease of installation and maintenance.

Guide rails, mounted in the motor control center structure, provide for easy insertion or drawout. Two mounting points on each side of the unit engaged the rails located near the top of each unit space, providing minimum friction. They also provide precise alignment to the unit for accurate staving on the vertical bus.

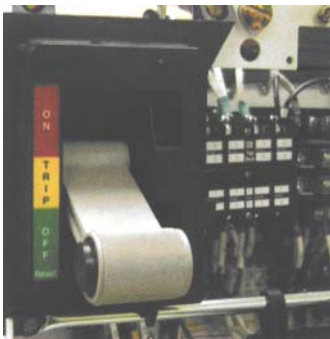
Safety is enhanced with a latch that securely holds the unit in the structure. The latch can only be engaged when the stabs are fully mated to the vertical bus. Upon partial withdrawal for inspection or maintenance, the latch can be re-engaged to prevent the unit from being stabbed to the bus or removed from the structure. Each cell is provided with the standard double ground system for maximum operator and maintenance personnel safety.

After fabrication, the control center unit wrapper is cleaned and powder coating. The white color increases visibility within the unit to facilitate wiring and maintenance. Additionally, the wrapper provides ample space for cable entry from the wireway to the unit.

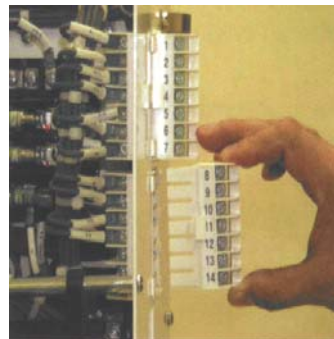


Series C HMCP Motor Circuit Protection is standards in Series 2100 motor starter units

- | | | |
|------------------------------------|------------------------------------|---------------------|
| 1. Operating Handle | 5. Motor Starter | 9. Pivot Tube |
| 2. Short Circuit Protective Device | 6. Terminal Blocks | 10. Control Devices |
| 3. Stab Assembly | 7. Control Transformer | 11. Device Panel |
| 4. Unit Drawout of top rail | 8. Primary / Secondary Fuse Holder | |



The easily operated handle mechanism is mechanically connected to the circuit breaker providing accurate alignment and visual indication of the circuit protector status including on, off and tripped.



Exclusive modular pull-apart terminal blocks provide for easy installation and maintenance. The removable portion can be wired outside of the vertical wireway and then easily installed.



Each cell is provided with a standard stainless steel, corrosion resistant spring steel ground clip. This is in addition to the traditional metal to ground provided by the wheel lance and guide rail system.

LOW VOLTAGE METAL-ENCLOSED DRAW-OUT SWITCHGEAR TYPE DSII



General Standards, Ratings

Type DSII Switchgear is constructed in accordance with ANSI C37.20.1 standards for metal-enclosed low-voltage draw-out switchgear. As such, it contains low-voltage power circuit breakers, Type DSII (no-limiting) and Type DSLII (with limiters) as the over current protective devices both as main and as feeder protection. The draw-out feature of DSII Breakers facilitates testing and maintenance which are important in many applications.

Compartmentalization of the draw-out breakers is part of the standard construction and additional safety barriers are available in maintenance areas. DSII and DSLII Breakers are designed to ANSI Standards C37.13, C37.16 and C37.17 in frame sizes ranging from 800 to 5000 Amperes. Type DSII Switchgear is designed in accordance with ANSI standards C37.20.1, C37.51 and UL Standard 1558.

Ratings are as Follows:

Voltage: 120-600 Volts ac, 3-phase, 3 wire or 4 wire

Main Bus capacity: 800-5000 amperes continuous.

Short circuit capability: up to 85kA with non-current limiting breakers (DSII) interruption and bus rating: up to 200kA with current limiting type breakers (DSII) at 480 volts ac.

Features

- 4-position Drawout.
- Double Steel Front Safety Barrier.
- Ease of Inspection and Maintenance.
- Safety Shutter System for Primary Stationary Contacts.
- Standard 100 kA Bus Bracing.
- Front Accessible Terminal Block Trays.
- Rugged formed Steel Base with Jacking Provisions.
- Door with Removable Hinge Pins.

Type DSII Switchgear features removable terminal block trays above each circuit breaker. These trays contain fuses for circuit breaker control protection, short circuiting terminations for circuit breakers secondary wiring and remote control connections. The tray front also provides a location for breaker control and indication devices, and 2% ammeters and switches. Non-adhesive wire anchors are provided to secure factory and field installed wiring. Trays are design to hang from openings of compartment doors for the clear access to terminal blocks and wiring. Standard wire markers further aid in circuit identification and maintenance.

Outer door with quick opening latches closes compartment completely with breaker in and out. All controls of the face of the breaker are protected from unauthorized or accidental operation. Removable hinge pins allow unrestricted access to the breaker and compartment.

Types DSII and DSLII Power Circuit Breakers

Types DSII and DSLII Power Circuit Breakers constitute a complete, modern and rugged line of low-voltage power circuit breakers utilizing the Westinghouse DE-ION principle of arc extinction. The breaker family is distinguished by its similarity of appearance and operation frame to frame. All frame sizes are either manually or Electrical operated.



**COMPLETE DSII
3-POLE BREAKER**

Circuit Breaker Features

- Two-step stored energy closing mechanism.
- Closing spring automatic discharge on breaker withdrawal.
- Interchangeable current sensor.
- Digitrip RMS trip units.
- UL label
- Can be applied at 100% of frame rating.
- Built in trip unit test provision.
- Electric close release.
- Key interlock.
- Operation encounter.
- Capacitor trip (ac).
- Short time delay.
- Shunt trip attachments for manually operated breakers.
- Auxiliary switch.
- Portable test kit.
- Integral breaker ground faulting tripping (3 wire or 4 wire systems)
- Electric lockout for manual breaker.
- Zone interlocking wiring.

Optional Accessories

- Compartment position switch.
- Under voltage trip either instantaneous or time delay.
- Bell alarm switch (OTS).

TECHNICAL DATA

**Table 1: Electrical Characteristics of DSII and DSLII Power Circuit Breakers
DS and DSL Interrupting Ratings**

Breaker Type	Available Ampere	Current Sensor Rating Ampere	UL Listed Interrupting Capacities, kA Symmetrical Amperes					
			With Instantaneous Trip			Without Instantaneous Trip		
			240V	480V	600V	240V	480V	600V
DSII-308	50 – 800	200, 300, 400, 600, 800	42	30	30	30	30	30
DSII-508	50 – 800	200, 300, 400, 600, 800	65	50	42	65	50	42
DSII-608	50 – 800	200, 300, 400, 600, 800	65	65	50	65	65	50
DSII-516	50 - 1600	200, 300, 400, 600, 800, 1200, 1600	65	65	50	65	65	50
DSII-620	50 – 2000	200, 300, 400, 600, 800, 1200, 1600, 2000	65	65	50	65	65	50
DSII-632	800 – 3200	2400, 3200	85	65	65	65	65	65
DSII-840	1000 - 4000	4000	130	85	85	85	85	85
DSII-850	2500 - 5000	5000	130	85	85	85	85	85
DSLII-308	50 – 800	200, 300, 400, 600, 800	200	200	200	200	200	200
DSLII-516	50 – 1600	200, 300, 400, 600, 800, 1200, 1600	200	200	200	200	200	200
DSLII-620	50 – 2000	2000	200	200	200	200	200	200
DSLII-632	800 – 3200	2400, 3200	200	200	200	200	200	200
DSLII-840	1000 – 4000	4000	200	200	200	200	200	200

Standard Control Voltages

DC: 48, 125, 250V

AC: 120, 240V

Table 2: Available Digitrip RMS Rating Plugs Marked 50/60 Hertz

Sensor Ratings, Amperes	Plug Rating in Amperes
200	100, 200
300	200, 250, 300
400	200, 250, 300, 400
600	300, 400, 600
800	400, 600, 800
1200	600, 800, 1000, 1200
1600	800, 1000, 1200, 1600
2000	1000, 1200, 1600, 2000
2400	1600, 2000, 2400
3200	1600, 2000, 2400, 3000, 3200
4000	2000, 2400, 3200, 4000
5000	5000

Ampacity vs Catalog Number

Frame	Breaker Designation
800A	DSII-308, -508, -608, DSLII-308*
1600A	DSII-516, -616, DSLII-516*
200A	DSII-620, DSLII-620*
3200A	DSII-632, DSLII-632**
4000A	DSII-840, DSLII-840**
5000A	DSII-850**

* These Breakers have the current limiters Mounted on the breaker

** These breakers have the current limiters Mounted separately

Table 3: Digitrip RMS Adjustable Trip Settings

Time/Current Characteristic	Pick-up Setting	Pick-up Point (See note)	Time Band, Seconds
Long Delay	0.5, 0.6, 0.7, 0.8 0.85, 0.9, 0.95, 1.0	I_n Times Long Delay Settings	2, 4, 7, 10, 12, 15, 20, 24 (At 6 times pick-up value)
Instantaneous	2, 2.5, 3, 4, 5, 6 $M_1 = 8$ $M_2 = 12$	I_n Times Instantaneous Settings	
Short Delay	2, 2.5, 3, 4, 5, 6 $S_1 = 8$ $S_2 = 10$	I_n Times Short Delay Settings	0.1, 0.2, 0.3, 0.4, 0.5 (Flat Response) 0.1*, 0.3*, 6.5* *(1^2t Response)
Ground Fault	A (.25), B (.3), C (.35), D (.4), E (.5), F (.6) H (.75), K (1.0) (1200A Maximum)	I_n Times Ground Fault Settings	0.1, 0.2, 0.3, 0.4, 0.5 (Flat Response) 0.1*, 0.3*, 6.5* *(1^2t Response)
Note: I_n = Rating Plug Value I_r = Long Delay Pick-up Setting x I_n			

LOW VOLTAGE METAL ENCLOSED SWITCHGEAR TYPE MAGNUM DS

Meets all Standards... Seismically Qualified

Magnum DS Switchgear is built and tested to the following standards:

- | | |
|-----------------|-----------------|
| ■ ANSI C37.20.1 | ■ ANSI C37.20.1 |
| ■ ANSI C37.51 | ■ ANSI C37.51 |
| ■ UL 1558 | ■ UL 1558 |

Magnum DS Switchgear and Circuit breakers are manufactured and assembled in ISO certified facilities.

The switchgear has been seismically qualified and exceeds requirements of the Uniform Building Code (UNC) and Californian Building Code (CBC).

Two Structure Widths Provide Greater Capacity in Less Space

Cutler Hammer engineered magnum DS Switchgear in two space saving structure widths: 22-inches wide for 800-3200A breaker frames. Magnum DS Switchgear provides opportunities for more circuit breakers in less space than any other ANSI Switchgear.



Magnum DS Breakers are designed and engineered specifically for use in Magnum DS Low Voltage Switchgear assemblies applied at nominal voltages of 240,480 and 600V AC. Six continuous rating – 800 amperes through 5000 amperes – are covered by only two breaker sizes.

Controls and indicators are functionally grouped on the front of the breakers... and the through-the-door design means they are easily viewed and accessible.

Magnum DS Breaker Comprises of:-

- | | |
|--|--|
| 1. Trip Flag | 7. "Push Off" to Close Breaker Button |
| 2. Three Accessory Windows | 8. Manual Charging Handle |
| 3. Digitrip RMS Trip Unit | 9. Optional Operational Counters |
| 4. Contact States Indicator (Open or Closed) | 10. Optional "off" Key Lock |
| 5. Spring Status Indicator (Charged or Discharged) | 11. Padlockable Levering Device |
| 6. "Push Off" to Open Breaker Button | 12. Color Coded Breaker Position Indicator |

Higher Ratings, Increased Strength, and Expanded Capabilities... In Less Space

Type Magnum DS Switchgear is constructed structurally stronger while providing greater interrupting and withstand ratings in less space than any other ANSI switchgear. Increased ratings in less space provide opportunities to design more rugged electrical distribution systems that can handle larger available fault current while eliminating the need for limiters in most instances and providing for better coordination with downstream devices.

It is also included capabilities for our customers to utilize Cutler Hammer industry leading communications and power quality measurement technologies.



Highest Interruption and Short Time (Withstand) Ratings.

Magnum DS Breakers provide the industry's highest ANSI Ratings available without current limiters in a physically smaller size.

A New Through-the-Door Design

All Magnum DS Breakers controls, indicators and the trip unit are visible and can be safely accessed without opening the compartment door.

Smaller Size

Magnum DS Breakers include several unique technology breakthroughs making them the industry's physically smallest ANSI Power Breakers.

A New Family of Trip Units

A full range of Digitrip RMS Electronic and Programmable Trip Units has been developed to provide customers with a choice of expanded protection, information, power quality measurement and communication capabilities to meet specific requirements.

Only Two Structure Widths

22 and 44 inch widths

Unique Wire way

A unique 4-inch wireway is located on the side of the structure for quick and safe wiring.

Programmable Trip Units

Digitrip RMS 1150 provides programmability for more sophisticated distribution systems.

- Increased protection and coordination capabilities.
- Systems monitoring information including power factor, voltage current, harmonic distortion values, and waveform capture with three line, (eight characters per line) led display.
- Two programmable contacts for customer use.
- Time stamping of trip events for improved troubleshooting and diagnostics.
- Accuracy of 1% metered values and 2% on energy and power.
- Systems diagnostic information.
- IMPACC Communication.

Electronic Trip Units

- Digitrip RMS 220 provides long time and instantaneous protection only.
- Digitrip RMS 520 enables the user as many as nine phase and ground current protection settings for maximum flexibility in trip curve shaping and multi unit coordination and adds ground current protection settings.
- Digitrip RMS 520M adds phase, neutral and ground current metering... with four character LCD Display window.

TECHNICAL DATA

Table 1. Available Bus Ratings

Cross Bus Ampacity	Vertical Bus Ampacity	Bus Bracing①
3200 3200 4000	2000 3200 4000	100kA, 150kA, 200kA
5000 6000	5000 -	100kA, 150kA, 200kA

① In addition to these available bus bracings, the bus has been tested for short circuit values of 85,000 Amperes for a full 60 cycles.

Table 2. Rating of Magnum DS Breakers

Breaker Type	Frame Amperes	Ratings, RMS Symmetrical Amperes					
		Interrupting Rating			Short Time Rating		
		208-240V	480V	600V	208-240V	480V	600V
MDS-408	800	42,000	42,000	42,000	42,000	42,000	42,000
MDS-608	800	65,000	65,000	65,000	65,000	65,000	65,000
MDS-808	800	85,000	85,000	85,000	85,000	85,000	85,000
MDS-C08	800	100,000	100,000	100,000	85,000	85,000	85,000
MDS-616	1600	65,000	65,000	65,000	65,000	65,000	65,000
MDS-816	1600	85,000	85,000	85,000	85,000	85,000	85,000
MDS-C16	1600	100,000	100,000	100,000	85,000	85,000	85,000
MDS-620	2000	65,000	65,000	65,000	65,000	65,000	65,000
MDS-820	2000	85,000	85,000	85,000	85,000	85,000	85,000
MDS-C20	2000	100,000	100,000	100,000	85,000	85,000	85,000
MDS-632	3200	65,000	65,000	65,000	65,000	65,000	65,000
MDS-832	3200	85,000	85,000	85,000	85,000	85,000	85,000
MDS-C32	3200	100,000	100,000	100,000	85,000	85,000	85,000
MDS-840	4000	85,000	85,000	85,000	85,000	85,000	85,000
MDS-C40	4000	100,000	100,000	100,000	100,000	100,000	100,000
MDS-850	5000	85,000	85,000	85,000	85,000	85,000	85,000
MDS-C50	5000	100,000	100,000	100,000	100,000	100,000	100,000

Table 3. Dimensions, In Inches (Millimeters)

FC①	W	D②	A③	CC④⑥	Recommended Number of Power Conduits (Maximum) ⑤	
					3.5 Inch	4 Inch
36 (914)	22 (259)	54 (1372)	18 (457)	7.3 (185)	3	3
		60 (1524)	24 (611)	13.3 (338)	6	6
		66 (1676)	30 (764)	19.3 (490)	9	9
		72 (1829)	36 (916)	25.3 (643)	12	12
		78 (1981)	42 (1069)	31.3 (795)	15	15
		84 (2143)	48 (1221)	37.3 (948)	18	18
		90 (2286)	54 (1373)	43.3 (1100)	21	21

FC①	W	D②	A③	CC④⑥	Recommended Number of Power Conduits (Maximum) ⑤	
					3.5 Inch	4 Inch
36 (914)	44 (1118)	54 (1372)	18 (457)	7.3 (185)	7	7
		60 (1524)	24 (611)	13.3 (338)	14	14
		66 (1676)	30 (764)	19.3 (490)	21	21
		72 (1829)	36 (916)	25.3 (643)	28	28
		78 (1981)	42 (1069)	31.3 (795)	35	35
		84 (2143)	48 (1221)	37.3 (948)	42	42
		90 (2286)	54 (1373)	43.3 (1100)	49	49

- ① PC is the recommended front clearance for breaker removal with top-of-switchgear-mounted breaker lifter. If a portable breaker is to be used, allow at least 84 inches (2134 mm) of aisle space.
- ② Hinged rear doors add 1.25 inches (32mm).
- ③ Bolt hole location for mounting the center floor channel when required. Floor channels not included.
- ④ When a zero-sequence ground-fault CT is mounted on line-side or load-side of a breaker, reduce CC dimension by 10 inches (254mm).
- ⑤ Stub conduit 2 inches (50mm) maximum in power cable are, 1-inch (25mm) maximum in control wiring area.
- ⑥ For available area for bus duct connection contact Wescosa.

WESCOSA ASSEMBLED PANELBOARDS

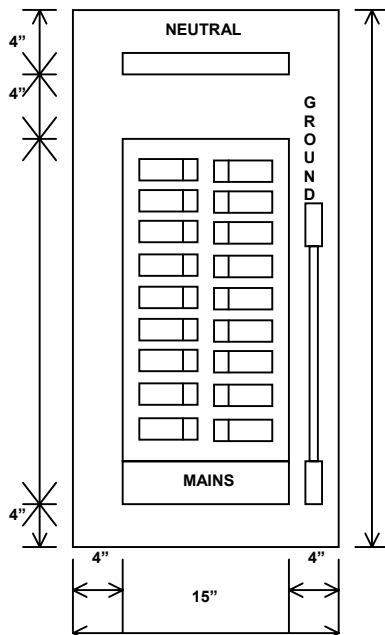
STANDARD SPECIFICATIONS

Boxes

Code gauge commercial galvanized sheet steel. (All box dimensions are I.D.) 15" Wide, 5" Deep

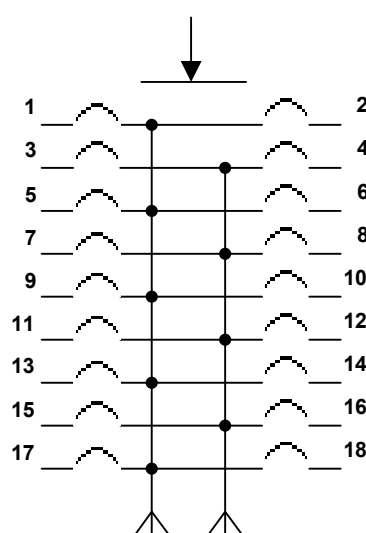
Trims (Surface or Flush)

Code gauge sheet steel and finished with gray ANSI-61 or ANSI-70. Doors provided with directory card and transparent cover. Doors up to 48" have single point catch and lock. Doors over 48" in height have one single point catch and lock with two quarter-turn fasteners. All locks keyed alike.

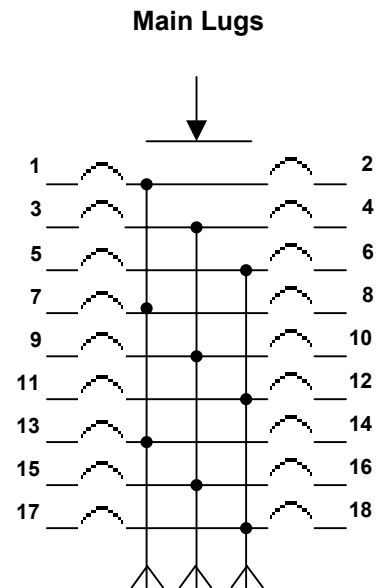


Typical Box with Interior Surface or Flash Trim

Typical Panelboard Wiring Diagrams



1 Phase 3 Wire,
1 Phase 2 Wires (No. SN)



3 Phase 4 Wires,
3 Phase 3 Wires (No. SN)

Busbars

Tin Plated. Copper Busbars

Type HQP 10

Plug-in Circuit Breakers
Main Lugs Only: 125, 225A
Main Breakers: 60, 100, 125, 150, 225A

.Modifications

Split Bus
Lighting contactor
Override Switch
Time Switch
Photo Cell
Special Enclosure
Special Modifications
Knock-outs
Grand Plate
Special Paint
Ground Fault Protection
Shunt Trip on the Main
Shunt Trip on the Branches

HQP 10
Amps, RMS Sym.
Fully Rated

Interiors:

Mains and Branches

Short Circuit Rating

Main Lugs Only

125, 225A

10,000A & 22,000A
(Fully Rated)

Main Breakers

60A: HQP, GW, GHB, GHC, QPH, FD
100A: HQP, GHB, GHC, QPH, FD, GW
125A, GW, FD
150A FD
225A FD

10,000A & 22,000A
(Fully Rated)

Branched Devices: 15-30A, 1P, 2P, QPHGF & QPGF

Type: HQP, QPH

Ratings: 15thru 100A-1, 2 & 3 pole

Voltage: 1 Pole 120 Volt

2 Pole 120/240 Volt or 240 Volt

3 Pole 240 Volt or 380Y/220V

LOW VOLTAGE PANEL BOARDS



POWER R-Line 1A, 2A and 3A

- Standard design utilizing Series C circuit Breakers.
- Increased series ratings (with Series C Main Circuit Breakers) provide higher short circuit ratings using standard breakers.
- Branch Pow-R-Line 3A can accommodate branch breakers dual mounted through 225 Amps.
- Lock and Door opening mechanism includes a positive slide catch and right or left-hand installation.
- Surface of flush trims.
- UL tested and listed. Meets NEC and NEMA standards.

POWER R-Line 4B and 4F

- Pow-R-Line 4B panel board utilizes circuit breakers.
- Pow-R-Line 4F Panelboards utilizes types FDPW fusible switches.
- A single chassis accommodates both circuit breakers and fusible switches.
- Main and neutral are located at the same ends to provide additional space for branch devices.
- Three-piece trim facilitates installations.
- Will accommodate Series C Circuit Breakers to provide higher ratings in a standard chassis and increased series ratings.
- UL tested and listed. Meets NEC and NEMA standards.



General Construction Features

WESCOSA assembled Panelboards as per Cutler-Hammer technologies are designed for sequence phase connection of branch circuit devices. This allows complete flexibility of circuit arrangement (1-, 2- or 3-poles) to allow balance of the electrical load on each phase.

Sturdy rigid chassis assembly assures accurate alignment of interior with panel front; prevents flexing and minimizes possibility of loosening or damage to current carrying parts during and after installation.

Four-point in-and-out adjustment of panel interior is provided to meet critical depth dimension on flush installations. This compensates for possible alignment of box at installation. Main lugs are mechanical solder less type and approved for copper or aluminum conductors.

Enclosure

Boxes are code-gauge galvanized steel except for column type Panelboards that include a painted box finished in ANSI-61 light gray to match the rim.

Standard Panel board cabinets are designed for indoor use. Alternate types are available for indoor and special purpose applications.

All enclosures are furnished in accordance with Underwriters Laboratories standards and include wiring gutters with proper wire bending space. Special cabinets can be provided at an additional charge.

The box dimensions shown are inside dimensions. For outside dimensions, add 14 inch (6.4 mm). Standard Panelboards boxes are supplied without knockouts (blank end walls).

Fronts

Fronts (trims) for all Panelboards are made of code-gauge steel and have a high durability ANSI-61 light gray finish applied by a baked-on polyester powder coating paint system.

The fronts for lighting and appliance branch circuit Panelboards and small power distribution Panelboards include a door with rounded corners and concealed hinges that allow a 130° door swing. A flush type latch

and lock assembly is included. All locks are keyed alike. These trims are available in both surface and flush mounted designs.

Fronts for power distribution Panelboards utilize a unique breaker front cover design in which each device has a dedicated bolt-on steel cover. The individual covers form a single dead front for the Panelboards that is used in conjunction with two wiring gutter covers to complete the trim. A door is not finished as part of the standard offering on these Panelboards but can be provided, for an additional charge, using a deeper than standard box.

TECHNICAL DATA

Table 1: Panelboards Selection Guide

Panelboard Type	Device Type	Maximum Voltage Rating		Maximum Main Rating, Amperes		Branch Circuit Ampere Range	Short Circuit Current Ratings rms Symmetrical Amperes, AC	
		AC	DC	Main Lugs Only	Main Device		Fully Rated (kA)	Series Rated (kA)
Pow-R-Line 1a	Breaker	240	-	600	600	15 – 100	10 – 22	22 – 200
Pow-R-Line 2a	Breaker	240	250	600	600	15 – 100	65	65 – 200
		480Y/227		600	600	15 – 100	14	22 – 150
Pow-R-Line 3a	Breaker	240	250	800	600	15 – 225	10 – 200	22 – 200
		480		800	600	15 – 225	14 – 100	22 – 150
		600		800	600	15 – 225	14 – 35	-
Pow-R-Line 4b	Breaker	240	250	1200	1200	15 – 1200	10 – 200	22 – 200
		480		1200	1200	15 – 1200	14 – 200	22 – 150
		600		1200	1200	15 – 1200	14 – 200	-
Pow-R-Line 4f	Fusible Switch	240	250	1200	1200	30 – 1200	100 – 200	-
		600		1200	1200	30 – 1200	100 – 200	-

Terminal Wire Ranges, Pressure-Type Al/Cu Terminal Except as Noted①

Where copper-aluminum terminals are supplied on designated Panelboard types, best results are obtained if a suitable joint compound is applied when aluminum conductors are used.

Table 2: Standard Main Lug Terminals

Panel Type	Wire Size Ranges for Ampere Capacity						
	100 Amps	225 Amps	250 Amps	400 Amps	600 Amps	800 Amps	1200 Amps
Pow-R-Line 1a	#12-1/0	#6-300 kcmil	-	(2) #2-500 kcmil	-	-	-
Pow-R-Line 2a	#12-1/0	#6-300 kcmil	-	(2) #2-500 kcmil	-	-	-
Pow-R-Line 3a	#12-1/0	-	#6 – 350 kcmil	(3) #2-500 kcmil	(2) #2-500 kcmil	(3) #2 – 500 kcmil	-
Pow-R-Line 4	-	-	#2 – 500 kcmil	(2) #2-500 kcmil	(2) #2-500 kcmil	(3) #2 – 500 kcmil	(4) #2 – 500 kcmil

① For other terminals available on some ratings of molded case circuit breakers and FDPW fusible switches, refers to MCCB CD-ROM.
Note: Optional 750 kcmil mechanical screw-type terminals are available upon request. Panelboards dimension may be affected. Refer to Wescosa.

Table 3: Standard Main Breaker, Branch Breaker, Main Switch or Branch Switch Terminals.

Breaker Type	Ampere Rating	Wire Size Ranges
BAB, HQP	15 – 70 90 – 100	#14 - #4 #8 - #1/0
QBHW, QPHW	15 – 70 90 – 100	#14 - #4 #8 - #1/0
ED, EDH, EDC	100 – 225	#4 - #1/0 or #6 - 300 kcmil
EHD, FDB, FD, HFD, FDC	15 – 100 125 – 225 175 – 225	#14 - #1/0 #4 - #4/0 #6 - #350
FCL GHB	15 – 100 15 – 100	#14 - #1/0 #14 - #1/0
GHQ HGHB GHBS	15 – 20 15 – 30 15 – 30	#14 - #1/0 #14 - #1/0 #14 - #1/0
JD, JDB, HJD, JDC	70 – 250	#4 – 350 kcmil
DK	25 – 350 400	250–500 kcmil (2) 3/0 – 250 kcmil Or (1) 3/0 – 500 kcmil
KD, KDB, HKD, KDC, CKD③, CHKD③	100 – 225 250 – 350 400	(1) #3 – 350 kcmil (1) 250 – 350 kcmil (1) 3/0 – 350 kcmil (1) 3/0 – 350 kcmil

Breaker Type	Ampere Rating	Wire Size Ranges
LD, HLD, LDC, CLD④, CHLD④, CLDC④	300 – 500 600	(2) 250 – 350 kcmil (2) 400 – 500 kcmil
MDL, HMDL, CMDL④, CHMDL④	400 – 600 700 – 800	(2) #1 – 500 kcmil (3) 3/0 – 400 kcmil (2) 500 – 750 kcmil
ND, HND, NDC, CND④ CHND④ CNDC④	600 – 1000 1200	(3) 3/0 – 4000 kcmil (4) 4/0 – 500 kcmil
LCL	125 – 225 250 – 400	(1) #6 – 350 kcmil (1) #4 – 250 kcmil And (1) 3/0 – 600 kcmil
FB-P	15 – 100	#14 – 1/0
LA-P	70 – 225 250 – 400	#6 – 350 kcmil (1) #4 – 250 kcmil And (1) 3/0 – 600 kcmil
NB-P	350 – 700 800	(2) #1 – 500 kcmil (3) 3/0 – 400 kcmil

③ 100% rated breaker.

④ 100% rated breaker

Table 4: FDPW Switches

Ampere Rating	Wire Size Ranges
30, 60, 100 200	#14 – 1/0 #4 – 300 kcmil
400	250 – 750 kcmil or (2) 3/0 – 250 kcmil
600	(2) #4 – 600 kcmil or (4) 3/0 – 250 kcmil
800	(3) 250 – 750 kcmil or (6) 3/0 – 250 kcmil
1200	(4) 250 – 750 kcmil or (8) 3/0 – 250 kcmil

Note: For other terminals available on some ratings of molded case circuit breakers and FDPW fusible switches refer to MCCB CD-ROM and product guide.

Note: All terminal sizes are based on wire ampacities corresponding to those shown in NEC Table 310-16 under 75°C insulation columns (75°C wire), regardless of insulation temperature is not permitted without voiding UL labels on device and equipment.

SWITCHBOARDS POW-R-LINE C AND TYPE WF

Pow-R Line C Switchboards

Meet NEMA Standard PB-2 and UL 891

Construction Feature

- 6000S Maximum main bus rating.
- Front accessible for placing against a wall or rear accessible for placing away from a wall.
- Sections rear aligned or front and rear aligned.
- NEMA 1 or NEMA 3R enclosures.
- The IQ family of microprocessor based metering devices.
- Group mounted distribution devices.

Main Devices

- DS-II air power circuit breakers, 800 – 4 000A, drawout.
- DS-II air power circuit breakers, 800 – 4000A, fixed or drawout.
- RD Molded Case circuit breakers, 1600 – 2500A, fixed or drawout.
- Bolted pressure switches, 400 – 5000A.
- Molded Case circuit breakers, 400 – 1600A.
- FDP fusible switches, 400 – 1200A.

Group Mounted Distribution Devices

- Molded Circuit Breakers, 15 – 1200A.
- FDP Fusible Switches, 30 – 1200A.

Standard Height

The Pow-R-Line switchboard height is 90 inches.

Type 1 Pow-R Line C Front Access / Rear Aligned

Pow-R Line front accessible switchboards align at the rear enabling them to be placed against the wall. If the main section is deeper than the others, due to physical size of the main device, the necessary offset in the line up will occur in the front, and the main section will be accessible from the side as well as from the front.

Front Access / Front and Rear Aligned

Pow-R Line C front accessible switchboards may also be built with all section aligned in the front as well as the rear.

Type 2 Pow-R Line C Rear Access / Front and Rear Aligned

- Pow-R Line C rear accessible switchboards are design to be placed away from a wall. Access to the main device is from the rear and structures align in both the front and rear.

Group Mounted Distribution Devices

- Feeder devices are group mounted and may be molded case breakers or FDP fusible switches. Feeder devices are accessible from the front in all Pow-R Line C Switchboards. A main molded case breaker or main FDP switch up, up to 1200A, may be included in the panel mounted assembly in lieu of a separate, individual mounted device.

Bus Bar System

- Pow-R Line C Switchboards are provided UL heat tested in tin plated aluminum as standard. Copper and silver plated copper bus are available at an additional price. Copper and aluminum bus based on densities of 1000A/in² for copper and 750/in² for aluminum are also available.





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Bus Short Circuit Rating

- Standard Bus and Connectors on all Pow-R Line C Switchboards are rated for use on system capable of delivering up to 65,000 amps RMS symmetrical short circuit current at the incoming terminals.
- Increased bus short circuit ratings equal to that of connected switchboard devices, up 200,000 amps RMS symmetrical, are available.

Provisions for Busway

- Busway connection to switchboard section includes call out and drilling in the top of the switchboard with riser connections are furnished external to the switchboard.

Transitions

- Transition structures are required for connecting switchboards to the secondary of power center transformer (dry or fluid filled), ATS, Motor Control Centers and for other special switchboard configurations such as "L" or "U" shaped lineups. In some application, an extra structure complete with connection is required; in others, where switchboard depth and space permit, only the connection conductors are required (Refer to factory for these applications).

Auxiliary Structure

These are normally mounted adjacent to service structures and used where incoming service or feeder conductors require additional space or facilities not included in the standard switchboard, such as:

1. Mounted adjacent to a top connected service structure and used as a cable pull structure where service conductors are brought in underground. Auxiliary structures are the same depth and height as the service structure, and are wide enough to accommodate the incoming cables.
2. Mounted adjacent to a service structure and used as a bus transition compartment for running riser bus up to top outgoing busduct connection when distribution structures are the same depth and height as service structures.

In addition to the above applications, auxiliary structures may be mounted adjacent to a distribution structure and used as a structure for lighting panel or other device, which may be cable, connected to a branch circuit device in the distribution structure. Dimensions are compatible with arrangements required.

- Reduced dimensions with increased device flexibility.
- Utilize the Pow-R-Line 4 chassis design for the distribution section.
- Will accommodate Series C Circuit Breakers and fusible units in the same chassis.
- UL Tested and approved. Meets NEC and NEMA Standards.
- Available with IQ series metering units or conventional customer metering.
- Front or rear accessible.
- Aluminum, copper or silver plated copper main bus.
- A full range of device modifications is available.
- Available NEMA 1 and 3R enclosures, UL Listed.
- Three distribution chassis available: 22X, 38X and 50X.

Modifications

- Ground fault protection on main and distribution devices.
- Wide range of metering capabilities.
- A full range of device modifications is available.
- Coordination with other Westinghouse Division busway and transformer connections.



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Dimensions

Height	Width(s)	Depth(s)
90°	26", 30" 36" 45", 51"	18", 24", 30" 36", 48", 54", 66"

Voltage: 240-480-600 V Ac, 250 V Dc

Mains: 400 thru 6000 Amps

Device Type	Amps	Short Circuit Symmetrical Rating
Molded Case Circuit Breakers	400 thru 1600	18 kA thru 200 kA
Bolted Pressure Switches	400 thru 5000	200 kA
Air Power Circuit Breakers, Type DS-II, DSL-II	800 thru 4000	30kA thru 200kA
Fusible Switches, Type FDP	400 thru 1200	200 kA
Main Lugs Only	400 thru 6000	Per Distribution Below

Distribution

Utilizes the full family of Westinghouse molded case circuit breakers and fusible switches.

Device Type	Amps	Short Circuit Rating
Molded Case Circuit Breakers	15 thru 1600	10 kA thru 200 kA
Fusible Switches, Type FDP	30 thru 1200	200 kA
Stacked-Main/Branch Devices	400 thru 2500	18 kA thru 200 kA

Switchboard Size Comparison

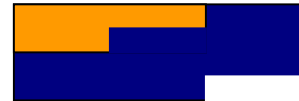
600 Amps L-Frame Main
 Circuit Breaker Branches < 600 Amps



1200 Amps FDP Main
 Fusible Branches < 800 Amps



1600 Amps Pringle Main
 Circuit Breaker Branches < 800 Amps
 Utility Metering
 Customer Metering
 Ground Fault Metering



2500 Amps RD Main
 Circuit Breaker Branches < 800 Amps



4000 Amps Pringle Main
 Fusible Branches Thru 1200 Amps



SWITCHBOARD MAIN DEVICE RATINGS

Molded Case Circuit Breakers

Circuit Breaker Type	Continuous Ampere Rating	Interrupting Rating RMS, Symmetrical Amperes (000)			
		AC Ratings Volts			DC
		240	480	600	250
JD	70 – 250	65	35	18	10
HJD	70 – 250	100	65	25	22
JDC	70 – 250	200	100	35	22
DK	250 – 400	65	-	-	-
KD	70 – 400	65	35	25	22
CKD	70 – 400	65	35	25	22
HKD	70 – 400	100	65	35	25
CHKD	70 – 400	100	65	35	25
KDC	70 – 400	200	100	50	25
LD	300 – 600	65	35	25	22
CLD	300 – 600	65	35	25	22
HLD	300 – 600	100	65	35	25
CHLD	300 – 600	100	65	35	25
LDC	300 – 600	200	100	50	25
CLDC	300 – 300	200	100	50	25
MDL	400 – 800	65	50	25	22
CMDL	400 – 800	65	50	25	22
HMDL	400 – 800	100	65	35	25
CHMDL	400 – 800	100	65	35	25
ND	600 – 1200	65	50	25	-
CND	600 – 1200	65	50	25	-
HND	600 – 1200	100	65	35	-
CNDC	600 – 1200	200	100	50	-
NDC	600 – 1200	200	100	50	-
CHND	600 – 1200	100	65	35	-
RD 1600	800 – 1600	125	65	50	-
CRD 1600	800 – 1600	125	65	50	-
RD 2000	1000 – 2000	125	65	50	-
RD 2500	1000 – 2500	200	65	50	-
CRD 2000	1000 – 2000	125	65	50	-
RDC 1600	800 – 1600	200	100	65	-
CRDC 1600	800 – 1600	200	100	65	-
RDC 2000	1000 – 2000	200	100	65	-
RDC 2500	1000 – 2500	200	100	65	-
CRDC 2000	1000 – 2000	200	100	65	-

Bolted Pressure Contact Switches, 250 or 480 v Ac

Amps Rating	Fuse Class Used	Short Circuit Ratings (kA Sym)
QA Manual 800-5000 Amps	L	200 kA
CBC Electric 800-5000 Amps	L	200 kA

FDP Switches, 250 or 600 V Ac

Amps Rating	Fuse Class Used	Short Circuit Ratings (kA Sym)
400, 600 400, 600 800, 1200	R J L	100 200 200

Power Circuit Breakers, 3-Pole 600V ac Max. w/ Digitrip RMS Solid State Trip Units

Circuit Breaker Type	Available Ampere Ratings	Ratings, Symmetrical Amperes (000)				
		Interrupting Rating			Short Time Ratings	
DS II Circuit Breaker		240V	480V	600V	480V	600V
DS II-308	50-800	42	30	30	30	30
DSII-508	50-800	65	50	42	50	42
DSII-608	50-800	65	65	50	65	50
DSII-516	50-1600	65	50	42	50	42
DSII-616	50-1600	65	65	50	65	50
DSII-620	50-2000	65	65	50	65	50
DSII-632	800-3200	85	65	65	65	65
DSII-840	1000-4000	130	85	85	85	85
DSII-850	1600-5000	130	85	85	85	85
DSLII-Circuit Breakers						
DSLII-308	50-800	200	200	200	-	-
DSLII-516	50-1600	200	200	200	-	-
DSLII-620	500-2000	200	200	200	-	-
DSLII-632	800-3200	200	200	200	-	-
DSLII-840	1000-4000	200	200	200	-	-

DEAD-FRONT DISTRIBUTION SWITCHBOARDS "TYPE WF".

Type WF Switchboards
Meet NEMA Standard PB-2, 1972

CONSTRUCTION DETAILS

400 Ampere Main Bus Maximum

All front accessible – Main Section front and/or side accessible.

Front and Rear Accessible

Branch devices panels mounted available.

Section flush at rear

Front accessible designs are designed especially mounting against a wall, but self-supporting.



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Main Devices, Individually Mounted

Molded case breaker, 225 – 2000 Amps, Fixed

Electronic trip breaker: 600 – 2500 Amps, Fixed

Thermal Magnetic Trip 600 – 800

Amps, Fixed

DSII or MDS Power Circuit Breaker, fixed or drawout, 800 – 4000 Amps

Bolted pressure contact switch, 800 – 4000 Amps

FDP fusible switch, 800 – 1200 Amps, fixed

Branch Devices, Panel Mounted

Molded Case Breaker, 15 – 1200 Amps

Electronic Trip Breaker: 600 – 12000 Amps

FDP fusible Switch, 30 – 1200 Amps

Combination motor starter unit, full voltage, non-reversing or reversing;

SPECIFICATIONS

General

Completely metal enclosed (except bottom) self supporting

Sections bolted together to form rigid line-up

90 inch high

Universal Frame construction

Die formed members bolted and braced using self-tapping bolts

All covers removable and fastened with self-tapping screws

Formed edges on all covers

Code gauge steel covers

Copper and thin plated aluminum bars sized to U.L. Inc. requirements

Bus bracing as required

All-bolted bus joints and connections using high strength zinc coated steel hardware

Ground bus extends through line-up

Lifting means furnished for each shipping section

Maximum conduit space consistent with NEMA requirements

Finished inside and out with gray powder coating, ANSI 61 except internal brackets galvanized steel

Hinged wireways for easy access.

Type WF

All sections 20 inch deep except main device sections requiring greater depth

Sections line up in rear for against the wall placement

All installation and maintenance can be performed without rear access

Branch devices are panel mounted and front removable

Horizontal bus supported on glass polyester insulators

Bus bracing standard 50,000 amps, maximum 100,000 amps

Bus splices connect adjacent bus sections

Vertical sections designed for bolting together at jobsite

Individual sections completely assembled and tested

Build to UL specifications

Meets all NEC, NEMA and OSHA requirements

LOW VOLTAGE SWITCHRACK AND POWER DISTRIBUTION RACKS

- Special Design for Classified Areas and Corrosive Environments.
- Suitable for Outdoor Application
- Special Design for Classified Areas and Corrosive Environments.
- Switchracks are manufactured to NEMA, UL, CSA, & FM standards and NEC requirements.
- All enclosures are tested and certified by third party laboratories.
- Maximum rating 600 V AC, 50/60 Hz, 1200 Amps.



Switchrack

Switchracks are manufactured to NEMA, UL, CSA, and FM standards and NEC requirements and are suitable for outdoor applications in the desert environment corrosive and hazardous locations. All enclosures are labeled with NEMA 44X compliance labels approved by independent laboratories.

Ratings

Switchrack has a rating nameplate attached to the left side of the post. The nameplate shows the general order number under which the rack was built and its electrical ratings, in terms of incoming line voltage, current and frequency. In addition, this nameplate shows a passive circuit (withstand) rating, buyer P.O. no., line item nos., or serial no.

Maximum Voltage: 600V

Frequency: 50 or 60 Hz

Continuous Current: 1200 Amps

Qualified Personnel

Individuals who install, operate or maintain Switchrack must be trained and authorized to operate the equipment associated with the installation and maintenance of a Switchrack, as well as the operation of the equipment that receive its power in the Switchrack.

Such individuals must be trained in the proper procedures and following established safety procedures as outlined in the national Safety Code (ANSI C2) and Electrical Maintenance (NFPA 70).

TABULA IEC SWITCHBOARD SYSTEM

General

TABULA is a unique low voltage switchboard system, fully tested and certified from international testing labs. From the standard modular parts of TABULA system, WESCOSA builds various assemblies, e.g. small distribution boards, Withdrawable MCC's and heavy distribution boards for extreme current ratings.

Busbar System

The busbar system complies with BS EN/IEC 60439 and consists of both vertically and horizontally mounted busbars. Vertical busbars are "C" shaped Cu-bars with current ratings 225A-1600A. Horizontal bars are standard shaped Cu-bars 250A – 7800A.

Vertical Distribution Busbars

The vertical distribution busbars are designed as copper C-Profiles reducing the skin effect to a minimum. The profiles are stiff in order to withstand high short circuit levels and well suited from branching without drilling holes/connections by means of spring nuts.

Units (Compartments) (Din Rail) Units

The great variation of DIN-rail material demands a flexible built-in system. DIN rail parts are in accordance with DIN 43 880, meaning that all ordinary components can be built-in as standard. This is e.g., MCCB's, domestic fuses, earth-fault relays, motorstarters, etc.

Air Circuit Breaker (ACB) Units

An ACB is often used as incoming short circuit protection from the current rating of 800 A and up. It comes in fixed and drawout versions, where the drawout versions can be removed from the main busbars without having to loosen any connection in the switchboard.

Draw-Out Units

General Information

Draw-out compartments are used in installations, where a production stop from longer time is unacceptable and where preventive maintenance is demanded.

Connected Position

In connected position both main and sliding contacts are connected.

Test Position

The push button is activated and the drawer is pulled out. The drawer will automatically lock in the test position, where the sliding contacts are still connected, to maintain the control current.



Disconnected (Isolated) Position

From test position, the push buttons is activated and the drawer is pulled out, where stop pawl locks into it. The stop pawl can be locked with the pad lock, in the case that maintenance is executed on the installation. It is possible to mount up till 3 pad locks in both left and right side of the drawer.

Security Position

This position is temporary and prevents heavy drawers to drop while pulling them out in removed position. The stop pawl in the back prevents that the drawer can be pulled out in one movement. This position is not locked with a pad lock, as it is temporary.

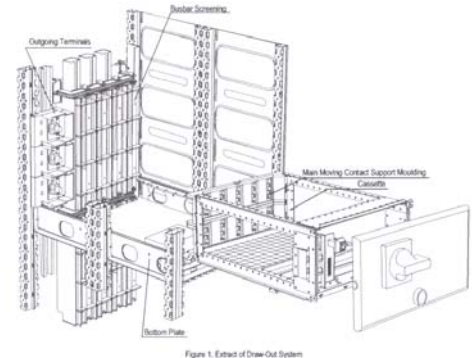


Figure 1: Extract of Draw-Out System

Main Moving Contacts

This main moving contact consists of a silver plated U-shaped spring, with another small stainless spring inside. The stainless spring provides a high contact pressure on the same time stiffens the contact.

Sliding Contact

The sliding contacts are primary for control and auxiliary circuits, but can replace an outgoing contact for maximum current of 32 A. The sliding contact consists of a fixed part mounted on the bottom plate and a moving part mounted in the cassette.

Enclosures

Choice of Switchboard model – divided into three categories:

1. Wall Mounted
2. Floor Mounted
3. Floor Panel with closed bottom

General

In general, the enclosure of TABULA is built of plinth and enclosure profiles, intermediate profiles, doors/covers and corner assemblies, all of which contribute to the required stability and strength.

Internal Division

Vertical and horizontal division plates gives possibility for separate component-, cable-, and busbar compartments in order to construct a switchboard in accordance with IEC 439-1/EN 60439-1, from 2-4a.

General

Doors and covers have identical basic forms and are made from 1.5 mm steel plate and designed as a plain surface with double-folded edges, welded at the corners in order to obtain high stability and strength.

Doors / covers are grey RAL 7032. The doors are used for division of electrical components-, cable and busbar compartment in a switchboard. Covers are used for the following purposes: Closing of the rear side of the switchboard (rear covers). Cover sides/top of enclosure frame.

Door Gasket

The door gasket is a self-adhesive gasket with a closed cell structure, which is mounted in the enclosure profile and the intermediate profile. A narrow as well as a wide version of a gasket is available.

Mounting of Doors / Covers

Doors can be hinged left or right. The opening angle is 95 degrees.

Degrees of Protection

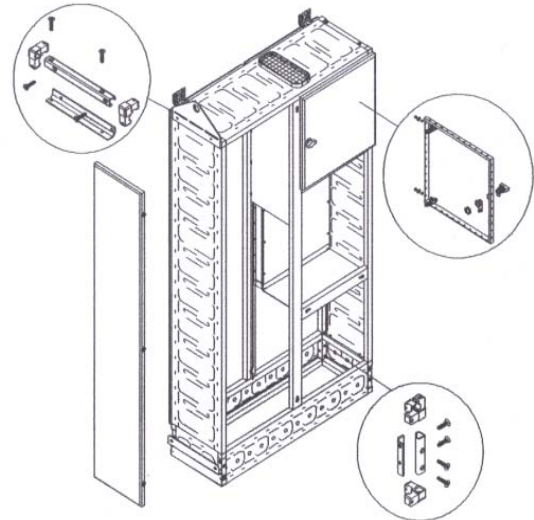
The degree of Protection for a switchboard concerning access to hazardous parts, solid foreign objects and water is started with an IP code in accordance with IEC/EN 60529.

First Characteristic Numeral

P2X standard design, IP3X standard design with gasket at doors and rear covers, IP4X as IP3X, IP5X standard design with gasket at doors and rear covers and sealing of coners and joint.

Second Characteristic Numeral

IPX1 standard design with gasket at doors and rear covers, IPX2 as IPX1, IPX3 as IPX1, but corners tightened with Silicon IPX4 standard design with gasket at doors and rear covers. Sealing with silicon when he draw out compartment is in removed position, the busbar screening ensures a degree of protection of IP2X.



Technical Information

Enclosure

Principle : Modular Sluzinc assembly System
Degree of Protection : IP20 to IP54

Busbar System

Rated Current: 225 A to 7800 A
Rated Short-Time Withstand Current: 5.4 kA to 115kA
Rated Peak Withstand Current : 46kA to 253kA
Rated Operational Voltage : 690 V (1000 V – special design)
Insulation Rated Voltage, U : 1000V
Rated Impulse Withstand Voltage, U_{imp} : 12 kV
Max. test Voltage, V_{eff} : 3500 V for 1 minute

Draw-out System

Rated Current : 125 A to 630 A

Norm Reference

IEC/EN 60439-1

Polyester Powder Coating for Doors and Covers

Type : Powder Coating based on epoxy and polyester resins, color grey RAL 7032.

Service Conditions Ambient Air Temperature

Ambient temperature : -5°C and +40°C

Altitude

2000m (6600 ft)

Storage and Installation

-25°C and +55°C

Medium Voltage Distribution Equipments

IEC METAL-CLAD SWITCHGEAR

17.05kV, 25kA Vacuum Metal-Clad Switchgear



GENERAL DESCRIPTION

To satisfy the needs of the Utility Companies and a segment of Industrial customers, WESCOSA has developed a 17.5kV, 25kA Switchgear conforming to IEC standards.

The Switchgear utilizes Tamco's VK series of Vacuum Circuit Breakers with world-renowned Cutler-Hammer Vacuum Interrupter.

CERTIFICATION AND APPROVAL

Conforms to IEC Specification 60289 and subjected to Type Test in KEMA, Netherlands, including arc resistance test at 25kA.

CONSTRUCTION

Typical cross-section and overall dimensions of the switchgear are shown in Fig. 1. As standard, all exterior and interior parts are painted with ANSI 61, Light Grey paint, applied through electronic deposition. Units have provision to enable them to be bolted together to form a rigid freestanding assembly and are designed to permit extension on either side in future.

Each vertical structure consist of the following:

1. VCB Compartment
2. Bus Bar Compartment
3. Low Voltage Compartment
4. Potential Transformer Compartment (For incoming and bus Tie units only)
5. Cable Compartment

1. VCB COMPARTMENT

This compartment accommodates the vacuum circuit breaker. Circuit breakers are available with continuous current rating of 630, 1250 and 2000 Amperes. Movement of VCB inside the compartment is by means of racking mechanism, which is operable with the front door of the compartment closed. Comprehensive interlocks are provided to ensure the following:

- To ensure that VCB cannot be inserted into or withdrawn from Service Position unless it is in open condition.
- VCB can be closed or opened only when it is in the Service or Test/Isolated position.
- To ensure that VCB cannot be inserted into Service position. Unless control circuit pug is inserted.
- To ensure that earthing switch cannot be closed when circuit VCB is in Service position.

2. BUS BAR COMPARTMENT

This compartment contains the main bus bars. Bus Bars are made out of rounded-edged electrolytic copper to reduce dielectric stress and joints are silver plated for better contact. Bus Bars are insulated as a standard feature and are braced with epoxy-molded standoff insulators. Bus bar joints are provided with removable bus boots.

3. LOW VOLTAGE COMPARTMENT

All the LV components like Relays, Meters, Control Switches, Control Pushbuttons; Indicating Lamps etc. are housed in this compartment.

4. POTENTIAL TRANSFORMER COMPARTMENT

Potential Transformer Compartments are provided in front of the Incoming Bus Tie units for monitoring the line/bus voltage. Potential transformers are mounted on Potential Transformers Rollouts. A safety provision is provided to automatically ground the primary connection to Potential Transformers when rollout is withdrawn, before access can be made.

5. CABLE COMPARTMENT

Feeder bus bars for incoming/outgoing cable connection are located in this compartment. This compartment also contains the manually operated Earthing switch, which is Type-tested for a short time rating of 25kA for 3 seconds.

SPECIAL FEATURES

- Minimal Maintenance since VCB is employed.
- Horizontal isolation, horizontal draw-out type circuit breaker.
- Isolating mechanism operable with front door of VCB compartment closed.
- Proven arc-venting system for each high voltage compartment ensures the damage will be minimal in the unlikely event of flashover.
- Mid-panel mounted VCB lends space to enable Potential Transformer Compartment to be located in front, for better accessibility.
- Operation indicators for breaker position (Service/Test), VCB ON/OFF, Closing Spring Charged/Discharged Earthing switch ON/OFF.
- Donut type Current Transformers mounted over specially designed bushings make their removal easy, for maintenance/testing.

ALL DIMENSIONS ARE IN MM

RATING	W	A	B	C
630A	700	400	500	660
1250A	800	500	600	760
2000A	800	500	600	760

Figure 1 – Cross-section and dimension of Switchgear

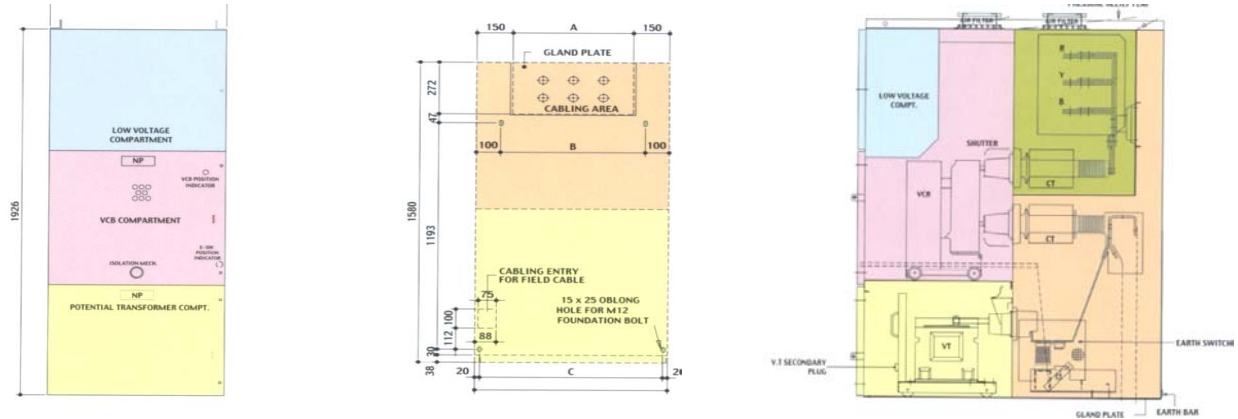


Table 1 – Specification of Vacuum Circuit Breakers

Model #	VK-10J25	VK-10M25	VK-10P25
Rated Voltage		17.5	
1-minute frequency withstand voltage (kV)		38	
Impulse withstand voltage (kV)		95	
Frequency (Hz)		50/60	
Continuous Current (A)	630	1250	2000
Short-Circuit breaking Current (kA)		25	
Short-circuit making current (kAp)		63	
Operating Sequence		O-0.3 S-CO-3 Min-CO	
Duration of Short-circuit (S)		3	
Opening Time (mS)		35	
Break time (mS)		<60	
No-load Closing time (mS)		50	
Closing Supply Voltage (V)		48/60/110/125/220	
Tripping Supply Voltage (V)		48/60/110/125/220	
Full load Switching Life (operations)		20,000	
Auxiliary contacts		3a+3b	
Approximate weight (kg)	75	80	95

Table 2 – Dimensions of Vacuum Circuit Breakers

Model #	Dimension (mm)						
	A	B	C	D	E	F	G
VK-10J25	289.0	302.0	628.0	495.0	69.0	567.0	619.0
VK-10M25	291.0	298.0					
VK-10P25	295.0	290.0					

Note: Information contained in this bulletin is correct at the time of publishing. As we are in the continuous process of improvement of our products, details are likely to change without any notice.

ANSI METAL-CLAD SWITCHGEAR



METAL-CLAD SWITCHGEAR 5KV ABD 15 KV CLASS 250 MVA THRU 1000 MVA TESTED TO ANSI STANDARDS The most Significant New Metal-clad Design in 25 years

Powell Electrical's Custom Designed metal-clad switchgear has been the standard of excellence for over 25 years. Powell Electrical has led the electric industry with quality and innovations to meet customer's needs.

Through this continuous effort, Powell has now introduced POWL-VAC vacuum metal-clad switchgear, incorporating 25 years of custom design and ongoing testing to meet all applicable ANSI, IEEE and NEMA standards.

The ANSI test series is the basic criterion, and includes a complete range of momentary, current interruption, BIL, dielectric, continuous current and mechanical life tests.

Since the successful completion of the ANSI testing in 1982 and the subsequent introduction of the POWL-VAC have completed over 100 installations throughout the United States and around the world.

Over 30 Years Providing Quality Products

The POWL-VAC is available in one or two high configurations with ratings to 3000 amperes, 100 MVA at 26kV. The POWL-VAC metal clad switchgear and circuit breaker meet all applicable ANSI, IEEE and NEMA standards.

The purpose of this technical catalog is to describe POWL-VAC Medium voltage metal-clad switchgear and to aid in the application and selection of POWL-VAC switchgear arrangements to meet the customer's electrical and space requirements. Powell POWL-VAC type metal-clad switchgear with horizontal disconnect circuit breakers provides control and protection for generators, motors, transformers, capacitors, and all types of feeder circuit.

POWL-VAC metal-clad switchgear is available in ratings of 4.16, 7.2 and 13.8kV with maximum interrupting capacities of 350, 500 and 1000 MVA, respectively. POWL-VAC switchgear is the most extensive ever performed by Powell. Two years of research and development combined with extensive laboratory short circuit and other design testing ensures the customer the highest quality and performance vacuum circuit breaker in the industry.

Designed to Meet ANSI Standards C37.04, C37.06 and C37.20 Tested per ANSI standards C37.09 and C37.20

POWL-VAC circuit breakers have been ANSI tested and meet ANSI published maximum Symmetrical Ratings using applicable K factors (I.e., 48kA at 1000MVA).

Certified test reports of tests to ANSI standards available upon request.

Customer Advantages when using POWL-VAC Metal-Clad Switchgear

Vacuum Interrupters have hexagon stems this protecting and eliminating distortion to the internal below.

- Sliding contacts to connect vacuum interrupter stem to load connected primary disconnects.
- Positive interlock visual umbilical cord for control circuitry.
- Cycloaliphatic epoxy insulation system
- 100% copper conductor silver-plated.
- One high or two high equipment designs.
- Chrome copper vacuum interrupter main contacts.
- Direct floor roll out horizontal design.
- Full compliance with ANSI C37.09 and C37.20 standards.
- Meets full interrupter rating through 49kA.
- Free of partial discharge at operating voltages.
- Continuous current rating through 300 amps.

VACUUM CIRCUIT BREAKER



POWELL

Designers and builders of a fully tested and field proven

Vacuum Circuit Breaker

More flexibility, more safety... Experienced with quality manufactured electrical equipment throughout the world.... The new Powell Vacuum Breaker has a proud heritage. A thoroughly tested piece of equipment is your assurance that the Powl-Vac will perform.

Vacuum Interrupters

The vacuum interrupters have ceramic insulators, which permit high temperatures to be used in the evacuation process thus ensuring the highest possible reliability. The contacts materials are used are those having the highest voltage withstand the least loss of material under severe arcing conditions.

Primary Disconnects

A unique arrangement results in lower primary disconnect temperatures. The unique Powell design has been tested at the maximum continuous and momentary currents required for this class of switchgear.

Circuit Breaker Frame

The frame of the circuit breaker is made from the components' fabricated by numerical controlled machines and jig welded into a precision rigid assembly thereby eliminating the variability inherent with the bolted assemblies.

Drawout Mechanism

Movement of the circuit breaker between the disconnect and connect positions is by means of crank arms which when engaging in racking slots attached to the compartment frame react with the circuit breaker midway between the line and load contacts. This eliminates all possibility of unequal wipe distances of the primary connections, which can occur when the breaker is pushed by racking mechanism located below the circuit breaker, and the consequent possibility of failures occurring on high momentary currents.

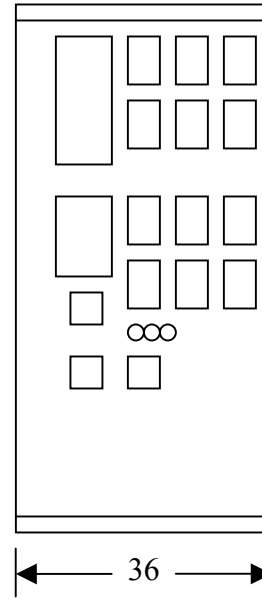
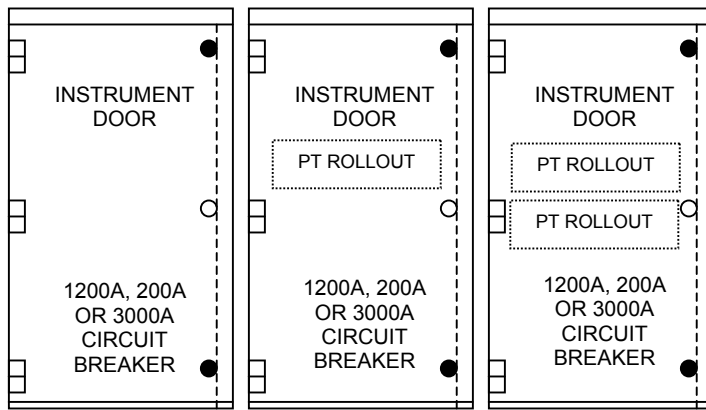
CHOICE OF EQUIPMENT DESIGNS

ONE-HIGH DESIGN

95" HIGH X 36" WIDE X 95" DEEP

- MINIMUM EQUIPMENT DEPTH
- MAXIMUM ISOLATION OF CIRCUITS
- MAXIMUM CABLE TERMINATION SPACE
- FULL HEIGHT FRONT LEVEL

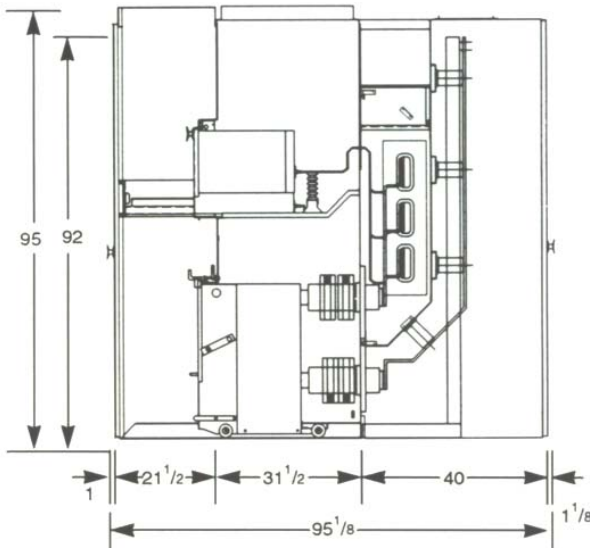
AVAILABLE ONE-HIGH UNIT ARRANGEMENTS



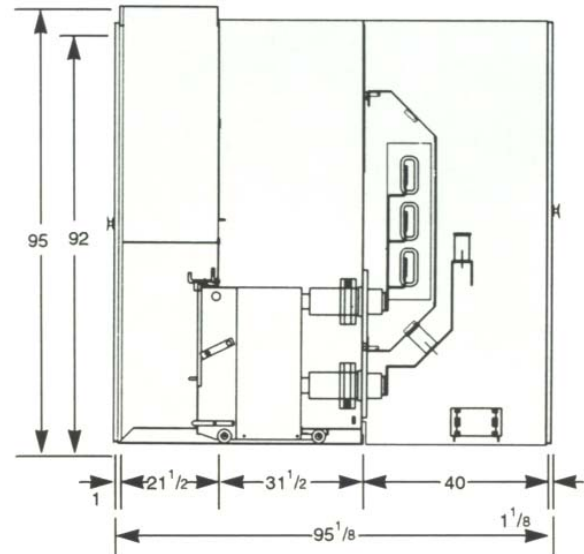
TYPICAL FULL HEIGHT PANEL LAYOUT

FULL HEIGHT FRONT PANEL

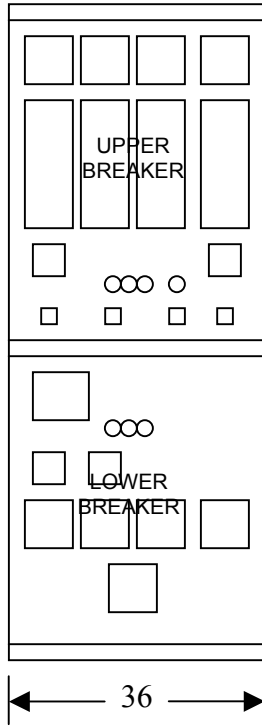
TYPICAL SIDE VIEWS



1 HIGH POWL-VAC WITH PT AND CPT ROLLOUTS



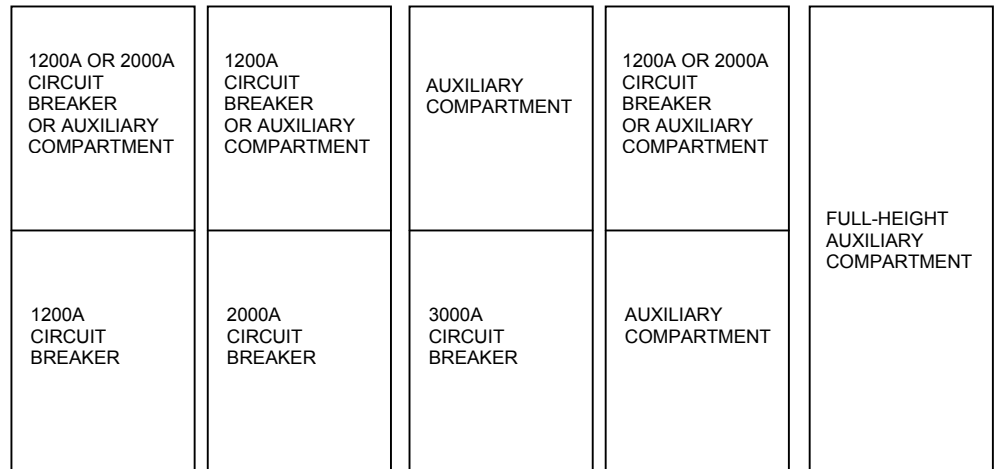
1 HIGH POWL-VAC



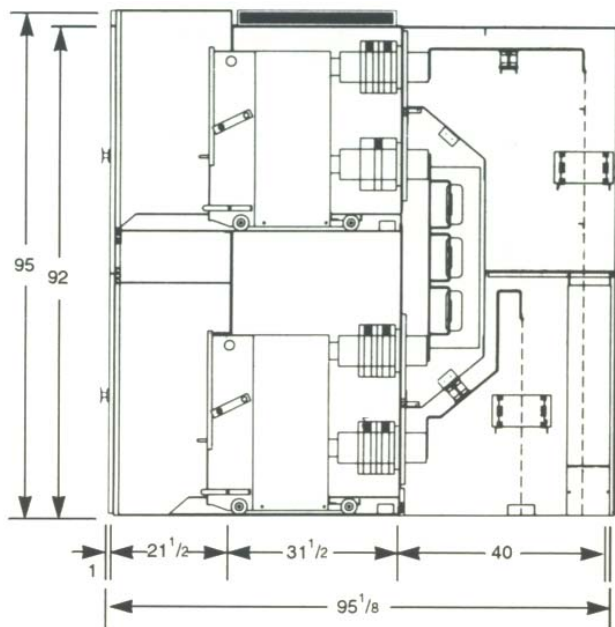
TWO-HIGH DESIGN

95" HIGH X 36" WIDE X 95" DEEP

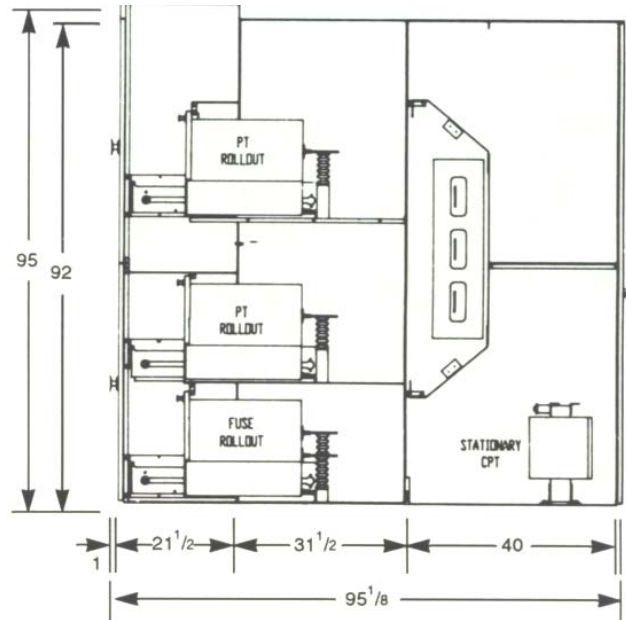
- MAXIMUM UTILIZATION OF FLOOR SPACE
- FULL ISOLATION OF CIRCUITS PER ANSI STANDARDS
- CHOICE OF OVERHEAD LIFTING DEVICE OR PORTABLE LIFT TRUCK TO HANDLE BREAKERS
- FLEXIBLE ARRANGEMENTS



TYPICAL SIDE VIEWS

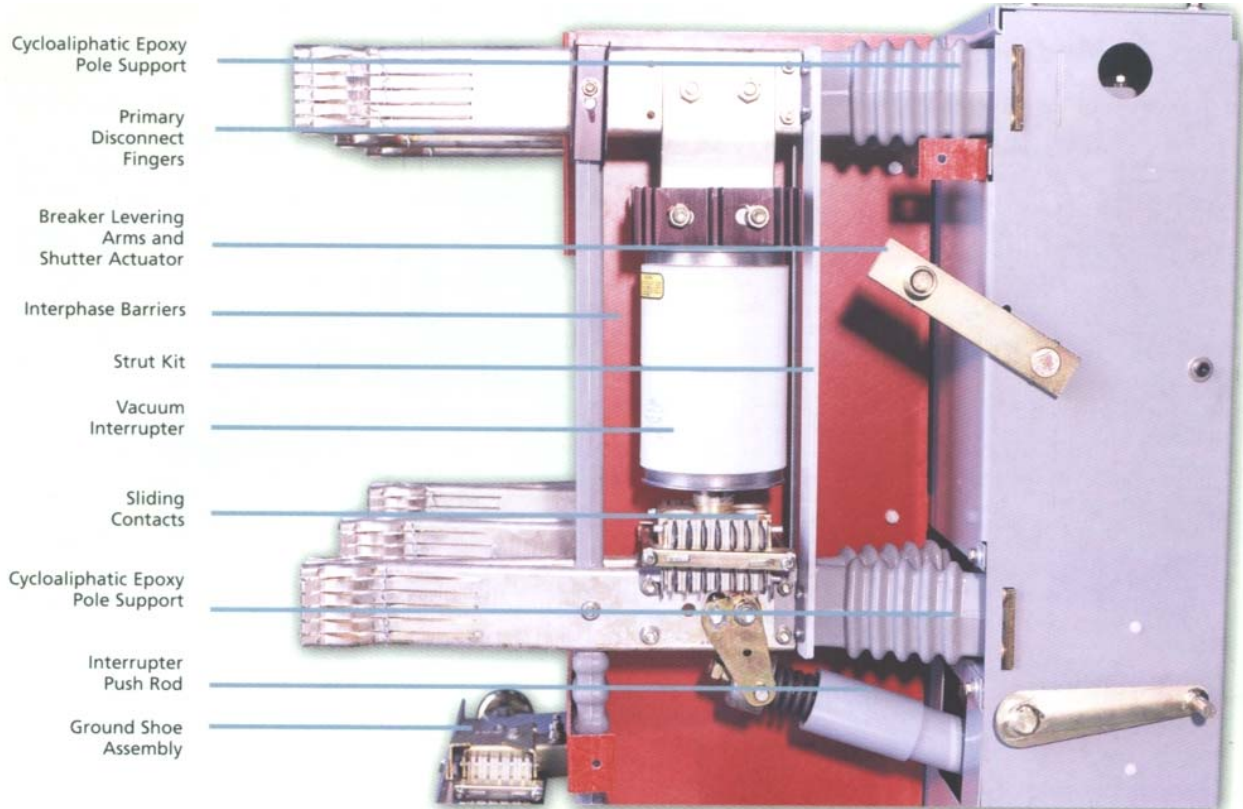


2 HIGH POWL-VAC

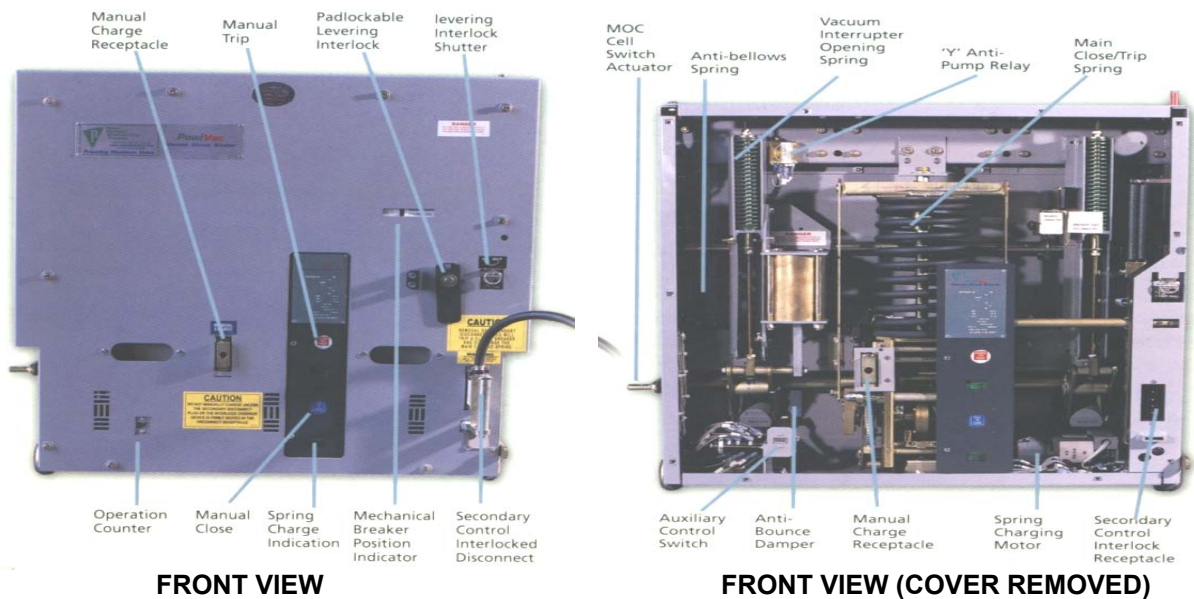


2 HIGH POWL-VAC WITH STATIONARY CPT AND ROLLOUTS

POWL-VAC CIRCUIT BREAKER



POWL-VAC 15PV1000-3000 Vacuum Circuit Breaker rated 1000MVA – 3000 ampere Side View with phase barriers removed



SPECIFICATIONS AND RATINGS

Ratings of Medium Voltage Circuit Breakers with K Factor = 1.0

Standard Design Powl-Vac® and Powl-Vac-AR® (36" wide)														
5kV	Breaker Type	Cell width Inch/mm	Maximum Voltage	Nominal Voltage	Symmetrical Interrupting Rating (kA rms) (a)	Obsolete MVA Ratings	Continuous Current (A rms)	Power Frequency Withstand (kV)	BIL Crest (kV)	Monetary Close & Latch Rating (kA Crest)	% DC Interrupting Current (%) (b)	Rated Interrupting Time (cycle/msec) (b)	Short Time Current 3 sec. (kA)	Back to Back Capacitor Switching (Amps) (c)
	05PV36STD	36/914	4.76	4.16	36	250	1200, 2000, 3000	19	60	97	50	3/50	36	-
	05PV50STD	36/914	4.76	4.16	50	350	1200, 2000, 3000	19	60	135	50	3/50	50	-
	05PV63STD	36/914	4.76	4.16	63	500	1200, 2000, 3000	19	60	170	50	3/50	63	1640
15kV	Breaker Type	Cell width Inch/mm	Maximum Voltage	Nominal Voltage	Symmetrical Interrupting Rating (kA rms) (a)	Obsolete MVA Ratings	Continuous Current (A rms)	Power Frequency Withstand (kV)	BIL Crest (kV)	Monetary Close & Latch Rating (kA Crest)	% DC Interrupting Current (%) (b)	Rated Interrupting Time (cycle/msec) (b)	Short Time Current 3 sec. (kA)	Back to Back Capacitor Switching (Amps) (c)
	15PV25STD	36/914	15.0	13.8	25	500	1200, 2000, 3000	36	95	67	50	3/50	25	1640
	15PV36STD	36/914	15.0	13.8	36	750	1200, 2000, 3000	36	95	97	50	3/50	36	1640
	15PV50STD	36/914	15.0	13.8	50	1000	1200, 2000, 3000	36	95	135	50	3/50	50	1640
	15PV63STD	36/914	15.0	13.8	63	1500	1200, 2000, 3000	36	95	170	50	3/50	63	1640
Narrow Design Powl-Vac-ND (26" wide)														
5kV	Breaker Type	Cell width Inch/mm	Maximum Voltage	Nominal Voltage	Symmetrical Interrupting Rating (kA rms) (a)	Obsolete MVA Ratings	Continuous Current (A rms)	Power Frequency Withstand (kV)	BIL Crest (kV)	Monetary Close & Latch Rating (kA Crest)	% DC Interrupting Current (%) (b)	Rated Interrupting Time (cycle/msec) (b)	Short Time Current 3 sec. (kA)	Back to Back Capacitor Switching (Amps) (c)
	05PV36SND	26/660	4.76	4.16	36	250	1200,2000	19	60	97	50	3/50	36	-
	05PV50SND	26/660	4.76	4.16	50	350	1200,2000	19	60	135	50	3/50	50	-
Notes: (a) Interrupting Current constant for all voltages less than the maximum voltage. Rated voltage range K factor=1.0 (b) 5 cycle breakers available at the same % DC ratings (c) Back to back capacitor switching rating is applicable for 1200, 200, 3000 and 4000 continuous current ratings. For 1200 Amp circuit breakers the continuous current limits the capacitor switching current.														

POWL-VAC Operating Characteristics for Stored Energy Mechanism and Control Requirements

Control Voltage	24 DC (1)	48 DC	125DC	250 DC	120 AC	24 AC
Close Current (SR), Amp	NA	10.2	3.2	1.7	3.4	1.7
Shunt Trip Current, Amp	16.9	10.2	3.2	1.7	3.4	1.7
Spring Charge Motor, Amp (2)	NA	8.8	3.5	1.8	3.5	1.8
Close Voltage Range	NA	38 – 56	100 – 140	200 – 280	104 – 127	208 – 254
Trip Voltage Range	14 – 28	28 - 56	70 - 140	140 – 280	104 – 280	208 – 254

(1) Not a recommended voltage

(2) (2) Running Current, inrush approximately 400%.

Spring Charge Time – 7 seconds maximum.

Time for spring to Close Breaker, until contacts touch – 5.0 cycles maximum

APPLICATION GUIDE

Application Guide for Vacuum Switchgear

The vacuum switching surge phenomenon has been clarified and problems in practical applications have been studied and solved.

Surge Suppression (Optional)

Because vacuum interrupters may occasionally generate switching surges that could be damaging to unprotected electrical apparatus, Powell recommends the use of surge suppression on all feeder circuits except those feeding liquid filled transformer or gas-filled or dry-type transformer with BIL levels equivalent to that of the switchgear.

Loss of Vacuum Detection

Its is often requested by vacuum metal-clad switchgear users that a vacuum gauge be supplied with the equipment to monitor the vacuum in the interrupter during power circuit breaker operation.

For a vacuum breaker, the simplest way of assuring that an adequate vacuum exists is to check the withstand capability by applying a high potential across each interrupter with the breaker open. This procedure is recommended during routine maintenance.

For the POWL-VAC Metal-Clad Circuit Breaker, a lightweight, portable high potential test set will be available to conduct its type of test. This set operates from a conventional 5-ampere single phase, 120 volt, 60Hz power supply. A self-contained instrument is used to show that both the high potential set and the vacuum interrupter are operating correctly.

Optional Loss of Vacuum Detection Circuit

A sensitive breaker failure relay has also been developed for those who wish to monitor in-service performance of the POWL-VAC Metal-Clad Circuit Breaker.

Loss of vacuum may be detected in the following manner. Add a sensitive current relay in series with the CT residual current circuit. The sensitive current relay is connected in parallel with a normally open breaker auxiliary contact, thereby permitting the relay to operate if the breaker is open and the current is flowing through one of the vacuum interrupters for more than 3 cycles after its contacts part. Under normal interrupting conditions, the duration of current should continue for about one cycle after it's contacts part.

Maintenance Requirements

While questions relating to loss of vacuum are sometimes raised, operating experience over the past fifteen years has shown that maintenance and reliability of vacuum circuit breakers has been even better than that of comparably rated breakers employing oil and air as the interrupting media.

The maintenance procedures are simple:

1. Check that the mechanism is clean, lubricated and operating properly.
2. Make a visual inspection to assure that erosion contact material has not exceeded the recommended amount. This is easily done, as the gauge is integral to the interrupter movable rod assembly.
3. Use the high potential test set to check that vacuum integrity still exists.
4. Provide the above are all right; the breaker can be placed in safety.

Optional Ground and Test Device

The type PV-E Electrically operated Ground and Test Device is an accessory device for use with POWL-VAC Metal-Clad Switchgear. This device is design to be inserted in a metal-clad switchgear unit in place of the vacuum circuit breaker. It may be used to ground either the upper or the lower sets of primary disconnect stabs for testing purposes.

POWL-VAC DETAILS

Typical POWL-VAC one high feeder rated kV 2000-amp main bus, 750 MVA. Photograph illustrates typical metering and relaying with ample space for field incoming control wire.

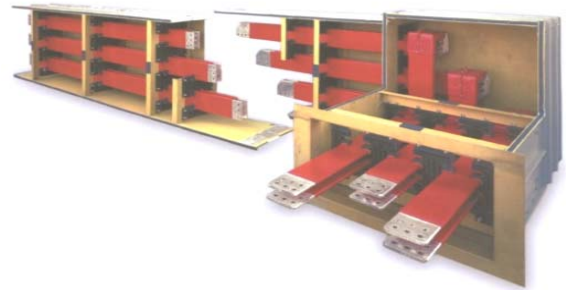
POWL-VAC switchgear features optional MOC, TOC and kirk key interlocking provisions.

BUSDUCT For Utilities and Industries

WESCOSA Licensee of Unibus, Inc.

WESCOSA is now manufacturing Busduct under license by UNIBUS INC USA, one of the leading manufacturers of custom designed electrical bar system for utilities, industries and research and development establishment.

WESCOSA Licensee of Unibus products and system ranging from 600v to 34.5 kV (1200 to 6000 Amperes) are in use worldwide. Higher voltages and amperages are available, however and details can be obtained from WESCOSA.



Innovative design and quality have been the hallmarks of UNIBUS Inc since its inception. Our qualified experts insure efficient design, careful manufacture and prompt delivery with installation supervision if required. Companies are assured of a more reliable engineered system made to satisfy the most critical requirements.

WESCOSA and UNIBUS INC skilled professionals are committed to developing new and more efficient products for the future to better serve our customers.

So whenever there's a need for a quality custom-designed and engineered bus system, you can count on WESCOSA and UNIBUS INC to provide a completely coordinated system backed by the best expertise and experience everywhere.

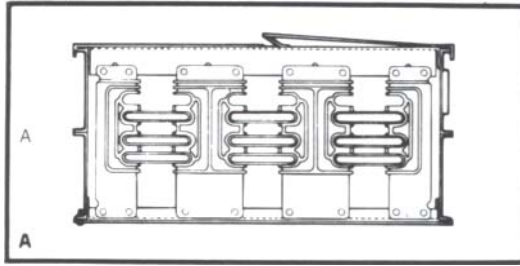
WESCOSA Licensee of Unibus, Inc. Has A Bus Product To Cover Every Application

WESCOSA licensee of Unibus Inc. products and systems are custom-designed to meet the exact specifications for a variety of applications and conditions.

Here are just a few of the alternatives Unibus Inc offers to suit job applications, climates, installation environments, budgetary allotments, and a host of other factors which are carefully weight to provide the best for your needs.

Type "A" Non-segregated Phase Bus

Description: All phase conductors are in a common metal enclosure with out barriers between the phases.



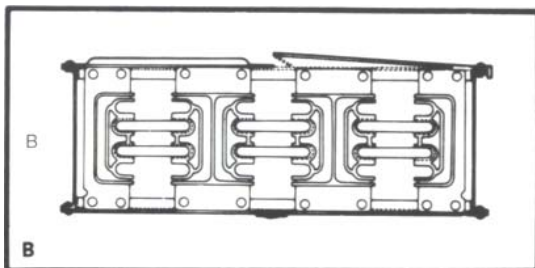
Application: Used to connect transformers to switchgear, for ties connections between motor control centers and large motors, and as the main generator lead in small generator and hydro plants.

Conductors: Copper and aluminum.

Supports: Standard Fiberglass

Type "B" Non-segregated Phase Bus

Description: All phase conductors are in a common metal enclosure with our barriers between the phases.



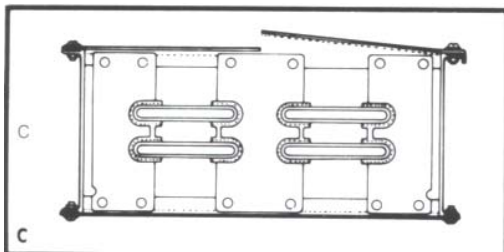
Application: Used to connect transformer to switchgear, for ties connections between motor control centers and large motors, and as the main generator lead in small generator hydro plants.

Conductors: Copper and aluminum.

Supports: High alumina porcelain.

Type "C" Non-segregated Phase Two Pole Bus

Description: Two A-C phase conductors or Two D-C pole conductors are in a common metal enclosure with out barriers between poles and phases.



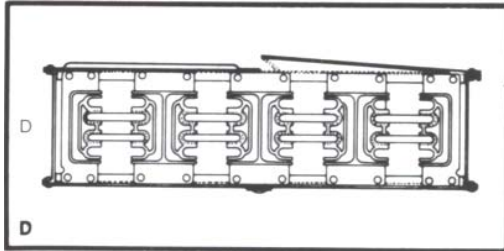
Application: Used to connect Switchgear to single phase loads transformer interconnections for delta connected transformer banks. Two pole D-C rules are used for generator exciter systems and for electric furnace and electroplating application.

Conductors: Copper or Aluminum.

Supports: Standard fiberglass or high alumina porcelain.

Type “D” Non-segregated Phase Four Pole Bus

Description: All phase conductors neutral conductor are in a common metal enclosure without barriers between phases or neutral.



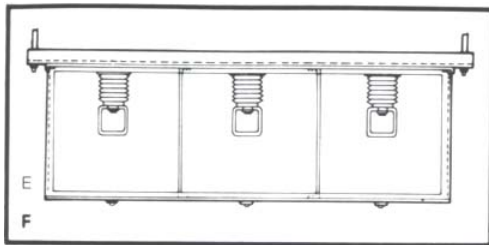
Application: Used for wyes connected system with underground neutrals.

Conductors: Copper or aluminum.

Supports: Standard fiberglass or high alumina porcelain.

Type “E” Segregated Phase Bus

Description: All phase conductors are in common metal enclosure, but are segregated by metal barriers between phases.



Application: Used to generator leads in power plants, switchgear tie-in metal enclosed substations, and in factories.

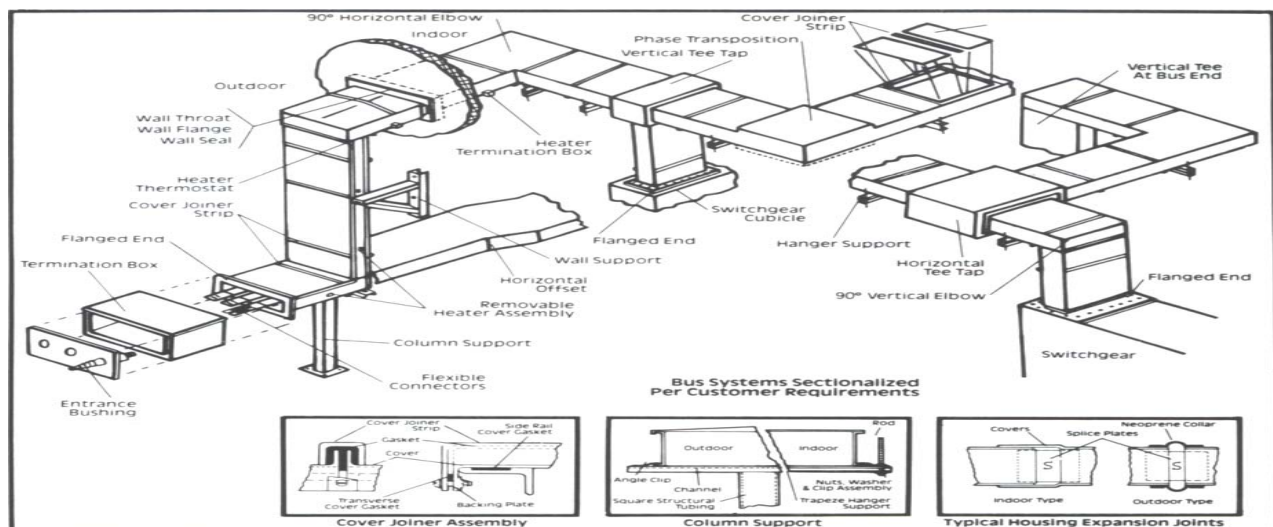
Conductors: Aluminum and Copper.

Supports: Fiberglass or porcelain.

Bus Accessories

A full line of Bus System accessories is available. These include metering cubicles with potential and current transformers, surge protection, neutral grounding assemblies, switches and disconnecting links, and facilities for extending or T-tapping existing busses.

Typical Bar Type Duct Layout (600V, 5kV, 34.5kV)





Metal-Enclosed Low and Medium Voltage Bus Product Description

Conductors:

High conductivity. Full round edge copper or aluminum bus bar.

Insulation:

Extruded Noryl insulating sleeves.

Bus Bar Supports:

Molded, track resistant, glass-reinforced polyester or porcelain.

Support spacing is appropriate to the momentary current rating of the bus.

Enclosures:

Ventilated or non-ventilated steel or aluminum housings, primed and painted with purchaser's choice of ANSI standard of special color steel or aluminum housings to 2000 Ampere A-C ratings above 2000 amperes. Non-ventilated outdoor housings provided with manual or thermostatically controlled electric heaters with screened breathers. All outdoor gasketing concealed from weather. Hardware exposed to weather corrosive atmosphere is stainless steel.

Contact Surfaces:

Copper contact surfaces are silver-plated. Aluminum contact surfaces tin plated over bronze strike by ALSTAN-80A process. All aluminum electrical connections are fitted with conical washers to maintain contact pressure.

Accessories:

A complete line of elbows, tees, termination for transformers and switchgear, phase Transpositions, expansion or earthquake joints, wall entrance seals, flexible connectors, bushing stud connectors and terminal enclosures is available.

Structural Supports:

A complete line of steel or aluminum structural supports is available for attaching bus to purchaser's buildings or property.

Ratings.

See pricing sections for available voltage and current ratings.

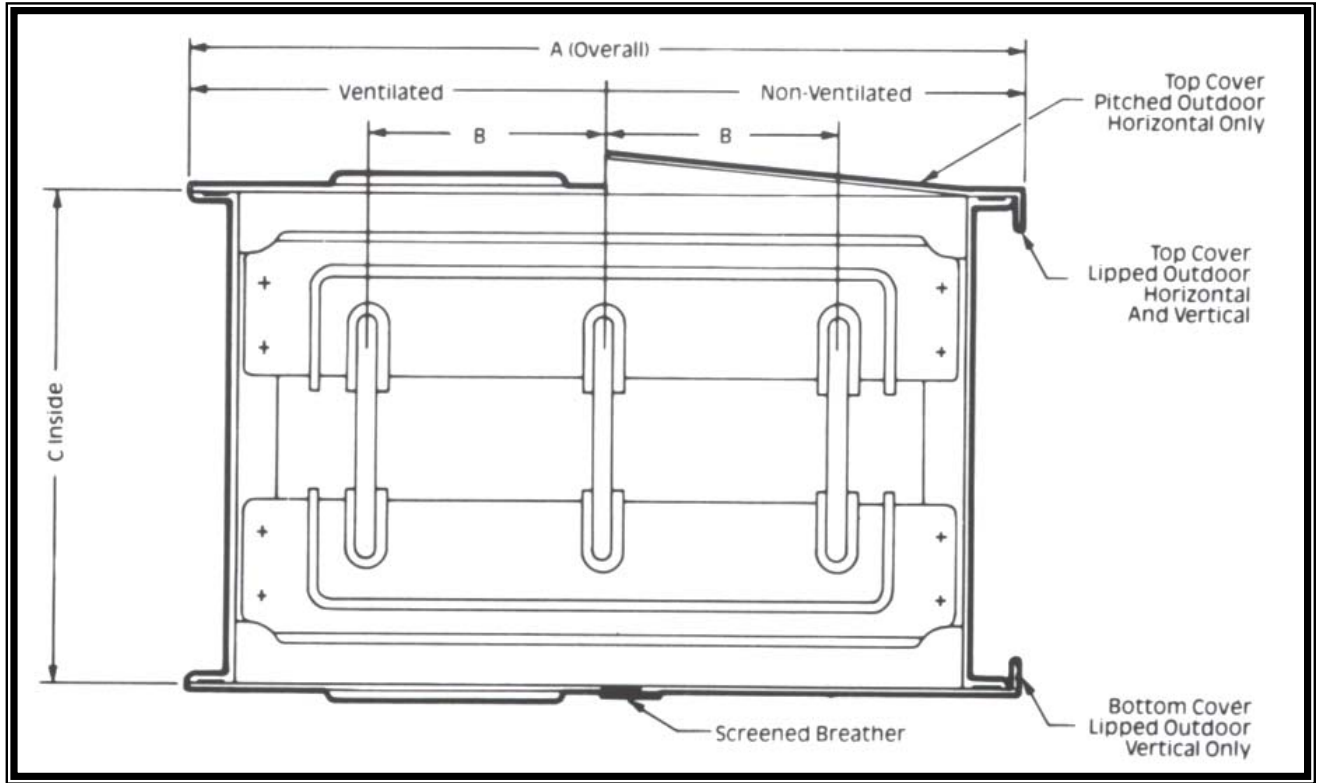
Standards:

All busses are in complete conformance with the requirements of the applicable IEEE as well as ANSI and NEMA standards.

Bar Bus Cross-Section for 600V, 3 Phase Service (60,000-150,000 Amperes, Momentary) Maximum Overall Dimensions Conductors (Non-Ventilated Bus)

Ampacity	Aluminum			Copper		
	A	B	C	A	B	C
1200A	21"	6"	10"	21"	6"	10"
1600A	21"	6"	10"	21"	6"	10"
2000A	21"	6"	10"	21"	6"	10"

*Ventilated bus cross-sections for some ratings are somewhat smaller. Refer to factory for ventilated bus applications.



Note: The conductors can also be designed in the horizontal plane for high momentary conditions and would incorporate the same dimensions, as the 5KV system except the conductors will be non-insulated.

HOUSINGS:

Aluminum, steel and stainless housing are available to meet a variety of environments. Non-magnetic housings are supplied at ratings above 2000 amperes.

Outdoor Housings are weatherproof and furnished with screened breathers and electric space heaters for condensation control.

Covers are gasket sloped to shed rain and are removable top and bottom.

Ventilated indoor buses with louvered top and bottom covers are available.

500-watt, 240-volt heaters, operated at 120 volts and mounted via weatherproof junction box for easy removal, are supplied on 7' to 8' centers on outdoor bus systems. Facilities are supplied to connecting heaters to purchaser's power supply.

CONDUCTORS:

Buses are supplied with copper or aluminum conductors per purchaser's specifications. Tin or silver-plated contact surfaces at all joints or terminations. Internal or external ground bars or neutral bars are available as required.

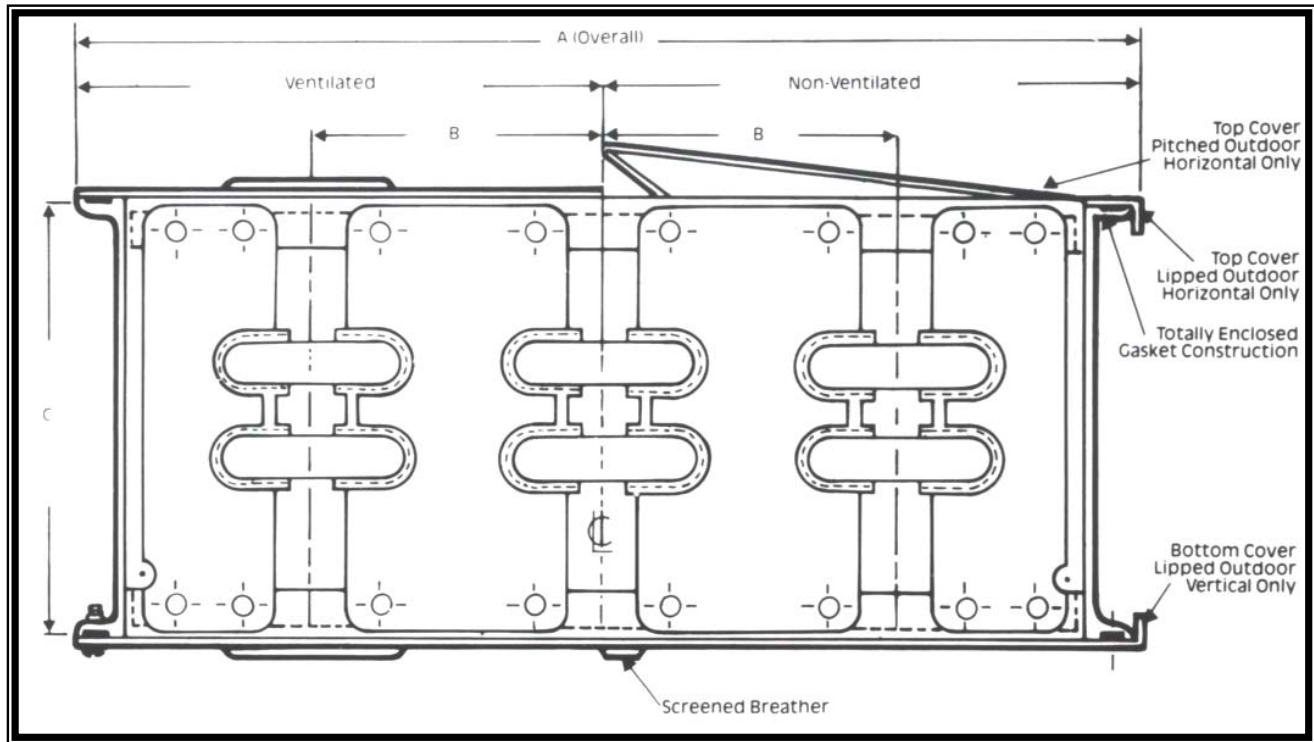
INSULATION:

Bus bars are mounted and secured against the movement during short circuit in molded, glass-reinforced polyester support blocks. Bus bars are un-insulated for 600-volt service, but can be furnished insulated on special request. Refer factory for momentary current ratings over 100,000A.

**Bar Bus Cross-Section for 5kV, 3 Phase Service (60,000-100,000 Amperes, Momentary; 60kV BIL.)
Maximum Overall Dimensions Conductors (Non-Ventilated Bus)**

Ampacity	Aluminum			Copper		
	A	B	C	A	B	C
1200A – 200A	25.5"	7.00"	10.0"	25.5"	7.18"	10.0"
2500A – 3000A	31.5"	9.12"	10.0"	25.5"	7.18"	10.0"
3500A – 4000A	31.5"	9.12"	16.0"	31.5"	9.12"	16.0"

*Ventilated bus cross-sections for some ratings are somewhat smaller. Refer to factory for ventilated bus applications.



HOUSINGS:

Aluminum, steel and stainless housing are available to meet a variety of environments. Non-magnetic housings are supplied at ratings above 2000 amperes.

Outdoor Housings are weatherproof and furnished with screened breathers and electric space heaters for condensation control.

Covers are gasket sloped to shed rain and are removable top and bottom. Ventilated indoor buses with louvered top and bottom cover are available.

500-watt, 240-volt heaters, operated at 120 volts and mounted via weatherproof junction box for easy removal, are supplied on 7' to 8' centers on outdoor bus systems. Facilities are supplied to connecting heaters to purchaser's power supply.

CONDUCTORS:

Buses are supplied with copper or aluminum conductors per purchaser's specifications. Tin or silver-plated contact surfaces at all joints or terminations. Internal or external ground bars or neutral bars are available as required.

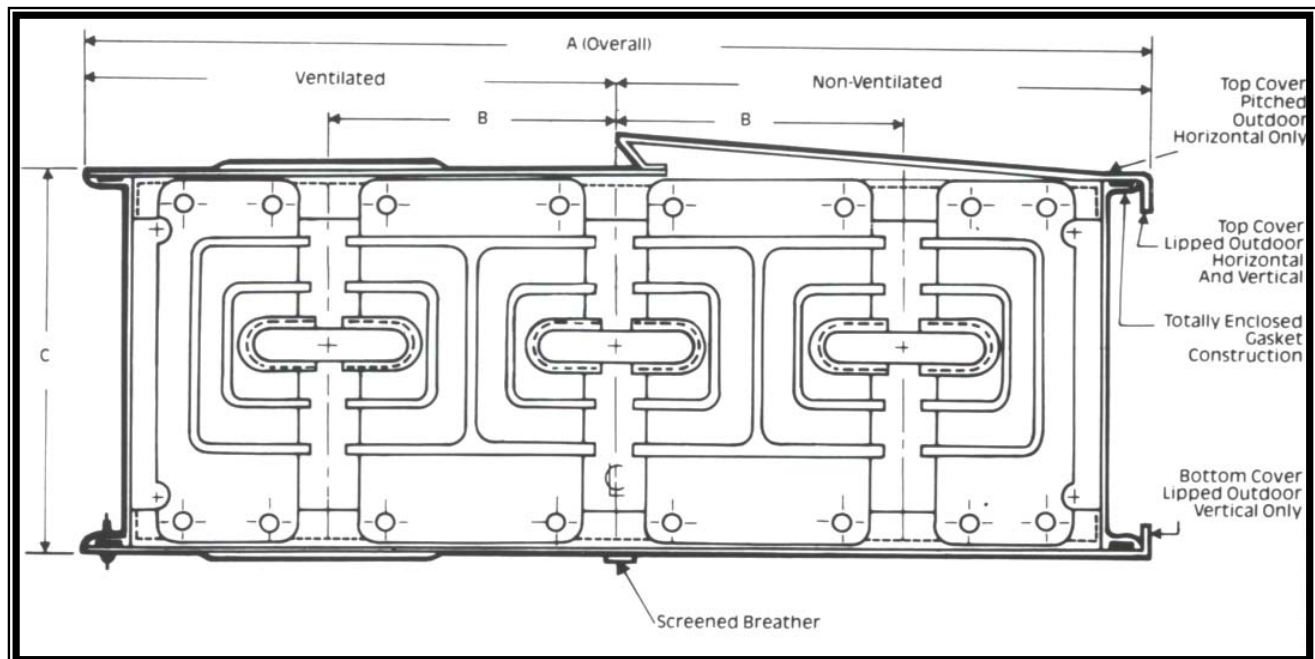
INSULATION:

Bus bars are mounted and secured against the movement during short circuit in molded, glass-reinforced polyester support blocks. Bus bars are un-insulated for 600-volt service, but can be furnished insulated on special request. Refer factory for momentary current ratings over 100,000A. Wet Process porcelain or high Alumina Bus Bar Supports available on request.

Bar Bus Cross-Section for 5kV, 3 Phase Service (60,000-100,000 Amperes, Momentary; 95kV BIL.) Maximum Overall Dimensions Conductors (Non-Ventilated Bus)

Ampacity	Aluminum			Copper		
	A	B	C	A	B	C
1200A – 1600A	29.5"	8.00"	10.0"	29.5"	8.00"	10.0"
2000A	29.5"	8.00"	12.0"	29.5"	8.0"	12.0"
2500A – 3000A	35.5"	10.0"	12.0"	29.5"	8.12"	12.0"
4000A	35.5"	10.0"	16.0"	35.5"	10.0"	16.0"

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CONDUCTORS:

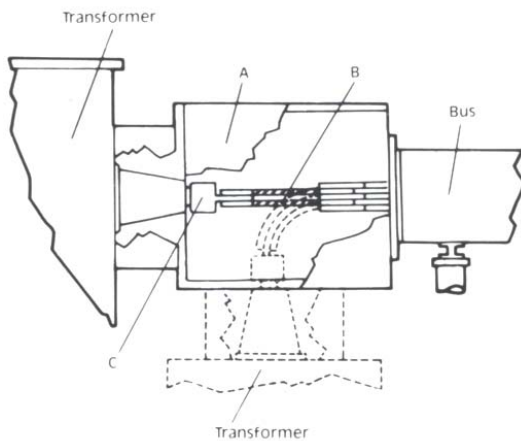
Buses are supplied with copper or aluminum conductors per purchaser's specifications. Tin or silver-plated contact surfaces at all joints or terminations. Internal or external ground bars or neutral bars are available as required.

INSULATION:

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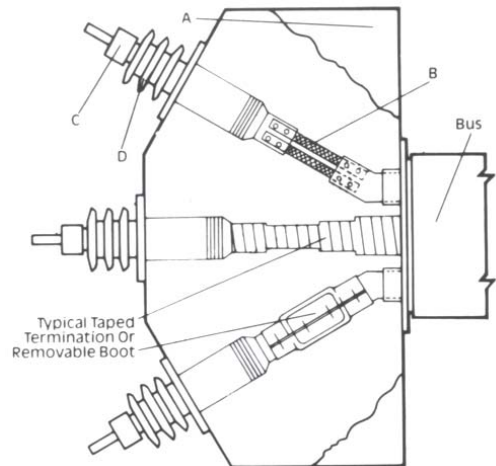
Wet Process porcelain or high Alumina Bus Bar Supports available on request.

Typical Bar Bus Termination



Transformer Termination Copper and Aluminum 600-34,500 Volts

Transformer termination can include busway terminating flange, bushing terminal enclosure (A), Flexible connectors (B), bushing stud connectors (C), current transformers and all necessary hardware. Available for either sidewall or cover mounted bushings.



Bushing Type Busway Termination Copper and Aluminum 600-34,500 Volts

Bushing type busway termination includes busway-terminating flange, bushing terminal enclosure (A), Flexible connectors (B), bushing stud connectors (C), and terminating assembly bushing (D). This termination assembly is suitable for use with bushing either in vertical or horizontal (side by side) position and outdoor or indoor application.

CABL-BUS Power for All Voltages



1. Lower Cost
2. Greater reliability
3. Lower power use

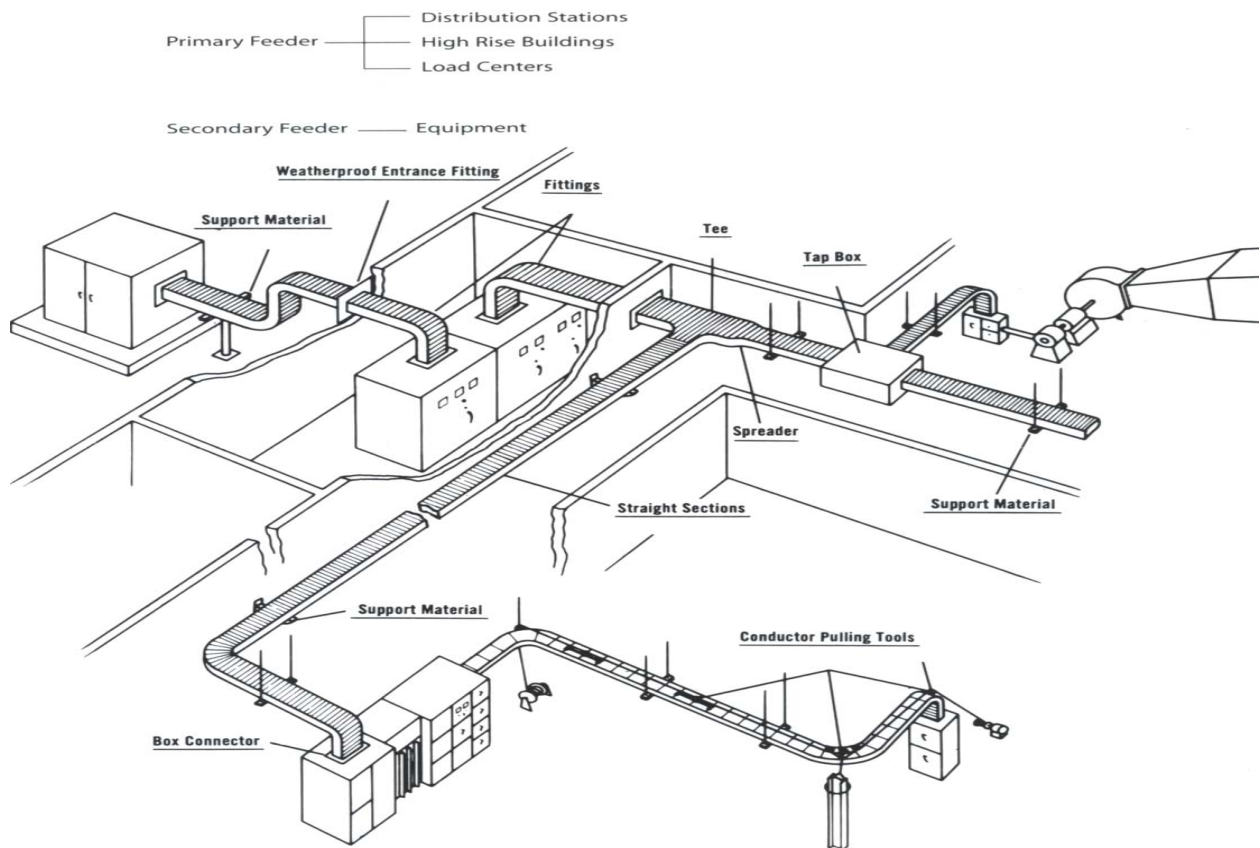
Lower Cost: In most electrical application over 1000 amperes, Cabl-Bus® is costly than bar bus or conduit and wire systems. When ampacities increase, the cost savings of Cabl-Bus over other systems are even greater.

Great Reliability: Since WESCOSA MP-Husky Cabl-Bus is continuous; there are no power losses from intermediate splices or connections. 25 years of field use and proven test results guarantee a higher quality system. And there is no limit to the voltage class rating of a cable bus system – it depends only on the rating of the cable itself.

Lower power use: WESCOSA MP-Husky's Cabl-Bus has lower impedance and lower losses than alternate methods. This means long-term energy savings for the user.

And there's more!

WESCOSA MP-Husky Cabl-Bus is of an all-welded structural design for superior strength. Top and bottom covers are ventilated for optimum free air rating so de-rating of cables is not normally required. The design flexibility our Cabl-Bus allows for easy, economical expansion of existing systems without expensive redesign.





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WESCOSA LICENSEE OF MPHUSKY CABL-BUS™ SYSTEM

The need for modern production processes and ever tightening production schedules demand increased reliability from electrical systems at the lowest possible unit cost. Today, whether in a utility, commercial or an industrial complex, these systems are asked to carry continually larger loads and when a breakdown occurs the "in plant" cost charged against such failures are becoming prohibitively high.

By the same token available short circuit currents are also on the increase. As such, the electrical design engineer must not only carefully select his equipment but must insure that the entire electrical system tying it together is compatible in all aspects with the equipment.

To gain the ultimate advantage, whether it is for new construction or additions to existing systems, the engineer must also plan for future expansion that allows quick and economic growth. Yet, industry still demands better more reliable systems with even greater flexibility.

WESCOSA Licensee of MP-Husky utilizing advance-engineering concepts provides up to date answers for the growing power needs.

CABL-BUS SYSTEM ADVANTAGES

Free Air Rating

- Less copper or aluminum carries full rated current.
- Minimum Temperature rise due to ventilated enclosure and maintained cable spacing by support blocks.
- Maximum ampacity in accordance with ICEA listings for 90oC rated conductors.

Continuous Runs of Conductors

- Cables "pulled-in" after system in place.
- No intermediate conductor connections (maintains system reliability).
- Eliminates expensive time consuming high voltage splicing.
- Proper Phase Balance
- Designed cable spacing and selection assures low impedance and low voltage drop.
- Cable support blocks provide continuous maintained spacing.
- Cable protected against insulation damage.
- Cable isolated from all metal parts.

Indoor or Outdoor Applications

- Standard WESCOSA MP-Husky CABL-BUS system is used indoors and outdoors.
- No special finishes are required.
- Excellent protection against adverse atmosphere.

Safe

- WESCOSA Licensee of MP-Husky CABL-BUS is an all welded rigid construction.
- High-pressure splice joints provide an excellent path to ground.
- Workmen free of shock hazards, no exposed bus elements, only insulated conductors are used.
- Ventilated design prevents entry from foreign objects.
- Support block designs assure proper arrangement of conductors.

Low Cost

- Substantial savings on materials and installation cost compared to other system.
- Compact space saving and neat appearance.



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Labor Savings

- Lightweight ventilated enclosure.
- No special heavy erection equipment required.
- Two men easily lift 24' length into position.
- No special erection practices required.

Less Support Material

- Design criteria accomplishes high load carrying ability, on long spans with minimum support material.
- Flush bottom design allows use of standard support material.

Adaptable

- Easily routed around foreseen field obstructions, i.e. piping, structural steel, equipment, etc.
- WESCOSA Licensee of MP-Husky CABL-BUS systems can be joined to other types of existing systems by use of adaptors.

All Welded Construction

- Entire support system including top and bottom covers in an all welded system for maximum strength with minimum space requirement.

Standard Fittings

- WESCOSA Licensee of MP-Husky CABL-BUS design offers a complete flexibility with standard fittings.

Factory Fabricated

- Entire system is factory fabricated with bottom cable support block in place.
- Minimum field of labor is required for the installation of splice plates, cables and top blocks.

Removable Covers

- Removable top covers provide for ease of conductor installation, and addition of other circuits or cables at later date.

Ease of Conductor Pulling

- Complete line of MP-Husky standard pulling tools available for ease of installation. (purchase).
- Match-Marked Layout Drawings
- CABL-BUS job layout complete with match-marked drawings to CABL-BUS sections.
- Facilities easy field erection.
- Small straightforward jobs do not require match-marked drawings and sections, because of standardization.

TECHNICAL DATA

Selection of the proper CABL-BUS System must be undertaken with care to assure that it complements the design of the overall electrical power system.

ELECTRICAL DESIGN

To insure an efficient, dependable high quality installation every WESCOSA Licensee of MP-Husky CABL-BUS System is engineered fully with particular emphasis placed on CABLES, SYSTEM BALANCE, SHORT CIRCUIT CAPABILITY and GROUNDING REQUIREMENTS. Each one of these key design considerations must be analyzed separately to determine how they affect the overall system design.

CABLES

The first electrical consideration of CABL-BUS System is the cables themselves.

Due to complex modern day power layouts a poorly selected cable can result in a below normal performance of interconnected equipment as well as failure or loss in production time.

CABLE INSULATIONS

There are many insulating materials used today; however, those commonly used are cross-linked Polyethylene and Ethylene-Propylene Rubber. Most other types of insulations have disadvantages such as lack of compactness, flexibility, or the requirement of an additional covering material for mechanical protection and moisture resistance.

CABL-BUS is supplied with cable in accordance with ICEA-NEMA or equivalent IEC Standards. In accordance with ICEA design criteria, all cables used in CABL-BUS have a full voltage rated insulation and are suitable for indoor and outdoor application without being adversely effected by ultra-violet rays.

Cross-Linked Polyethylene is a thermosetting type of insulating material, which has a very good resistance to chemicals weathering, crushing and impact. It has a low temperature-bending limit at -65°C and has deformation of only 8% at 150°C . XLP (cross-linked polyethylene) is available in all voltage classes up to 35KV. Its normal operating temperature of 90°C with an emergency overloads temperature of 130°C and has a circuit temperature of 250°C . XLP has an insulation resistance constant, minimum, equal to 50,000 at a 15.6°C temperature with a power factor of 0.5% and dielectric constant, SIC, of 2.9.

Ethylene-Propylene Rubber is a flexible mineral filled thermosetting compound with an ethylene propylene elastomer as the base material which has a superior resistance to radiation, high physical strength at operating temperatures, superior resistance to ozone and easy handling at all ambient temperatures. It has a low temperature-bending limit at -80°C ; EPR (Ethylene Propylene Rubber) is available in all high voltage classes (2kV and greater). Its normal operating temperature is 90°C with an emergency overload temperature of 130°C and a short circuit temperature of 250°C . EPR has an insulation resistance constant, minimum, equal to 30,000 at a 15.6°C temperature with a power factor of 1.0% and a dielectric constant, SIC, of 3.5.

A variety of jacketing materials can be supplied can be supplied with the above listed insulations, for shielded and non-shielded cable applications. The most common jacketing materials are polyvinyl chloride, neoprene and hypalon.

The advantage of the above listed types of insulation when used in WESCOSA Licensee of MP-Husky's ventilated CABL-BUS enclosure is that the conductors can be current loaded to the free air of 90°C rating. This is assured through the maintained cable spacing as provided by the support blocks, which prevent the accumulation of still or dead air between the cables. WESCOSA Licensee of MP-Husky' ventilated CABL-BUS enclosure design produces a "chimney effect", which is the principle of hot air rising and being replaced by a cooler air from below, keeping all cables in the system at the lowest ambient temperature. Since the top is fully ventilated, pockets of hot air are not trapped in the enclosure.

Figure 1 shows the free air rating of copper and aluminum conductors for 90°C operating temperature at a 40°C ambient. The 600-volt conductor ampacities are in accordance with the National Electric Code Article 310. At voltages greater than 600 volt, the ratings listed are in accordance with ICEA listing.

The ambient temperature can also be an important factor in limiting the current carrying capacity. Should the conductor be exposed to high ambient temperatures, such as those found in a boiler rooms or near steam pipes. Conversely, the lower the ambient, the higher the capacity.

Cable manufacturers supply correction factors for various ambient. Figure 2 illustrates typical correction factors.

When the cables are grouped closely together ambient conditions may be affected. To verify the fact that close grouping of conductors as used in WESCOSA Licensee of MP-Husky CABL-Bus systems do not adversely affect the allowable conductor temperature rise, various current cycle test were conducted. Listed is typical MP-Husky CABL-BUS performance test results (Figure 3).

Figure 1

Conductor Ampacity for*						
90°C conductor at 40°C Ambient						
Conductor Size	Copper			Aluminum		
	600V	5kVt	15kV	600V	5kVt	15kV
4/0	368	400	397	287	312	310
250	414	444	440	323	346	343
350	519	549	543	405	460	455
500	637	688	687	496	539	531
600	710	774	762	560	602	599
750	805	889	872	637	700	687
1000	960	1061	1040	769	841	825
1250	1092	1211	1185	874	969	948
1500	1206	1347	1313	987	1088	1060
1750	1315	1470	1430	1087	1198	1165
2000	1420	1574	1535	1215	1295	1263

* 600 Volt Class-Nec Art 310:5 kV Class
ICEA Pub. No. P-46-426

t Ampacity of 5 kV Shielded. 5kV Non-shielded
Ampacity is slightly higher.

Figure 2

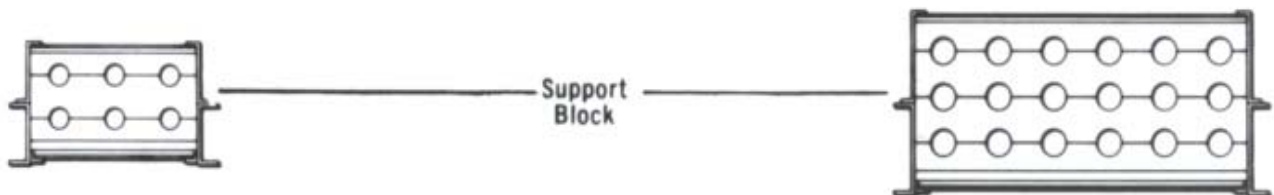
Correction Factor	
Ambient Temp °C.	Factor
10	1.26
20	1.18
30	1.10
40	1.00
50	.90

Test 1

Conditions Time: 5 hours
Current: 4310 amperes
Conductors: 18 – 750 MCM. Copper, 6
Per phase ICEA rated at 90°C
Ambient Temp.30°C
Note: a thermocouple was inserted into each
Conductor to a slit in the insulation.

Test 2

Time: 5 hours
Current: 4310 amperes
Conductors: 18 – 750 MCM. Copper, 6
Per phase ICEA rated at 90°C
Ambient Temp.30°C
Note: a thermocouple was inserted into each
Conductor to a slit in the insulation.





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Results: Maximums Recorded Temp. Rise
Top Row: 47°C
Bottom Row: 42.5°C
Average Rise For 6 Conductors: 42°C
Conclusions: Maximum Allowable Temp. Rise:
90 – 30 = 60°C.
Maximum Recorded Temp. Rise:
47°C
Difference: 13°C. below allowable

Results: Maximums Recorded Temp. Rise
Top Row: 46.5°C
Mid Row: 46°C
Average Rise For 18 Conductors: 42.5°C
Conclusions: Maximum Allowable Temp. Rise:
90 – 30 = 60°C.
Maximum Recorded Temp. Rise:
47°C
Difference: 13.5°C. below allowable.

PARALLEL CONDUCTORS

Parallel Conductors (more than one phase) can be used to advantage in CABL-BUS where large conductor size are encountered. The ampacity per circular mil of conductor decreases as the circular mil of conductor increase, i.e.:

A 250 MCM conductor requires circular mil per amp at 4.16kV while 1000 MCM conductor requires 944 circular mils per amp at the same voltage. This loss in capacity is due mainly to “skin” effect and a decrease in heat radiating area per circular mil.

With the close grouping of phase conductors, as found in CABL-BUS, the “Skin” effect must be combined with “Proximity” effect to determine the actual A-C resistance.

Skin effect causes the alternating current to concentrate towards the outer surface (skin) of the conductor. This is due to the self-inductance of the conductor, greatest at the center, and results in a back EMF.

Proximity effect is caused by the magnetic field about all a alive conductor and a nearby current carrying conductor, causing a distortion of current flow in the parts in the nearest to each other. This, in turn, increases the effective resistance and reduces current capacity for a given temperature rise.

VOLTAGE DROP

Proper system design dictates that voltage drop be considered for both the power feeders separately as well as the entire power system.

A voltage drop of 3 – 4% for power feeders and an overall of 5% or less for the entire power system are considered to be within the acceptable limits.

CABL-BUS is designed for low-voltage drop. Voltage drop data is available upon request, from your local representative, for your specific system. An approximate line to neutral voltage drop can be calculated by using the following formula:

$$V.D.L-N = I (R \cos \phi + X \sin \phi)$$

$$\% V.D. = \frac{KVA (R \cos \phi + X \sin \phi)}{10 (KV)^2}$$

(KVA is the three-phase kva and KV is line-to-line kilovolts)

SHIELDING

Shielding is used on power cables to confine the dielectric field of the conductor to the cable insulation. Its used should be considered for 4160 volts and above on cables that are to be used in CABL-BUS when any of the following condition exists.

1. Where cables are subject to soot or other heavy deposits that may form paths to ground.
2. Where electrostatic discharge can affect nearby computerized control cables or other low level signals.
3. Transition from wet to dry locations.
4. Personnel safety.

When installing shielded cable, metallic shielding must be solidly grounded. Installation of shielded single conductor cables must be studied to determine the best method of grounding. This is necessary as voltage induced in the shield of a single conductor cable carrying alternating current due to mutual inductance between its shield and any other conductor in its vicinity. This induced voltage can result in two conditions.

1. Metal Shields bonded or grounded at more than one point have circulating currents following in them, the magnitude of which depends on the mutual inductance to the other cables, the current in these conductors, and the resistance of the shield.
2. Shields bonded or grounded at only one point will have a voltage build up in the sheath.

The length of the circuit and the load conditions will indicate which of the above shielding methods is required for any particular application.

SYSTEM BALANCE

CABLE-BUS is a power distribution system using single conductor insulated power cables and support blocks to maintain cable spacing. Each phase consists of one or more cables connected in parallel. The complete assembly is enclosed in ventilated aluminum or steel enclosure for support and protection.

Parallel conductor transmission lines, using widely spaced conductors, have been in use for many years. The electrical coupling between the conductors of parallel conductor system, which is a function of the geometry of the location of the conductors, can cause an unbalance in the conductor currents. In a widely spaced overhead transmission line, transposition of conductors can economically be used to balance the conductor currents.

The spacing of the CABL-BUS design was to obtain the optimum balance for a parallel conductor system using untransposed conductors system using untransposed conductors with close spacing. MP-Husky has developed a computer program, which solves for the line and phase currents of parallel conductor system, using a mathematical model of the transmission line parameters. Through use of computer programs and verifying the laboratory and field-testing, MP-Husky had designed CABL-BUS Systems with minimal unbalance.

CABL-BUS is designed for intra-phase balance. Most any phasing arrangement will provide inter-phase balance of currents due to the load impedance, but only a few of these combinations will provide a minimal intra-phase current unbalance. CABL-BUS is a fully engineered system utilizing phase arrangements, which reduce the amount of parallel conductor unbalance to a minimum.

SHORT CIRCUIT CAPACITY

A CABL-BUS system must be able to withstand the forces created by short circuit currents. These forces are transmitted from the conductors, under shorted conditions, to the cable supports. In the case of CABL-BUS the support elements include the support blocks and enclosure itself.

The major concern regarding short circuits is the dangerous mechanical forces that can result; however, it is still an electrical problem as far as determination of magnitude and prevention.



Short circuit current s are made up of two parts; a symmetrical A-C component and a rapidly decreasing D-C component. (Fig. 5)

A CABL-BUS system must be selected so that its mechanical strength will withstand the maximum short circuit forces developed in a given application. It is therefore necessary to consider the maximum instantaneous current and to a lesser degree the 5 – 8 cycle resultant symmetrical current. The symmetrical current is the actual value that a high voltage breaker will interrupt.

Since CABL-BUS is used for main feeders connecting substation or generators to switchgear, load centers, high voltage machines, the available short circuit current will be that of the utility or generator supply to through the transformers. In some cases, if the cable bus feeds large motors, the motor contribution to short circuit current must also be considered. Numerous tables are available listing motor contributions for various operating conditions.

Even though short circuit sources can be quite large, actual experience indicates the point of fault can be removed from the source therefore available fault currents will be limited by conductor impedance. The impedance can be in the form of conductor length, size or a combination of both.

In MP-Husky CABL-BUS design these added factors of conductor impedance are not used, instead the worst fault conditions are always assumed.

For most application a three-phase short circuit current will result in the maximum mechanical forces for design considerations.

If CABL-BUS is fed directly from the utility company service, short circuit current data is available from them. Where CABL-BUS is connected to the transformer secondary the three-phase fault current can be calculated using the following formula:

$$I = \frac{KVA \times 1000 \times 100}{1.73 \times E \times Z}$$

I = RMS Symmetrical Fault Current

KVA = Transformer Rating

E = Secondary Voltage of Transformer

Z = Impedance of Transformer in Percent

Where motor contributions are considered the fault current due to the motor feedback will be a function of voltage and is usually expressed as multiples of the motor full load current. NEMA standards are available which list these factors.

Certified tests have been conducted to determine the short circuit performance of CABL-BUS using various supporting arrangements.

The CABL-BUS Systems were tested on a 600-volt, 3 phases, 60 Hz circuit having a power factor less than 20. One end of the CABL-BUS was connected to the source terminals the other was the short circuited with a three phase bolted faults.

Each test was conducted for a minimum of six cycles. Oscillograms recorded the phase currents during the test. Still photographs are high speed color motion [picture were taken to relevant to the test.

CABL-BUS was subjected to currents of 39,000, 67,500, 82,500 and 107,000 RMS symmetrical amperes with symmetrical currents greater than 200,000 amperes. CABL-BUS withstood the mechanical forces of the test without any damage to the cables, support blocks or enclosure.

GROUNDING

A CABL-BUS system must afford protection to life and property against faults caused by electrical disturbances. Lightning, electrical system failures as well as failures in the systems connected equipment all constitute possible fault hazard locations.

For this reason, all metal enclosures of the system, as well as non-current carrying or neutral conductors should be tied together and reduced to a common potential. This include the structural steel of the building, water, stream and gas piping, etc.

There are two distinct divisions to the grounding problem, the system and the equipment grounds.

The system ground is the connection of the distribution system to earth by means of neutral or grounded conductor. Grounding serves to limit the voltage, which might appear on the circuit due to lightning or accidental contact.

Equipment grounding is the connection to earth of all exposed non-current carrying metallic components of the distribution system.

CABL-BUS system should be grounded to the substation structure and thus to the substation ground grid and to the steel by means of the CABL-BUS support materials. CABL-BUS should also be grounded to the equipment of switchgear enclosure by means of a box connector.

It is an accepted fact that ground currents tend to concentrate near power conductors and that the cable enclosures take a large portion of the ground currents; therefore, it is important to consider CABL-BUS as a major carrier of ground currents.

Every CABL-BUS system is designed to insure safety of personnel, equipment and plant from ground faults. Figure 6 lists the electrical characteristics of WESCO Licensee of MP-Husky CABL-BUS enclosure.

Figure 6
Electrical Properties of CABL-BUS

Basic Data	6053-T6
Conductivity	53%
Electrical Resistance @ 20 – Microhms Per Sq. In. per ft.	15.37
Electrical Resistance @ 20 – Microhms Per CM per ft.	19.57

Slide Stringer		
Material	6063-T6	6063-T6
Resistance – Microhms/Ft.	21	16
Resistance Across Splice – Microhms	11	11
Resistance of 24 ft. Length With Splice – Microhms	257	197
Copper Equivalent – MCM	950	1250
Continuous Current Rating (50°C Rise) Amperes	1060	1260
One second Rating (50°C Rise) Ampere	51,500	68,500

CABL-BUS SYSTEM SELECTION TABLES

For maximum adaptability CABL-BUS straight selection are supplied as follows:

STANDARD

Length 12 & 24 feet

Block Spacing

Vertical 18" on centers

Horizontal 36" on centers

Block Hardware 3/8" diameter

Structural Enclosure

Straight section consists of:

Basic Enclosure

Covers: Top - Removable

Bottom - Permanently Fixed

Support Blocks

Splice Plates

All necessary hardware

ENCLOSURE CHART							
Voltage 600V 5KV 15KVA	Fig. No.	Conductor		Dimensions In Inches			
		No.	Sizes	W	H	h1	X
600V	7	3	500MCM	9	6	-	12 1/2
5.15KV	7	3	500MCM	12	6	-	15 1/2
ALL	7	3	750MCM	12	6	-	15 1/2
ALL	7	3	1000MCM	12	6	-	15 1/2
600V	8	6	500MCM	9	8	2	12 1/2
5.15KV	8	6	500MCM	12	8	2	15 1/2
600V	8	6	750MCM	12	8	2	15 1/2
5.15KV	8	6	750MCM	12	10	4	15 1/2
600V	8	6	1000MCM	12	8	2	15 1/2
5.15KV	8	6	1000MCM	12	10	4	15 1/2
600V, 5KV	9	12	500MCM	18	8	2	21 1/2
15KV	9	12	500MCM	24	8	2	27 1/2
600V	9	12	750MCM	18	8	2	21 1/2
5.15KV	9	12	750MCM	24	10	4	27 1/2
600V	9	12	1000MCM	24	8	2	27 1/2
5.15KV	9	12	1000MCM	24	10	4	27 1/2
600V	10	18	500MCM	18	10	4	21 1/2
5.15KV	10	18	500MCM	24	12	6	27 1/2
600V	10	18	750MCM	18	10	4	21 1/2
5.15KV	10	18	750MCM	24	12	6	27 1/2
600V	10	18	1000MCM	24	12	6	27 1/2
5.15KV	10	18	1000MCM	24	12	6	27 1/2

Contact Factory

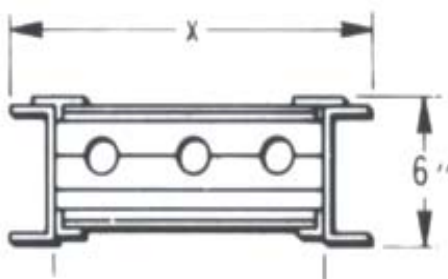


Figure 7

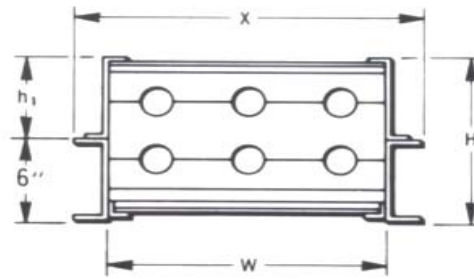


Figure 8

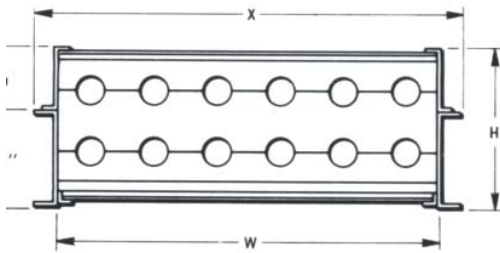


Figure 9

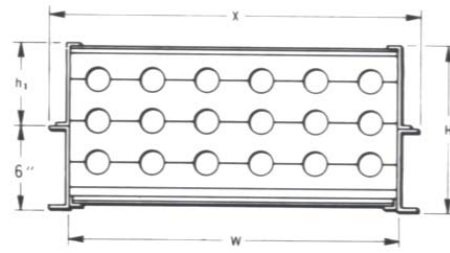


Figure 10

FITTING SELECTION TABLES

For maximum flexibility CABL-BUS "Fittings" are supplied as follows:

STANDARD

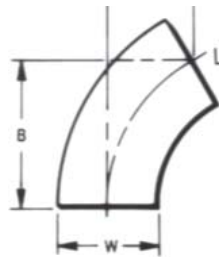
Width
Radius
Block Spacing
Block Enclosure

9", 12", 18", 24"
24"
Approx. every 18"
Aluminum 6063-T6

Straight section consists of:

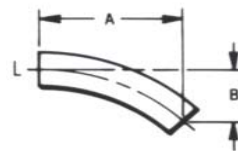
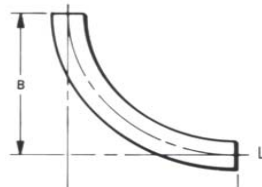
Basic Enclosure
Covers: Top - Removable
Bottom - Permanently Fixed
Support Blocks
Splice Plates

All necessary hardware



Horizontal Bends

Angles	90			60			45			30		
Catalog No	H90			H60			H45			H30		
Widths	A	B	L*	A	B	L*	A	B	L*	A	B	L*
9"	28 1/2	28 1/2	44 3/4	14 1/4	24 11/18	29 4/5	8 3/8	20 11/16	22 3/8	3 13/16	14 1/4	14 7/8
12"	30	30	47 1/8	15	26	31 7/16	8 13/16	21 3/16	23 9/16	4	15	15 11/16
18"	33	33	51 13/16	16 1/2	28 9/16	34 9/16	9 11/18	23 5/16	25 15/16	4 7/16	16 1/2	17 1/4
24"	36	36	56 9/18	18	31 3/16	37 11/16	10 9/16	25 7/16	28 1/4	4 13/16	18	18 7/8



Vertical Bends

Angles	90			60			45			30		
Catalog No	H90			H60			H45			H30		
Widths	A	B	L*	A	B	L*	A	B	L*	A	B	L*
All Widths	25 1/2	25 1/2	40 1/16	22 1/16	12 3/4	26 11/16	18	7 7/16	20	12 3/4	3 7/16	13 3/8

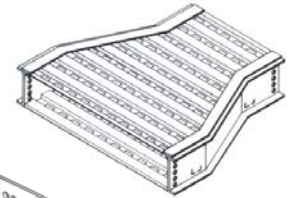
* "L" dimensions along centerline for 24" radius bend.

Consult factory for dimensions of 12", 18" and 36" radius bends.

NOTE: Due to variations in vertical cover heights, the above dimensions are based on the basic enclosure height of 6". Refer to enclosure selection table on preceding page before determining height clearance.

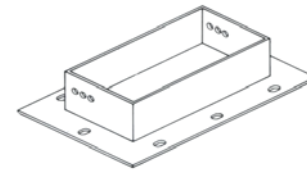
SPREADER

These fittings provide the additional width required for attachment of CABL-BUS to transformer terminal boxes, switchgear, motor centers, etc.



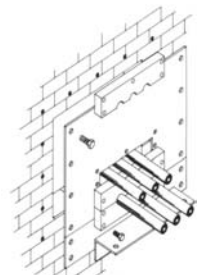
BOX CONNECTOR – TYPE BC

These connectors are used to terminate CABL-BUS at switchgear or other metal structures.



WATERTIGHT SEAL – TYPE EF (WALL)

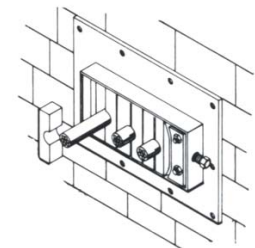
These fittings from a weatherproof seal with walls can also be used for floor penetrations where water tightness is necessary. Conductors are sealed with RTV silicon sealant.



Entrance fittings are furnished with all necessary hardware.

FIRESTOP WATERTIGHT SEAL – TYPE FS-RGS

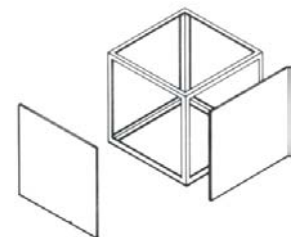
Weatherproof seal used at locations within the CABL-BUS run where an absolute watertight fitting is required. Neoprene blocks inserted into fitting after cables installed, for ease of cable pulling, these fittings are furnished with all necessary hardware. These fittings are rated as fire stops, and are UL listed for the 2 and 3 hour fire rating.



JUNCTION BOXES

Standard junction boxes are of aluminum construction. Painted steel and stainless steel junction boxes are also available. All junction boxes consist of welded angle frames with either bolted removable side panels or welded fixed panels.

Weatherproof boxes using gasketed removable panels are fully seam welded fixed panels are identified with a "W" prefix. WJB.



Standard boxes or specialty boxes are available for use with CABL-BUS applications, Cable Tray applications or any other application where a sturdy enclosure is required.

TAP BOXES – Type TB

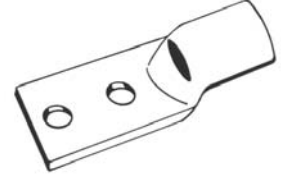
Tap boxes are used in a CABL-BUS System to allow for intermediate load taping. Tap box design provide, system voltage rated air separation between live parts and adjacent surfaces, to eliminate the necessity of taping all energized components Tap Box consists of:

- Aluminum Framed Enclosure
- Removable Covers (Gasketed for Outdoor Applications)
- Porcelain Post Insulators (above 600 volts)
- Bus Bars
- Cabl-Bus Entrance Fittings
- All necessary Fittings

ACCESSORIES

Electrical Connectors

Connectors are available for terminating cables at equipment and tap boxes, and for apparatus equipment studs.



Cable Termination Kits

Termination Materials are available for all CABL-BUS Systems.

Tape, pennant and molded stress cone kits available for high voltage termination up to 35 kV. Termination kits designed and engineered for reliability and low installed cost. All kits supplied will illustrated instruction sheets.

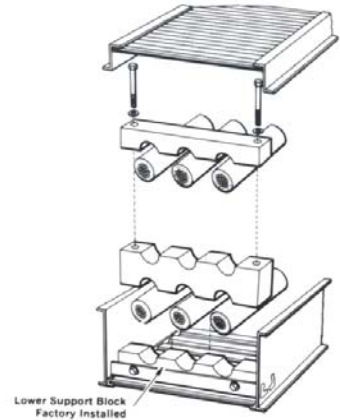
INSTALLATION SUGGESTIONS

The following practice is suggested to “pull” cables in place on CABL-BUS when using cable installation tools.

Cables with an O.D. larger than 2” should be “pulled” by a pulling eye, a basket grip or both.

Short lengths and small diameter cables maybe “pulled” with a basket grip only, providing the strain does not elongate or damage the insulation.

Best results for installing long lengths of conductor up to 1000 feet, with as many as a dozen bends, are obtained by “pulling” the cable in one continuous operation at a speed of 20 to 25 feet per minute. It may be necessary to employ a braked reel to reduce sagging of the conductor between EZ rolls.



The most economical spacing of EZ rolls depends on the weight of the cable to be pulled. In general, the spacing of EZ rolls should range between approximately ten feet for cable weighing over eight pounds per foot and sixteen feet for cable weighing not more than two pounds per foot.

DEFLECTION IN CABL-BUS SYSTEM

CABL-BUS systems should be designed for minimum installed cost. In order to achieve this objective, the engineer must bear in mind that the general design rules established for aluminum structure are not always compatible with the design rules for a CABLE-BUS system. This is particularly applicable in the case of restrictions on deflection.

As the most economical CABL-BUS system entails the use of heat-treated aluminum alloys and long spans, any limitations on deflection, which will not permit the best utilization of material and design, will increase the cost. By limiting (for any material) the maximum fiber and shear stress used in design, the adequacy and safety of the structure is assured and there is no reason to impose other limitations unless a specific result is desired at some point of the installation.

LOADING TABLES

STANDARD SUPPORT BLOCK SPACING IS: Horizontal: 3ft Vertical: 18 in. Material Spec: Alum. 6063-T6

The primary reason to limit deflection is appearance. It is well understood that engineers and owners take pride in the appearance of their plant. Restriction on the deflections of CABL-BUS system installed at or near eye level or in prominent area of installation.

Fig. 11 shows a table listing the total uniformly distributed load carrying capacities of CABL-BUS. The load is expressed in pounds per linear foot of span without exceeding the basic design stress. For each load the corresponding simple beam deflection is listed in inches depending on the loading. The continuous beam deflection varies from 1/5 to 1/2 of the simple beam deflection.

Figure 11

Weight (Inch)	Span Feet															
	6		8		10		12		14		16		18		20	
	Load	Defl.	Load	Defl.	Load	Defl.	Load	Defl.	Load	Defl.	Load	Defl.	Load	Defl.	Load	Defl.
24	100	0.05	78	0.12	56	0.20	35	0.24	107	0.80	90	1.15	72	1.48	54	1.69
18	100	0.05	78	0.12	56	0.20	35	0.24								
12	100	0.05	78	0.12	56	0.20	35	0.24								
9	100	0.05	78	0.12	56	0.20	35	0.24								

Cable Trays

CABLE LADDER AND TRAYS

WESCOSA is a licensee for the MP Husky Corporation of the U.S.A., in which we manufacture a cable ladder box shaped rung. The rung goes thru the side rail and it is welded on the outside. This method melts the rung and rail into one joint, and it is impossible for any rung separation. In addition, M.P. Husky has not seen one rung separation in 30 years history.

The rung has a flat surface for ease of pulling cables, and the open bottom box rung prevents moisture build up. Also, the open bottom box shaped design cannot deteriorate from within due to corrosion, foreign objects, rain, oils, acid and alkalies. In addition, the box shaped rung is continuously welded around the complete insertion, as not to pull from the rail under load and pressure.



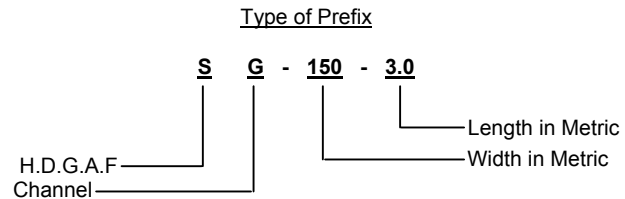
ELECTRAY

- Best constructed tray available for multiple large cables.
- Typical used by power plants, oil refineries, on & off shore platforms, desalination plants, commercial sites, and industrial construction sites requiring strength and reliability.
- Exclusive welded rungs to the outside of the rails for optimum structural integrity and reduce side rail rotation.
- Rung spacing: 6", 9", 12" and 18". Load Depths: 3", 3 1/2", 4", 5" through 6".
- Materials available: Aluminum; HDGAF, Coated Aluminum or Steel.
- Newer, more efficient and economical designs are now available in addition to older, established design still preferred by long-standing customers.

WESCOSA Cable tray with returned flange & side stiffener

WESCOSA Cable Trays are supplied in 2.4 or 3 meters standard lengths. The fittings have 900mm, 600mm, and 300mm standard radii. The channel is manufactured in various width and heights, of aluminum or hot dipped galvanized after fabrication steel, with ventilated or solid bottom. H.D.G.A.F., ASTM 123 or BS 729.

CATALOG NUMBERING SYSTEM FOR STRAIGHT LENGTH



Channel Standards length; 2.4 meters or 3 meters, with returned flange and without returned flange.

Channel Standard width; 4" (100mm), 6" (150mm), 9" (225mm), 12" (300mm), 18" (450mm), 24" (600mm) 30" (750mm) and 36" (900mm).

Channel Standard Heights; 25mm, 50mm, 80mm, 100mm

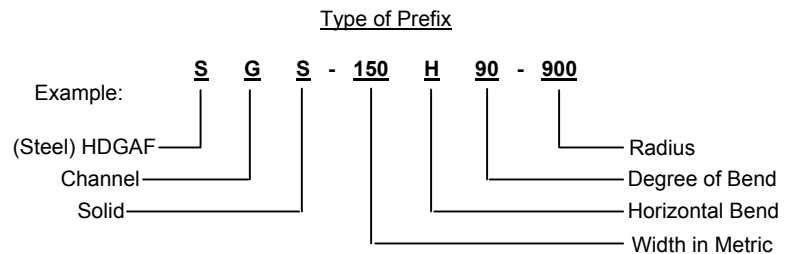
Channel Standard Slot Size: 6mm X 25mm

Channel Standard Thickness; 1.2mm, 1.5mm, and 2.0 mm.

All fittings are Non-Returned flange.

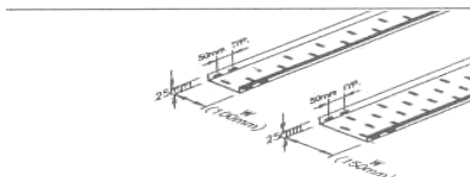
Straight lengths and fittings are ventilated or solid.

CATALOG NUMBERING SYSTEM FOR FITTINGS

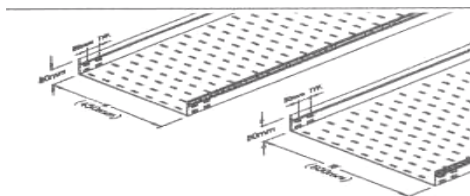
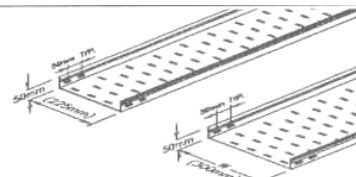


STRAIGHT SECTION PLAIN TYPE OR HEAVY DUTY RETURN FLANGE

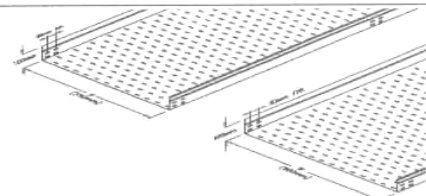
How to Order: Select Prefix for desired Type Channel And add Basic Catalog Number					
BOTTOM	TYPE PREFIX			BASIC CATALOG NUMBER	
	HDGAF STEEL	ALUMINUM	MILL GALVANIZE	(PREFIX) - W - L	HEIGHT
VENTILATED	SG-	AG-	MG-	() 100 - 3 METER	1 3/4" = 25mm
VENTILATED	2SG-	2AG-	2MG-	() 150 - 3 METER	2 3/4" = 50mm
VENTILATED	3SG-	3AG-	3MG-	() 225 - 3 METER	3 3/4" = 80mm
VENTILATED	4SG-	4AG-	4MG-	() 300 - 3 METER	4" - 100mm



TYPE: SG (STEEL)



TYPE: AG (ALUMINUM)



WESCOLA CABLE TRUNKING STRAIGHT LENGTHS: 1.5 MM ANSI GRAY FINISH / APPROVED BY SAUDI ARAMCO, HINGE TYPE COVER, KNOCKOUTS, ISO 9001

DUCT SIZE	CATALOGUE					
	12 INCH	24 INCH	36 INCH	48 INCH	60 INCH	96 INCH
2 ½ X 2 ½	S-2212	S-2224	S-2236	S-2248	S-2260	S-2296
4 X 4	S-4412	S-4424	S-4436	S-4448	S-4460	S-4496
6 X 6	S-6612	S-6624	S-6636	S-6648	S-6660	S-6696
8 X 8	S-8812	S-8824	S-8836	S-8848	S-8860	S-8896
10 X 10	-	S-101024	S-101036	S-101048	S-101060	-
12 X 12	-	S-121224	S-121236	S-121248	S-121260	-

STANDARD CABLE RUNWAY

Our most popular Cable Runway is made of 40 x 40 x 5 x 5 mm with cross members welded at 9inch intervals.

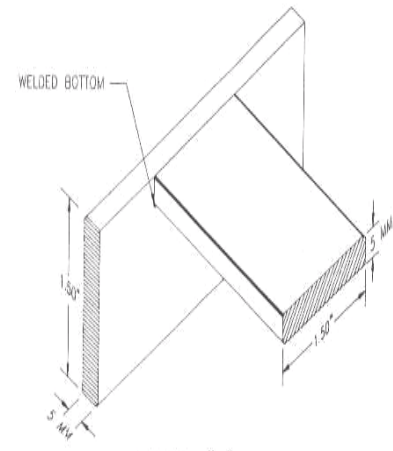
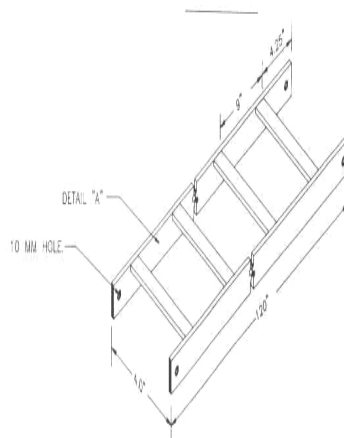
Material:

- Steel (Ansi Gray)
- Aluminum

Standard Length is 10 Ft or 20 Ft / Steel
Standard Length is 8 Ft / Aluminum

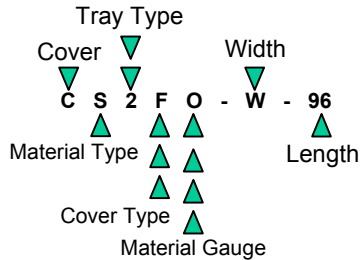
Ordering information

Part Number	Width (DimA)
SCR09 - 04 - 10	4"
SCR09 - 06 - 10	6"
SCR09 - 09 - 10	9"
SCR09 - 10 - 10	10"
SCR09 - 12 - 10	12"
SCR09 - 15 - 10	15"
SCR09 - 18 - 10	18"
SCR09 - 20 - 10	20"
SCR09 - 24 - 10	24"
SCR09 - 30 - 10	30"
SCR09 - 36 - 10	36"

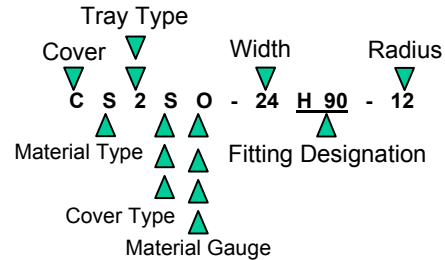


WESCOSA offers covers to provide protection for the cables contained within the system from the sunlight, environmental elements, dirt, debris and falling objects. All of the covers listed here are used for indoors as well as outdoor applications. Covers are fabricated from corrosion resistant aluminum or mill-galvanized steel.

Straight Covers Example:



Flat Fitting Covers Example:



Cover Code Definitions:

* Material Type	*Tray Type	*Cover Type	*Material Gauge
(A) Aluminum	(O) 3/8" Flanged Down	(S) Flat (Non-ventilated)	(0)20 Gauge Standard 1mm
(S) Mill Galvanized	(1) 3/8" Flanged Out	(SL) Flat (Ventilated)	(8) 18 Gauge 1.2mm
	(2) 3/4" Flanged Out	(F) Flat Flanged (Non-vent.)	(6) 16 Gauge 1.5mm
	(1) 1 3/4" Flanged Out	(FL) Flat Flange (ventilated)	(4) 14 Gauge 2.0mm

Note: All fitting covers are non-flange.
Straight length covers are 8' length.

Wall Brackets

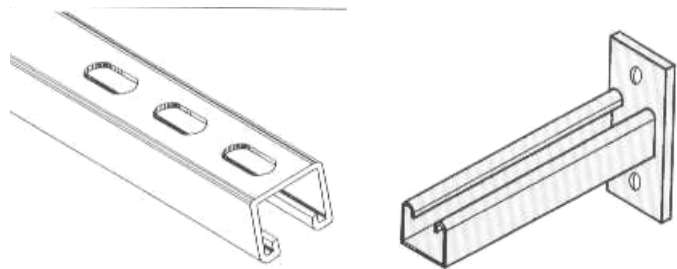
Single Strut Brackets

Designed primarily for use with strut framing, these brackets will work well in other applications. The uniform loads shown represent 2.5-safety factor. Furnished HDGAF Steel.

Allowable concentrated end load

One-half the listed uniform load.

Tray Width	Uniform Load	Electray
24inch	200	HP-S250-30
18 inch	500	HP-S250-24
12 inch	700	HP-S250-18
9 inch	700	HP-S250-15
6 inch	1000	HP-S250-12



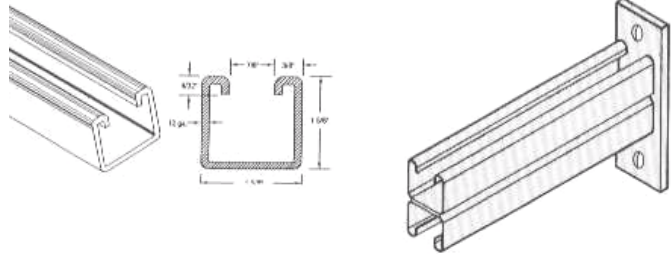
Double Strut Brackets

Similar to Single Strut Brackets but for wider trays and heavier loads. The uniform loads represent a 2.5 safety factor. Furnished in HDGAF steel.

Allowable concentrated end load

One-half the listed uniform load.

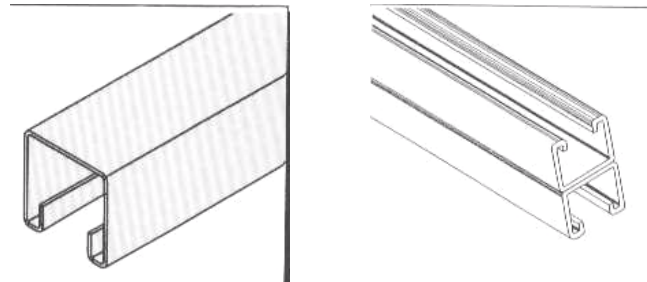
Tray Width	Uniform Load	Electray
36inch	400lb	HP-S251-42
30 inch	650lb	HP-S251-36
24 inch	800lb	HP-S251-30
18 inch	1000lb	HP-S251-24



Strut Type Support Channel

HP-type channels provide indirect support for hanger rods by spanning between available structural support beams and channels. The channel is supplied in 10' or 20' lengths and can easily be field cut to the length needed for use as a trapeze-type support. Available in single or double (back-to-back) configurations.

	Single	Double
Width	1-5/8"	1-5/8"
Depth	1-5/8"	3-1/4"
Weight/Foot	2 lbs	4 lbs
Black Steel	HP-200-()	HP-202-()
Mill-Galvanize	HP-200-()-P	HP-202-()-P
HDGAF	HP-200-()-G	HP-202-()-G



Note: () = insert 120 for 10' or 240 for 20' length.

STEEL GRATING PANEL WESCOSA METAL BAR GRATINGS

Wahah Electric Supply Company of Saudi Arabia (WESCOSA) has been an active local manufacturer in the Dammam first industrial estate since 1976. The company has grown steadily to its present size of nearly 600 employees occupying over 37,000 square meters of manufacturing and office space. As part of our commitment to the industrial world to meet its growing requirements, WESCOSA has most recently begun the manufacturing of heavy duty metal bar gratings specifically used as a catch basin covers according to the customer specifications and dimension.

WESCOSA Metal Bar Gratings typical used for oil refineries, desalination plants, commercial job sites, and industrial construction sites requiring catch basin if high strength and reliability.

Bearing Bars are vertically positioned bars that are also referred to as the load bearing bars.

Steel Grating Panels can be defined as a series of steel bars that are placed equally apart, vertically positioned, with crossed members that are joined to form a rectangular pattern, or a special design pattern according to customer request.

Cross Bars are the members that are joined at right angles to the load bars to allow lateral restraint that is also referred to as the transverse bars.

Span is the overall length of the load bearing bars, even if the length is shorter than the overall width.

Width is the overall dimensional width of the transverse bars, even if the width is longer than the length.

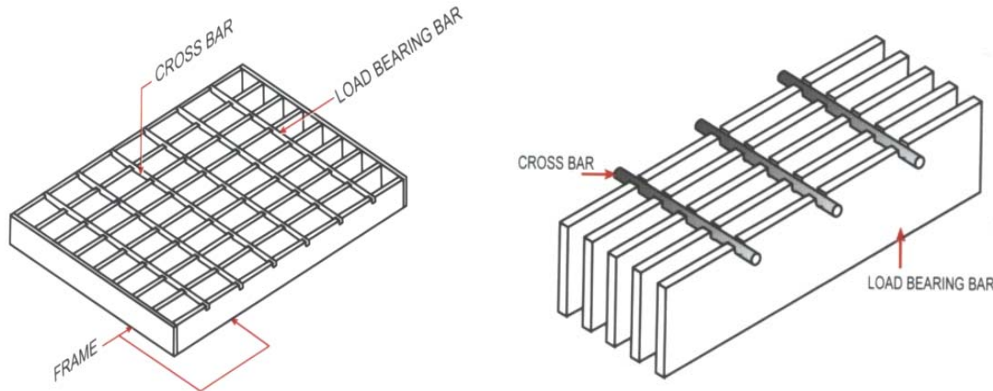
Binding Bar is the frame, which is flush with the top of the load bars, and is equal to the bottom of the load bars, or extends below the load bars.

The starter refers to the dimensions from the end of the frame, to center to the center of the distance to the first transverse bars.

Steel Gratings are manufactured by welding the load bars to the transverse bars at each intersection.

The Steel Gratings are hot dipped galvanized after fabrication according to ASTM A123 or BS 1461 (formerly BS729) specifications.

All of the steps in manufacturing till the shipment will be closely inspected by our dedicated quality team to ensure the high quality, reliability and standards, quality of welding, assembly and galvanizing.



WESCOSA HEAVY DUTY GRATINGS

TYPE 1:

Bearing Bar or Load Bar Size	: 65 X 10mm
Bearing Bar or Load Bar Pitch	: 30mm
Transverse Bar or Cross Bar Pitch	: 100mm
Bearing Bar or Load Bar Type	: Plain M.S. Flat Bar
Transverse Bar or Cross Bar Type	: 10mm M.S. Round Bar
Material Finish	: Hot Dip Galvanized ASTM A 123 Formerly ASTM A385 & or BS 1461 Formerly BS 729

TYPE 1 STANDARD SIZES:

WES-GR-698 X 500	GRATING (HDGAF) 698mm W x 500mm L x 65mm H
WES-GR-698 X 698	GRATING (HDGAF) 698mm W x 698mm L x 65mm H
WES-GR-698 X 898	GRATING (HDGAF) 698mm W x 898mm L x 65mm H
WES-GR-698 X 998	GRATING (HDGAF) 698mm W x 998mm L x 65mm H
WES-GR-698 X 1198	GRATING (HDGAF) 698mm W x 1198mm L x 65mm H
WES-GR-698 X 1448	GRATING (HDGAF) 698mm W x 1448mm L x 65mm H

TYPE 2:

Bearing Bar or Load Bar Size	: 90 X 10mm
Bearing Bar or Load Bar Pitch	: 30mm
Transverse Bar or Cross Bar Pitch	: 100mm
Bearing Bar or Load Bar Type	: Plain M.S. Flat Bar
Transverse Bar or Cross Bar Type	: 10mm M.S. Round Bar
Material Finish	: Hot Dip Galvanized ASTM A 123 Formerly ASTM A385 & or BS 1461

TYPE 2 STANDARD SIZES:

WES-GR-1148 X 1698	GRATING (HDGAF) 1148mm W x 1698mm L x 90mm H
WES-GR-1148 X 1948	GRATING (HDGAF) 1148mm W x 1948mm L x 90mm H
WES-GR-1148 X 2248	GRATING (HDGAF) 1148mm W x 2248mm L x 90mm H
WES-GR-1248 X 1798	GRATING (HDGAF) 1248mm W x 1798mm L x 90mm H
WES-GR-1248 X 1948	GRATING (HDGAF) 1248mm W x 1948mm L x 90mm H
WES-GR-1348 X 1698	GRATING (HDGAF) 1348mm W x 1698mm L x 90mm H
WES-GR-1348 X 2098	GRATING (HDGAF) 1348mm W x 2098mm L x 90mm H

TYPE 3:

Bearing Bar or Load Bar Size	: 100 X 12mm
Bearing Bar or Load Bar Pitch	: 30mm
Transverse Bar or Cross Bar Pitch	: 100mm
Bearing Bar or Load Bar Type	: Plain M.S. Flat Bar
Transverse Bar or Cross Bar Type	: 12mm M.S. Round Bar
Material Finish	: Hot Dip Galvanized ASTM A 123 Formerly ASTM A385 & or BS 1461

TYPE 3 STANDARD SIZES:

WES-GR-1518 X 1568	GRATING (HDGAF) 1518mm W x 1568mm L x 90mm H
WES-GR-1718 X 1968	GRATING (HDGAF) 1718mm W x 1968mm L x 90mm H

Fuse Cutout & WESCOSA Services Division

TYPE C CUTOUTS

110-125-150-170 KV BIL

PRODUCT FEATURES

Interchangeability

The Chance Company was the first to design a cutout that could interchange fuseholders WITH THOSE OF ANOTHER MANUFACTURER. Another type C fuseholders are mutually interchangeable with S&C Electric Company's Type XS cutout (within the same voltage class) U.S.A.

Fusetube

The one-half inch side diameter of the C cutout's 100-ampere fusetube increases internal pressure giving superior and reliable expulsion action. During frequently encountered intermediate fault range this diameter also permits higher TRV (transient recovery voltages) values to be tolerated. This





شركة واحدة العربية السعودية للإمدادات الكهربائية (المحدودة) Wahah Electric Supply Co. of Saudi Arabia (Ltd.)

small-bore design eliminates any concern related to high impedance phase-to-phase faults on underground wye and delta system.

The inside liner is constructed of arc quenching bone fiber. The tube is made of fiberglass which permits the smaller bore and provides a higher burst strength. It is protected from the weather and environment by a special ultra-violet resistant coating.

Also, the WESCOSA fusetubes operates which fuse links from all major suppliers.

Crossarm Brackets

C cutouts come package one per carton including brackets for crossarm mounting. Brackets are galvanized steel for long lasting service. Cutouts may be ordered without crossarm brackets.

“D” Brackets

This bracket is used to mount crossouts and/or arresters directly to the pole. It is commonly referred to as “D” type bracket. Three brackets may be used for three-phase application. It provides a clean, quick mounting for single-phase application without crossarm or special pole bands.

Higher Interrupt Capacities

By using a copper arc-shortening rod inside the top of the fusetube, higher interrupt ratings are obtainable. An arc-shortening rod is attached to the cap of some fusetubes and lowers the link within the fusetube. This permits a much shorter arc, resulting in less arc energy, less violence during the interruption, and higher interrupting capacities.

It is necessary to use fuse links with removable button heads when arc-shortening rods are employed.

Terminals

Tin-plated bronze parallel groove type terminals are standard on Type C cutouts. They can accommodate aluminum or conductor sizes ranging from No. 6 solid copper through 4/0 ACSR or 250 MCM stranded copper. The parallel groove design is perfect for handling two different sizes of conductor as in the case when arresters are being used.

STANDARD TYPE “C” CUTOUT WITH NEMA TYPE “B” BRACKET DIMENSIONS

KV BIL	A	B	C	D	E
110	16" 406mm	5 1/2" 137mm	10 3/4" 273mm	3 1/2" 89mm	21 1/2" 559mm
125	16 3/8" 416mm	7 1/8" 181mm	12 1/2" 318mm	3 1/8" 79mm	26 3/4" 679mm
150	16 3/8" 416mm	7 1/8" 181mm	12 1/2" 318mm	3 1/8" 79mm	26 3/4" 679mm
170	17 1/4" 438mm	8 1/2" 216mm	15" 381mm	1 3/4" 44mm	32 1/2" 826mm

**TYPE C STANDARD CUTOUTS
SPECIFICATIONS AND ORDERING INFORMATION**

15kv (110kv BIL) (Ru listed)

Catalog Number	Maximum Design Voltage	Nominal System Voltage	Continuous Current (Amps)	Interrupt Capacity (Asym)	Leakage to Ground Metal to Metal		Weight		Arc Shortening Rod
C710-112PB	15KV	Thru 14.4KV	100	10.000	10.2"	260mm	17.4lb	7.98kg	No
C710-114PB	15KV	Thru 14.4KV	100	16.000	10.2"	260mm	17.6	7.98kg	Yes
C710-143PB	15KV	Thru 14.4KV	200	12.000	10.2"	260mm	18.2	8.26kg	Yes
C710-133PB	15KV	Thru 14.4KV	300	12.000***	10.2"	260mm	17.7	8.03kg	N/A

27kv (125kv BIL) (Ru listed)

Catalog Number	Maximum Design Voltage	Nominal System Voltage	Continuous Current (Amps)	Interrupt Capacity (Asym)	Leakage to Ground Metal to Metal		Weight		Arc Shortening Rod
C710-211PB	27KV	Thru 24.9KV	100	10.000	12.6"	320mm	20.0lb	9.07kg	No
C710-213PB	27KV	Thru 24.9KV	100	16.000	12.6"	320mm	20.2lb	9.16kg	Yes
C710-242PB	27KV	Thru 24.9KV	200	12.000	12.6"	320mm	20.9lb	9.48kg	Yes
C710-333PB	27KV	Thru 24.9KV	300	12.000***	12.6"	320mm	20.4lb	9.25kg	N/A

27kv (150kv BIL) (Ru listed)

Catalog Number	Maximum Design Voltage	Nominal System Voltage	Continuous Current (Amps)	Interrupt Capacity (Asym)	Leakage to Ground Metal to Metal		Weight		Arc Shortening Rod
C710-311PB	27KV	No Restrictions thru 24.9KV +26.4 thru 36kv	100	8.000	17.3"	440mm	26.8lb	11.70kg	No
C710-313PB	27KV	No Restrictions thru 24.9KV +26.4 thru 36kv	100	12.000	17.3"	440mm	26.0lb	11.79kg	Yes
C710-342PB	27KV	No Restrictions thru 24.9KV +26.4 thru 36kv	200	10.000	17.3"	440mm	26.6lb	12.07kg	Yes
C710-333PB	27KV	No Restrictions thru 24.9KV +26.4 thru 36kv	300	12.000***	17.3"	440mm	26.2lb	11.88kg	N/A

36kv (170kv BIL) (Ru listed)

Catalog Number	Maximum Design Voltage	Nominal System Voltage	Continuous Current (Amps)	Interrupt Capacity (Asym)	Leakage to Ground Metal to Metal ●		Weight		Arc Shortening Rod
C710-613PB	36KV	Thru 36KV	100	12.000	26"	660mm	28.6lb	12.97kg	Yes
C710-643PB	27KV	No Restrictions thru 24.9KV +26.4 thru 36kv	100	12.000	26"	660mm	29.0lb	13.15kg	Yes
C710-633PB	36KV	Thru 36KV	300	12.000***	26"	660mm	28.6lb	12.97kg	N/A

36kv (170kv BIL)

(Ru listed)

Catalog Number	Maximum Design Voltage	Nominal System Voltage	Continuous Current (Amps)	Interrupt Capacity (Asym)	Leakage to Ground Metal to Metal		Weight		Arc Shortening Rod
C710-713PB	36KV	Thru 34.5KV	100	8.000	28.4"	720mm	33.9lb	12.97kg	Yes
C710-743PB	27KV	No Restrictions thru 24.9KV +26.4 thru 36kv	100	12.000	28.4"	720mm	34.3lb	15.55kg	Yes
C710-733PB	36KV	Thru 36KV	300	12.000***	28.4"	720mm	33.9lb	15.37kg	N/A

- Creepage distance 560mm is available for this type of cutouts. Specify creepage distance during order.

*** Momentary rating – solid blade

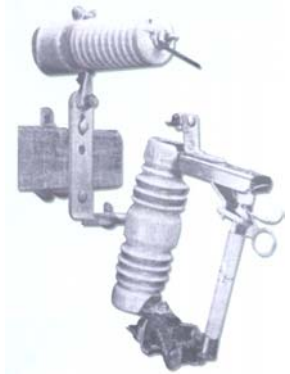
+ For application or single-phase to natural or three phase solidly – grounded Wye – connected circuits where recovery voltage does not exceed the max design voltage of the device.

Note: Due to the higher Creepage distance and BIL requirement, the cutout is connected to the station past insulator to achieve 30, 40 or 50mm/KV creepage distance for 36KV fuse cutout.



15KV cutout with direct-connected Copper, large block, MOV porcelain, 10KV arrester.

KV MAX DES	KV BIL	AMP	SYM	CREEPAGE DISTANCE
C710-613PB-1				
36KV	200	100	8.000	1320MM
C710-613PB-2				
36KV	200	100	8.000	990MM
C710-613PB-3				
36KV	200	100	8.000	1600MM



15KV cutout with direct-connected Ohio Brass large block MOV polymer, 9KV arrester.

TYPE C CUTOUT-ARRESTER COMBINATIONS Over-The-Arm-Type

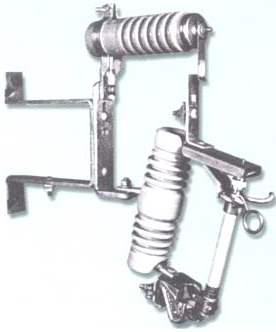
Advantages of Combination

WESCOSA cutout/arrester combination cost less than the total cost of separately purchased components. The combination units install faster, more economically and take up less space in the storage transit and service. Each combined unit takes up a minimum of space on the crossarm and has a favorable weight distribution for minimal off-center loading. The field-proven quality of both cutout and arrester assure consistent high performance for the combinations.

Wider selection of arresters

WEASCOSA distribution cutouts-arresters are available with various combinations of brands, basic designs, housing materials and duty classes of arresters. All combinations are directly connected to the cutout and have isolators on the groundside. Check with the arrester manufacturer for specific application recommendations.

WESCOSA/licensee A.B. Chance now offers Ohio Brass MOV arresters and Copper VariGAP TM and MOV arresters. These new arresters supersede the previous silicon-carbide units offered by Chance.



15 KV Type C cutouts, external gap 9/10KV arresters mounted on "D" type pole bracket.



Over the arm mounted, 15KV Type C cutout, direct connected, 9/10kV arresters, with crossarm mounting bracket.



Over the arm mounted, 15KV Type C cutout, external gap, 9/10KV arresters, on crossarm bracket.

ORDERING INFORMATION

	Catalog Number**	Maximum Design Voltage	Continuous Current (Amps)	Interrupt Capacity (Asym Amps)	BIL	Arrester Description	Weight
15 kV 110 kV BIL	C7 1A-412PB	15 KV	100	10,000	110 KV	9/10 KV External Gap	25 lbs. 11.25kg.
	C7 1D-412PB	15 KV	100	10,000	110 KV	9/10 KV Direct Connected	25 lbs. 11.25 kg.
27 kV 125 kV BIL	C7 1C-211PB	27 KV	100	8,000	125 KV	18 KV External Gap	32 lbs. 14.51 kg.
	C7 1F-211PB	27 KV	100	8,000	125 KV	18 KV Direct Connected	32 lbs. 14.51 kg.
27 kV 150 kV BIL	C7 1C-311PB	27 KV	100	8,000	150 KV	18 KV External Gap	35 lbs. 15.88 kg.
	C7 1F-311PB	27 KV	100	8,000	150 KV	18 KV Direct Connected	35 lbs. 15.88 kg.

** SUFFIX P = Parallel Groove Clamps B = NEMA Crossarm Mounting Bracket

NOTE: 1 – each of the above cutout-arrester combination includes tin-plated bronze PG Clamps and "Loadbuster" hooks.

TERMINAL VARIATIONS:

To order with small eyebolt (No. 8 sol. Thru 2/0 str) change the "P" to "E" (ie C7 1A-112EB)

To order with small eyebolt (No. 6 sol. Thru 250 str or 4/0 ACSR) change the "P" to "L" (ie C7 1A-112LB)

BRACKET VARIATIONS:

To order without crossarm bracket drop the suffix "B" from the catalog number (ie C7 1A-112P)

To order with a "D" pole-mounting bracket, change the suffix "B" to "D" (ie C71A-112PD)

SYNCHRONIZING PANEL

WESCOSA Synchronizing panels are designed and manufactured to meet power system requirements.

FEATURES

- Microprocessor based Auto-Synchronizer
- One Synchronizing unit controls multiple systems with up to six different sets of breaker closing parameters
- Suitable for small Diesel units to large difficult hydro.
- Synchronizer unit suitable for automatic control of the generators.
- Both Manual and Auto synchronizing feature.
- Custom designed Mimic diagram
- High accuracy Analogue / Digital meters (Optional)
- Test switch facilitates testing of Relays and Meters from the front panel.
- Dead Front with rear access or front access, freestanding panel / Wall mounting type panel design available.
- Panel protection – NEMA Type 1, IP 21 to IP 55



Panel construction as per ANSI / NEMA standard

RELAY PANEL & CONTROL PANEL

WESCOSA Relay and control panels are designed and manufactured to provide high degree of protection and control to power system equipment i.e. Transmission line, Power transformers and Breakers etc.

FEATURES

- Microprocessor based / Numerical protective relays
- High accuracy analog / Digital meters (Optional)
- Custom designed Mimic diagrams (Optional)
- Both Freestanding type and Wall mounting type relay panel design available.
- Both Fixed and Swing type 19" rack construction available for Relay / Meters and pilot devices installation on floor mounting type panel.
- Glazed door for floor mounting type panel to view relay panel front mounted components.
- Dead front with rear access or front access type control panels.
- Test switch facilitates testing of Relays and Meters from the front of the panel.
- Panel protection – NEMA type 1, IP 41 to IP 55
- Meets ANSI/NEMA/IEC Standard



ANNUNCIATOR PANEL

WESCOSA Annunciator panels are manufactured with AMETEK Power Instruments Annunciator AN3100C and meets ANSI/NEMA standard.

ANNUNCIATOR

- Microprocessor Based
- Field Programmable
- Compact Unit
- Programmable Common Relay Output
- High speed event capture (1 ms)
- Auxiliary relay output from windows (Optional) for remote Annunciation
- Rugged Construction
- Modbus Output
- Windows are available in five different color (White/Red/Amber/Green/Blue)
- Suitable for indoor and outdoor application
- Four different size windows to choose
 - Standard: (2.85"x0.83")
 - Medium: 2.85"x1.11")
 - Large: (2.85"x1.67")
 - Extra Large: (2.85"x3.34")
- Available in six different Auxiliary power supply
24VDC / 48VDC / 125VDC / 250VDC / 120VAC,50 & 60 HZ / 240VAC,50 & 60HZ)
- Transmitter / Alarm signal conditioning module (Optional) for analog inputs.
- Compact Multi-tone Hooter provides 28 different tones
- Type tested for RFI/EMI and radiated emission.



ENCLOSURE

- Free standing with front or rear access design / Wall mounting type.
- Protection category – IP 52 to IP 65

WESCOSA SERVICES DIVISION



WESCOSA is a pioneer manufacturer of Electrical Distribution Equipments like **TRANSFORMERS, MV & LV SWITCHGEARS, MCC'S CABLE SUPPORT TRAYS, FUSE CUTOUPS, SEGREGATED AND NON-SEGREGATED BUSDUCTS** with technical collaboration from **POWELL INC., CUTLER-HAMMER INC., MP-HUSKY AND AB CHANCE** of U.S.A.

WESCOSA, in same business line of manufacturing, continuously for the past three decades in the Kingdom of Saudi Arabia, has acquired considerable and varied technological experience in major electrical activities. Its aspired diversification, mainly aimed at serving and satisfying its customers, continued with servicing projects involving the same line of manufactured products, for major customers.



شركة واحدة العربية السعودية للإمدادات الكهربائية (المحدودة) Wahah Electric Supply Co. of Saudi Arabia (Ltd.)

In 1995, large-scale concentration on servicing projects as a result of high demand and bloom in **WESCOSA** servicing activities emerged **WESCOSA SERVICE DIVISION (WSD)** to attend to services task separately. The division comprises of experienced, skilled and well qualified Service Engineers and Service Technician. WSD services can be broadly classified as:

- | | |
|---|--|
| a) Service for All Products. | e) Replace, Retrofit or Retrofill |
| b) Maintenance and Refurbishment | f) Spare Parts Component |
| c) Installation, Testing and Commissioning | g) Engineering Support |
| d) Designing and Modification | h) Transformer Oil Filtration |



We extend our services to the following products but not limited to:

TRANSFORMER : Power and Distribution Transformer

SWITCHGEAR : **MV. SWITCHGEAR** of vacuum, oil, SF6 etc. **LV. SWITCHGEAR.**

MCC's : All types of MCC's.

BREAKERS : Both MV and LV Breakers.

BUS-DUCTS : Both MV and LV Busducts.

SF6 / Oil Switches, Ring Main Units, Switch Boards, Control Panels, All Types of Relays etc.

In addition to our well-experienced crew, we have all the support from our Licensors to handle the above-mentioned activities of their products and other manufacturer products.

TESTING AND COMMISSIONING

All testing activities can be conducted at our factory or at site to meet your requirements by using equipments calibrated from certified laboratories to maintain the accuracy of test results.

We have sufficient Engineers and Technicians to commission wide range of products related to transmission and distribution equipment:

Switchgear
Transformer
MCC's
Breakers
Relays

Motors
Generators
Relay Panel
UPS System
Cable

INSTALLATION:

Call us any time; we carry our termination, electrical installation and control wires interconnection for all distribution equipments.

DESIGN, SUPPLY AND MODIFICATION:

Do you need to upgrade or modify your Switchgear and MCC?

Do you have to change the application?

Do you have old transformer, which require meeting new standards?

Do you have a problem in the length of your bus duct?

Answer:

WESCOSA SERVICES DIVISION IS THE SOLUTION.



شركة واحدة العربية السعودية للإمدادات الكهربائية (المحدودة) Wahah Electric Supply Co. of Saudi Arabia (Ltd.)

REFURBISHMENTS AND RE-CONDITIONING:

Transformers, Substation, Switchgears, MCC, RMU, Switches and all types of panels.
We make them as new.

RETROFITS AND REPLACEMENT:

1. Digitrip Retrofit Kits for breakers or Replacement of breakers:

You can do it now with WECOSA Services Division

Westinghouse DA & DK Breakers
Westinghouse DB, DS & SPB Breakers
GE AK Breakers
ITE Breakers
Siemens and Siemens Allies Breakers
Other Breakers

2. Retrofit kits and assemblies for MV starters

Westinghouse AML air Ampgard
Westinghouse LF air Ampgard
GE Limit amp contactor

3. Retrofit for MCC

Do you have a problem getting spare parts for your MCC's?

WECOSA can offer a factory retrofit; we replace the breaker handle and the handle mechanism with Cutler-Hammer products. A new door will be manufactured at our factory. The old units wrapper is cleaned and repainted and the existing bus-stabs are reused.

If your MCC has a space for additional buckets, do not look for extensions. Just call WECOSA Services Division.

If many original components are obsolete or no longer feasible for isotrol plug in unit starters, we do install modern equals or equivalents to use the space available.

Do you have problems with other manufacturer's switchgear?

WECOSA SOLVES PROBLEMS CAUSED BY OBSOLETE BREAKERS

You call wescosa now!

...We offer **POWELL and CUTLER-HAMMER** Retrofill and Replacement.

The retrofill option allows operators to upgrade obsolete switchgear using the existing structure and bus work, by simply replacing the circuit breaker and cell with modern vacuum, metal-clad circuit breaker. Upgrades can be accomplished on site or at WECOSA factory.



Replacement option: We can supply exact replacements for obsolete General Electric Magneblast and Westinghouse DHP Circuit Breakers. Available for a wide range application:

5 kV, 26" wide cells, 1200 to 2000A
5kV, 36" wide cells, 1200 to 3000A
15kV, 36" wide cells, 1200 to 3000A
38kV, 48" wide cells, 1200 to 2000A

Installation:

You can depend on us. Our engineers and technicians remove obsolete breakers and cell components, then install the new retrofit cell into the existing enclosure. The new cell contains all new secondary disconnect, a close door racking mechanism and adaptive runback bus to connect to bus termination points. Replacement breakers correctly interface with existing cell switches. Safety interlocks inherent to the original switchgear design are maintained.

Transformers

PAD MOUNTED DISTRIBUTION TRANSFORMER

Application

The wescosa pad mounted distribution transformer is an oil filled, three phase, specifically designed for servicing such underground distribution loads as shopping centers, schools, institutions, and industrial plants. It is available in both live front and dead front construction, for radial or loop feed applications, with or without fusing or switching.

Industry standards

WESOSA pad mounted transformers meet the following industry standards.

ANSI C57.12.00	ANSI C57.12.80
ANSI C57.12.22	ANSI C57.12.90
ANSI C57.12.26	NEMA TR1
ANSI C57.12.70	NEMA TR-P9



Ratings

- kVA: 45, 75, 112.5, 150, 300, 500, 750, 1000, 1500
- High Voltages (Primary)

4160 Grd Y/2400	2400△
8320 Grd Y/4800	4160△
12470 Grd Y/7200	4800△
13200 Grd Y/7620	7200△
13800 Grd Y/7970	8320△
34500 Grd Y/9920	12000△
	12470△
	13200△
	13800△
	14400△

- HV Taps: 2-2 ½% above and below normal.

■ HV BIL:	45kV BIL	-	2400 volts
	60kV BIL	-	4160 – 4800 volts
	75kV BIL	-	7200 volts
	95kV BIL	-	12000 – 16340 volts
	150kV BIL	-	34500 Grd Y/19920 volts



شركة واحدة العربية السعودية للإمدادات الكهربائية (المحدودة) Wahah Electric Supply Co. of Saudi Arabia (Ltd.)

■ Low voltages (Secondary)

All low voltages are rated 30kV BIL

480/Y277 220Y/127

231Y/133 480Δ 400Y/231

208Y/120 (Refer to WESCOSA on 1500 kVA)

240Δ (Refer to WESCOSA on 1500 kVA)

240Δ/120 lighting tap (Refer to WESCOSA on 250-1500 kVA)

Typical Design Impedances

Impedance for 500 kVA and below range from 2.6% to 5.4%.

A 75 kVA unit would be about 2.6% and a 500 kVA would be about 5.4%. The impedance would increase within this range as kVA increases.

ANSI standards set the impedance for 750 kVA and above to be 5.75%.

Specific design impedances for fault let thru circulations may be obtained by contacting WESCOSA

Standard Features

1. The weather cover over the cabinet is provided with additional hold-down hardware to secure it more firmly to the cabinet.
2. Four lifting hooks.
3. Bolted-on terminal compartment (18" deep) with removable front sill.
4. Hinged, lift-off cabinet doors.
5. Interlocked hex-head or penta-head bolt/padlock handle operates a cam assembly, which is part of the three-point door latching mechanism.
6. Lighting arrester-mounting pad (live front only).
7. Tank ground pad (1 in HV, 1 in LV).
8. Steel high / low voltage compartment barrier.
9. Two 3/8" hex-head bolts must be removed from the flange formed on the steel high/low barrier before the H.V. door can be opened.
10. Externally clamped low voltage epoxy bushings with threaded copper studs with NEMA 4 hole spade.
11. Nameplate.
12. Fill plug and self-actuating pressure relief device.
13. Drain plug.
14. Removable neutral ground strap.
15. Externally operated tap changer (no load).
16. Liquid temperature gauge.
17. Liquid level gauge.
18. Drain Valve with integral sampler.
 - Five-legged core/coil assembly (inside tank)
 - Handhole cover bolted onto tank top (Protected by weather cover).
 - Panel coolers (112 ½ kVA through 500 kVA). Tabular coolers (750 kVA and above).

Standard Options Primary Termination

19. For live front construction, externally clamped high voltage porcelain bushings with a double eyebolt for 2/0 cable (45-225kVA) or a single eyebolt for 40 cables (300-1500 kVA).
20. For dead front construction, externally clamped high voltage epoxy bushing wells for loadbreak, or non-loadbreak inserts, 200-amp rating, for maximum 4/0 (95mm²) cable.
 - Non-Load break Integral Bushing rated 600 A for cable size upto 1000 mcm (500mm²).
21. Primary Switching
 - LBOR oil switch, loop or radial feed.
 - EFD air switch, (loop or radial feed) with current limiting fuse
 - Externally operated series-multiple (dual voltage) switch.

Overcurrent Protection

- Internal primary protective links.
- D.O. II bayonet-type fuses.
- Drawout, Drywell load break current limiting fuses.
- Secondary oil or air circuit breaker.
- Internal, partial-range current limiting fuse, in series with protective links or D.O. II bayonet type fuse.

Overvoltage Protection

- Distribution class lightning arresters, 3 thru 27kV rating available.

Secondary Termination

- Externally clamped bushings with threaded copper studs.
- Externally clamped bushings with NEMA 4 hole spades.

POWER SUBSTATION TRANSFORMERS Three Phase



WESCOSA Power Substation Transformers are designed to provide electrical service for distribution system. Primary and secondary cables enter the transformer cable boxes from below through openings in the foundation. All exposed live parts are enclosed in cable boxes (or compartments when required). Designs for close-coupled bus-duct are also available.

WESCOSA provides different designs to meet both IEC and ANSI standards.

H.V. TAPS: $\pm 2 \times 2 \frac{1}{2} \%$ is standard.

Special tapping is available.

Off load/On Load top changer can be provided

Standard Ratings

THREE PHASE kVA	HIGH VOLTAGES	LOW VOLTAGES
500-10000	160	20Y/127
11000	1Y/133	
13200	400Y/231	
13800	480Y/277	
33000		
34500		



Standard Features

1. Bolted or Welded top cover.
2. Four lifting hooks.
3. Dial thermometer with maximum pointer indicates oil temperature and shows the maximum temperature attained since last reset.
4. Oil temperature gauge with contacts. (Optional)
5. Padlockable off-load tap changer provide means of changing the voltage ration of the transformer in steps of fixed percentage voltage.
6. A pressure relief device relieves excessive internal pressure and reseals at a lower positive pressure.
7. Liquid level gauge – indicates the normal liquid level.
8. Magnetic oil level gauge with contacts (Optional).
9. Pressure vacuum gauge (Optional).
10. Drain valve with plug.
11. Jacking pads (Optional).
12. Fill Plug.
13. Skids.
14. Bi-directional roller (Optional).
15. Detachable cooling radiators, or panel cooling fins.
16. Winding temperature indicator with contact (Optional).
17. Rapid rise pressure relay. (Optional)
18. Relief device with trip contacts. (Optional)
19. Forced cooling fans increase capacity by about 25%. (Optional)
20. Hermetically-sealed or conservator type.

Standard Options

Primary Terminations

Side mounted cable box with high voltage bushings suitable for H.V. termination kit.
Cover-mounted cable box with high voltage bushings suitable for H.V. termination kit.
Cover –mounted “stand alone” high voltage bushings.
High voltage cable box with provision for fixing H.V. power fuses.

Secondary Terminations

Side-mounted cable box with low voltage bushing with spade connectors.
Cover-mounted cable box with low voltage bushings with spade connectors.
Side-mounted low voltage bushing throat for close coupling with busduct/switchgear.
Cover mounted low voltage bushing throat for close coupling with busduct/switchgear.

Insulating Liquid

Normal mineral oil conforming to applicable latest international standard specifications.

Core Construction

High quality, low loss, cold-rolled, grain oriented silicon steel with five-legged, wound-core construction, or three ledge, step lap stacked-core construction is used.

POLE MOUNT AND PAD MOUNT DISTRIBUTION TRANSFORMERS

INTRODUCTION:

WESCOSA has been manufacturing distribution transformer since 1978.

WESCOSA's distribution transformer are designed, manufactured and tested in accordance with IEC 76 and its equivalent standards. Standard type transformer are well suited for serving both industrial and commercial applications: the small, compact design saves value space and lighter weight makes handling and installation easier and less expensive. In addition to the standard type a variety of options are available to meet your specific requirements.

WESCOSA's distribution transformers are designed for continuous operation, self-cooled for tropical climates, and are suitable for indoor and outdoor installation.



STANDARD FEATURES:

High Reliability and Easy Maintenance:

Distribution transformers can be manufactured with simple structure and having compact size, and yet they are mechanically strong and easy to inspect. The self-cooled or ONAN type system requires no auxiliary devices and permits easy maintenance.

Well Insulated Against Lightning Surge:

The coil is wound with untreated kraft paper, and the lack of varnish treatment allows the coil to be amply impregnated with degassed oil, which gives it high impulse voltage. Coils of high voltage have multi-layer windings, which minimize internal potential oscillation and electrical stress.

Cold-Rolled Grain-Oriented Silicon Steel:

Cold-rolled grain oriented sheet steel is used in the core, resulting in highly efficient transformer of reduced size and weight.

Mineral Oil:

The transformer is vacuumed and filled with high quality refined mineral oil having excellent insulating property that complies with IEC-296.

Temperature Limits:

WESCOSA distribution transformers are designed for the average winding rise of 55°C and average top oil rise of 50°C at an average ambient temperature of 40°C. Other designs may be provided on special order.

Paint Finish:

The tank walls are shot blasted, cleaned and applied with corrosion inhibiting epoxy/polyamide primer. Then an intermediate coat and a topcoat are applied using aliphatic polyurethane paint, which is resistant to corrosive industrial atmosphere. The standard color finish is cement gray.

Ratings:

- KVA: 50, 100, 200, 300, 500, 1000, 1500
- High Voltages (Primary)
 - 13800V Delta
 - 33000V Delta
- Low Voltages (Secondary)
- All low voltages are rated 30kV BIL
 - 231Y/133V
 - 400Y231V
- HV TAPS: 2 - 2.5 above and below normal.
- HV BIL: 95 / 110kV BIL – 13800 volt
170 / 200kV BIL – 33000 volt

DRY TYPE TRANSFORMERS (Three phase – 60 HZ)

WESCOSA offers a complete line of in-Kingdom manufactured three phase dry type transformers through 1000kVA. The distinguished WESCOSA transformer family provides dependable utilization voltages that are vital in today's energy conscious distribution system in Saudi Arabia are Quiet and Dependable.

WESCOSA provides different designs to meet the variety of customer's needs in Saudi Arabia.



These include:

Voltage

- 480V – 480Y/277V
- 480V – 220Y/127V
- 480V – 208Y/120V
- 380V – 220Y/127V

Connection DELTA – WYE

Frequency 60Hz

Temperature Rise 150°C Average Winding Rise

Enclosure indoor ventilated outdoor (with weathershields).

WESCOSA three-phase design is based on a 220°C rated insulation system. This reduces the size of the cooling duct area providing shorter core loop. The result is a lighter, smaller transformer and a major reduction in core vibrations, keeping the gap vibrations to a minimum along with other important assembly procedures assures quiet operation and low losses.

Steel grid bottoms in the enclosure permits the cooler ambient to enter the terminal compartment on ventilated designs. The grid on the bottom also provides rodent protection.

The front panel is removable for easy access to the wiring compartment. Terminal straps, located in the terminal compartment below the core and coil assembly, facilitate connections.

The smaller unit contains\ knockouts on both side near the bottom. Larger units are equipped with removable plates for economical cable entry.

Wall mounting brackets are available for smaller designs. Transformers can be furnished with weathershields for outdoor service. Lifting accessories are on all designs.

TYPE DT-3

-150°C AVERAGE WINDING RISE, 220°C INSULATION SYSTEM

480 – 220Y / 127 VOLTS

CATALOGUE NO.	KVA	TAPS	RATED TAP	FRAME
V48M31T15A	15	+ 15 – 10	3	912
V48M31T30A	30	+ 15 – 10	3	912
V48M31T45A	45	+ 15 – 10	3	912
V48M31T75A	75	+ 15 – 10	3	915
V48M31T12A	112.5	+ 15 – 10	3	915
V48M31T49A	150	+ 15 – 10	3	916
V48M31T22A	225	+ 15 – 10	3	918
V48M31T33A	300	+ 15 – 10	3	918
V48M31T55A	500	+ 15 – 10	3	920

480 – 280Y / 120 VOLTS

CATALOGUE NO.	KVA	TAPS	RATED TAP	FRAME
V48M28T15B	15	+ 15 – 10	3	912
V48M28T30K	30	+ 15 – 10	3	912
V48M28T37K	37.5	+ 15 – 10	3	912
V48M28T45K	45	+ 15 – 10	3	912
V48M28T50J	50	+ 15 – 10	3	912
V48M28T75J	75	+ 15 – 10	3	915
V48M28T12H	112.5	+ 15 – 10	3	915
V48M28T49K	150	+ 15 – 10	3	916
V48M28T22L	225	+ 15 – 10	3	918
V48M28T33K	300	+ 15 – 10	3	918
V48M28T55G	500	+ 15 – 10	3	920
V48M28T77F	750	+ 15 – 10	3	920
V48M28T11G	1000	+ 3.5 – 3.5 **	2	N/A

380 – 220Y / 127 VOLTS

CATALOGUE NO.	KVA	TAPS	RATED TAP	FRAME
V38M31T15A	15	+ 15 – 10	3	912
V38M31T30A	30	+ 15 – 10	3	912
V38M31T45A	45	+ 15 – 10	3	912
V38M31T75A	75	+ 15 – 10	3	915
V38M31T12A	112.5	+ 15 – 10	3	915
V38M31T49A	150	+ 15 – 10	3	916
V38M31T22A	225	+ 15 – 10	3	918
V38M31T33A	300	+ 15 – 10	3	918
V38M31T55A	500	+ 15 – 10	3	920

480 – 280Y / 277 VOLTS

CATALOGUE NO.	KVA	TAPS	RATED TAP	FRAME
V48M47T15B	15	+ 15 – 10	3	912
V48M47T30N	30	+ 15 – 10	3	912
V48M47T45G	45	+ 15 – 10	3	912
V48M47T75F	75	+ 15 – 10	3	915
V48M47T12E	112.5	+ 15 – 10	3	915
V48M47T49F	150	+ 15 – 10	3	916
V48M47T22F	225	+ 15 – 10	3	918
V48M47T33E	300	+ 15 – 10	3	918
V48M47T55F	500	+ 15 – 10	3	920
V48M47T77A	750	+ 15 – 10	3	920

DRY TYPE TRANSFORMERS EPT Resin encapsulated

Features and Specifications

Suitable for indoor/outdoor mounting (600 volt class).

Can be mounted in any position indoors. Outdoors mount upright only.

Constructed in accordance with NEMA / ANSI and IEEE standards.

Totally enclosed – non – ventilated design permits installation in areas that contain dust, moisture or corrosive fumes.

As much as 40% smaller in cubic volume than equal kVA rating in other dry type designs.

Low sound levels permit installation in hospitals, hotels, schools, and libraries.

Large terminal compartment permits easier connections.

Immersion of core and coil in sand and resin provides rigid construction which means attenuates sound and will withstand short circuit stresses up to 25 times normal load current for two seconds.

15 kVA and below have terminal compartment on the bottom.

30-45 kVA have terminal compartment at top no knockouts.

Lifting holes are provided.

Flexible leads built into the unit for ease of making connections.

115°C rise - 185°C total insulation system.

With the above operating temperatures, EPT types can be used in hazardous areas in which contain substances with ignition temperatures more than 185°C.

Additional Features and Specifications for shielded isolation type.

1. Includes electrostatic shield with ground wire.
2. Suppress high-frequency signals from reaching sensitive electronic equipment.
3. Prevent electrical disturbances from being transmitted to load units.
4. Contribute to attenuation ratio of 100: 1 for suppression of common mode noise.



PACKAGE TRANSFORMER SUBSTATION

WESCOSA transformer substations are available with a wide range of capacities up to 1600 kVA with maximum system voltage 15 kV. The substations assembled as an integrated unit from sheet steel, built on heavy channel foundation frame to withstand the weight of its components.

The substation is divided into three compartments.

- A. MEDIUM VOLTAGE COMPARTMENT.**
 - B. TRANSFORMER COMPARTMENT.**
 - C. LOW VOLTAGE COMPARTMENT.**
-

A. MEDIUM VOLTAGE COMPARTMENT.

M.V. Compartment contains two load break switches and one automatic fused load break switch for transformer (RMU). It is available to mount min. oil or vacuum or SF6 load breakswitch.

B. TRANSFORMER COMPARTMENT

Transformer compartment is designed to enclose a 3-phase oil immersed naturally air-cooled transformer specially designed for substation. Transformer is connected to L.V. distribution board through copper bus bars. The necessary openings are provided, by which air entry is assured, so that temperature is kept to a minimum.

C. LOW VOLTAGE COMPARTMENT

L.V. compartment contain the L.V. distribution board. The incoming and outgoing feeders are available providing with either molded case circuit breakers or high rupturing capacity fuses. The incoming unit is equipped with voltmeter and selector switch, 3 ammeters with current transformers, signal lamps and space for optional K.W.H. meter.



Calibration Laboratory



Technology changes are rapidly increasing the numbers and types of electrical/electronic test and measurement tools that typically feature increasing level of sophistication with a growing list of functions and capabilities, all of which need to be calibrated to keep running in top form. With all of these changes and those yet to come you need a calibration service supported by best-in-class quality systems. In the kingdom, an excellent solution to help ensure that you always receive precise, reliable and fast calibration services is WESCOSA.

SUPERIOR QUALITY SYSTEM

WESCOSA is an ISO 9002 Certified Laboratory. Its quality system meets the exacting and stringent requirements of government and commercial agencies.

ISO 9002:1994
ISO 10012-1:1992 (E)
ISO/IEC Guide 25/17025
MIL-STD-45662A

CALIBRATION SERVICE CAPABILITIES

Calibration of your instrument are accomplished by comparison to standard maintained by WESCOSA calibration laboratory which has an ISO 9002 certification and using standards that are directly/indirectly traceable to the National Physical Laboratory (UK) and National Institute of Standards and Technology (U.S.) within the limitation of their laboratory services, or have been derived from accepted values of physical constants, or by the ratio type of self calibration techniques.

REPAIR

WESCOSA also offers repair services on your non-conforming test equipment whenever practicable.