Westinghouse Electric Corporation
Relay and Telecommunications Division
Coral Springs, FL 33065

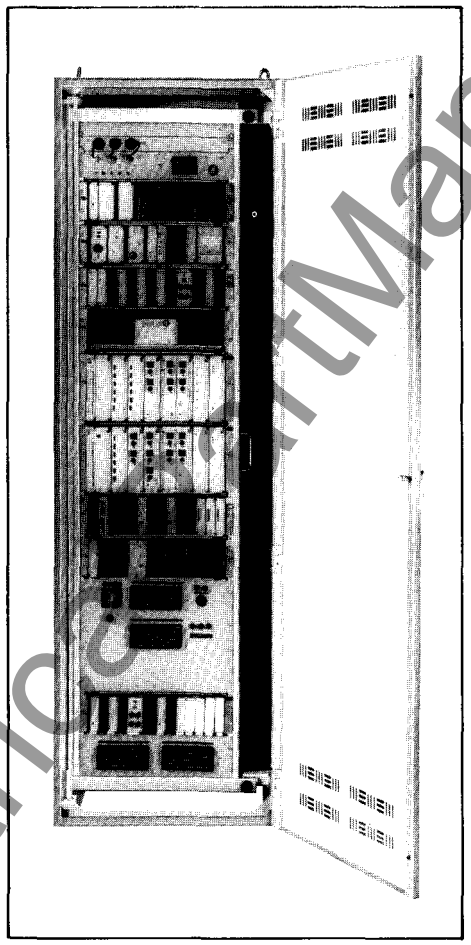
December, 1985
Supersedes 40-100 DWEA
dated September, 1975
Mailed to: E, D, C/40-000A, 40-000B, 40-000C

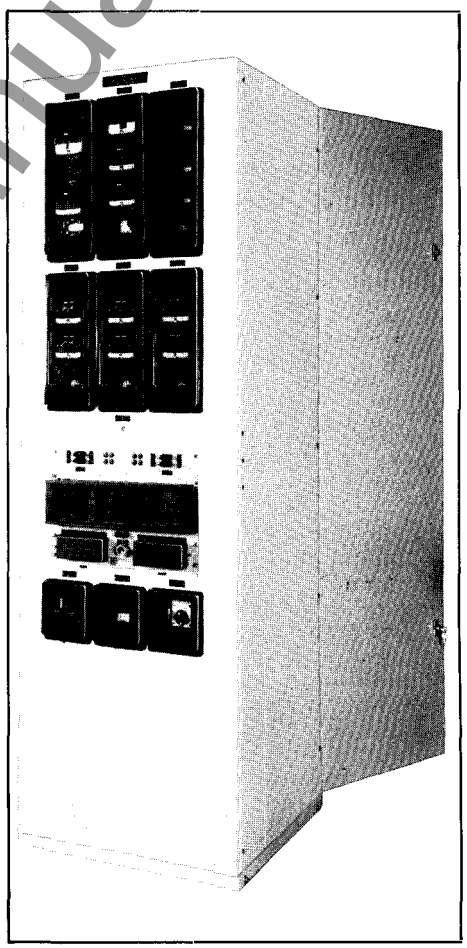
- Solid State
- Electromechanical
- Power Line Carrier Teleprotection
- Enclosures and Standards

Relay Systems

Introduction

The Relay and Telecommunications Division of Coral Springs, Florida, manufacturer of protective relaying since 1890 offers utilities and industry modern manufacturing facilities. Experienced engineers, skilled fabricators, assemblers, wiremen, and testers provide high quality, "tailor made", assembled and functionally tested electromechanical, solid state, and power line carrier teleprotection systems for control and protection of generating stations, power lines, and substations. Purchase of a completely wired and tested system gives single supplier system responsibility and warranty on all parts and workmanship. Also, single point contact is provided by a project engineer assigned to follow the system order during design, assembly, testing and shipment (the step-by-step process from receipt of order to shipment of equipment).





Relay Systems

Customer Order Engineering

Experienced project engineers review and implement customer specifications, to insure that information is available to prepare:

1. General assembly and floor plan similar to those shown in the enclosure section pages.
2. Bills of material.
3. AC-DC schematics.
4. Front and rear view layout drawings.
5. Terminal block layout drawings showing external equipment connections.
6. Wiring diagrams.

If requested, items 1 through 5 above are submitted to the customer for review and approval.

In addition, the project engineer reviews approved drawings, follows the assembly, and functional testing of the equipment, and approves the shipment of the equipment.

To further insure compliance to the customer specifications and allow smooth and efficient processing of an order, complete information should be supplied with an order. The information required is:

- Single line AC diagram showing phase rotation, frequency, CT and PT ratios and connections.
- Panel layout preference (sketch).
- If match-up is required the following information should be supplied:
  - Detailed construction drawing.
  - Dimensioned panel layout.
  - Panel finish – sample chip is preferred; however, supplier and supplier's identification should be furnished as a very minimum.
  - Schematics and wiring diagrams for coordination.
- Type panel – see section on "enclosures" page 12.
- Panel finish if non-standard (standard is ANSI 61 light gray, munsel notation 8.3G6.10/0.84 gloss 20).
- Customer cable entrance (top or bottom).
- Relay ranges and/or style numbers.
- Instrument ranges and scale markings.
- DC control voltage.
- Breaker and motor operated disconnect switch control schemes.
- Frequencies of channel equipment.
- Shipping limitations.
- Desired nameplate wording.
- Type nameplate if non-standard (black micarta with white lettering is standard).
- Mimic bus layout sketch including colors and whether plastic or anodized aluminum.

To assist in supplying this information Westinghouse has the following forms available for customer use:

Form Number PDL 40-100
Electromechanical Systems Relay-Instrument Switchboards Information Required with Order.

Form Number NK 1587-1
Uniflex Solid State Relay Systems Information Checklist.

Typical Panel Layout

In addition, the following general layout as well as suggested component spacing and typical layouts are offered to assist customers in preparing layout sketches which make maximum use of panel space, conserve floor space, and provide ease and efficiency of operation.

General Rules

The following rules of thumb for component location are offered for consideration:

Control and Metering Panels

- Annunciators and/or meters – top quarter of the panels.
- Recorders – second quarter of panel.
- Switches, indicating lights, and mimic bus – mid third of panel.
- Protective relays – bottom quarter of panel.
- FT test switches – bottom of panel.

Protection Panels

- Transformer and/or bus differential relays – top third of panel.
- Distance and/or line protection relays – mid third of panel.
- Time overcurrent relays – bottom third of panel.

Solid State Panels

- Power supplies (where required) – top of panel.
- Power line carrier or audio tone equipment – top third of panel.
- Solid state relays – mid third of panel.
- Test panels and indicating lights – mid third of panel.
- Optional relays such as high set overcurrent and out of step blinder relays – bottom third of panel.

Power Line Carrier Teleprotection Panels

- Power supplies (if any) – at top.
- On-off carrier equipment – top quarter of panel in descending order by frequency.
- Frequency shift carrier transmitters second quarter of panel in descending order by frequency.
- Frequency shift receivers – second quarter of panel in descending order by frequency.

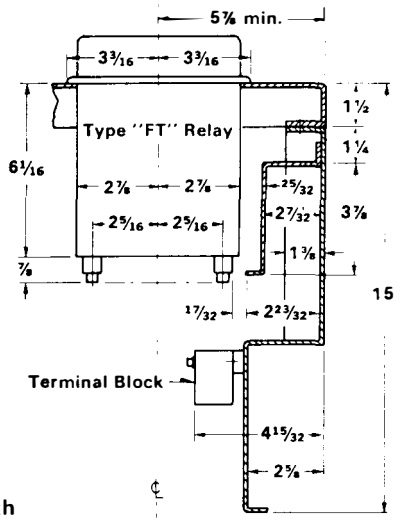
Component Spacing

Spacing which allows satisfactory clearances between components are shown in the following pages 3, 4, 5, 6.

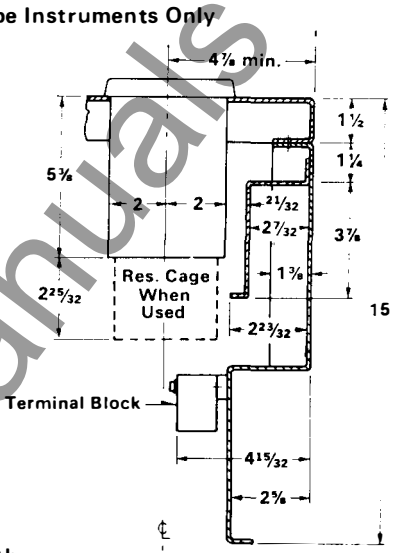
Relay Systems

Stationary Panel Horizontal Distances in Inches Between Relays and Instruments

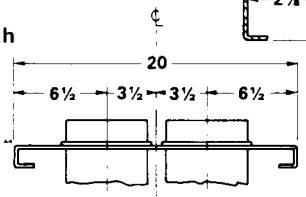
FT Relays And 6½ Inch Type Instruments

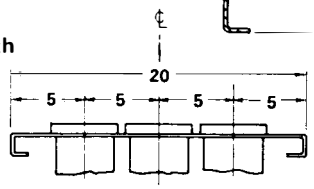


4½ Inch Type Instruments Only

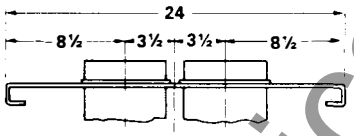


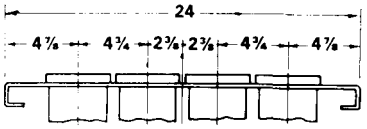
20 Inch Width



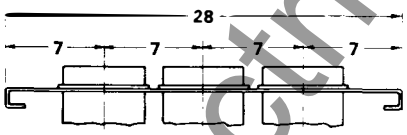


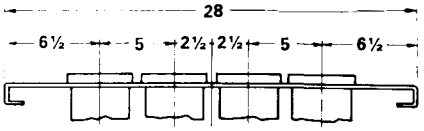
24 Inch Width



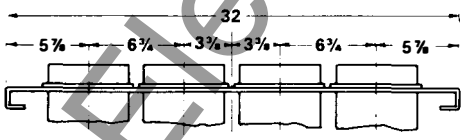


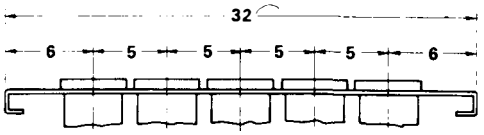
28 Inch Width



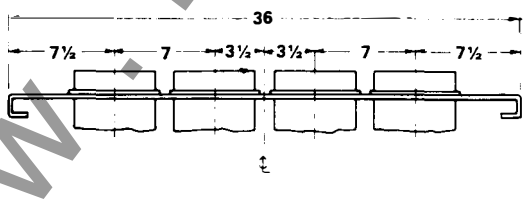


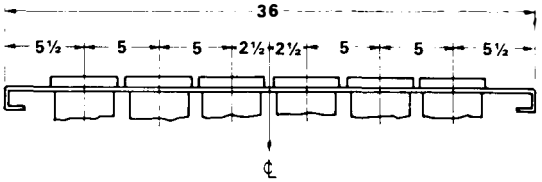
32 Inch Width





36 Inch Width

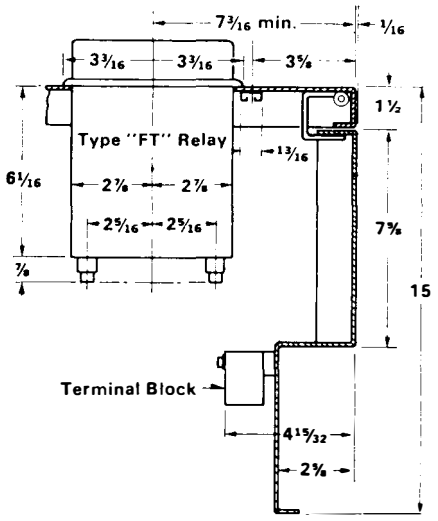




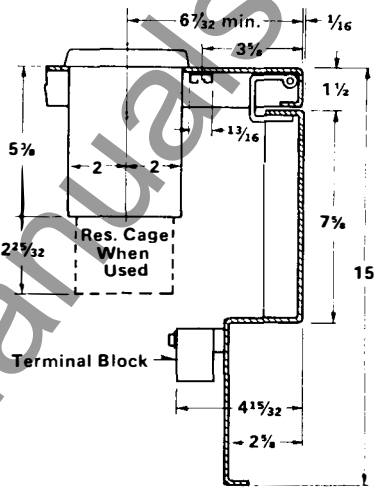
Relay Systems

Hinged Panel Horizontal Distances in Inches Between Relays and Instruments

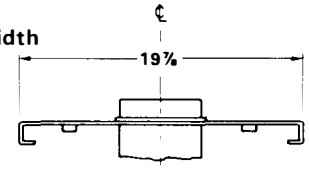
FT Relays And 6½ Inch Type Instruments



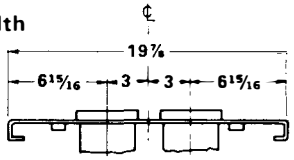
4½ Inch Type Instruments Only



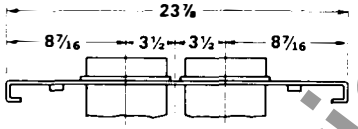
19⅞ Inch Width



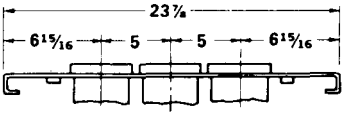
19⅞ Inch Width



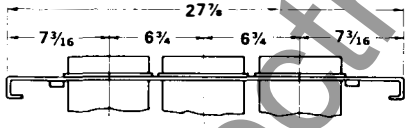
23⅞ Inch Width



23⅞ Inch Width



27⅞ Inch Width



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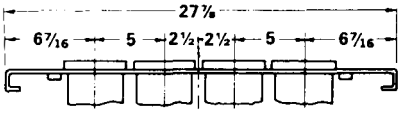
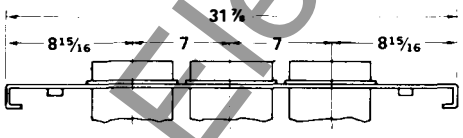


31⅞ Inch Width



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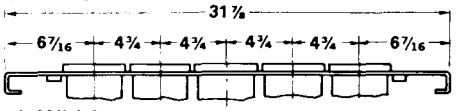

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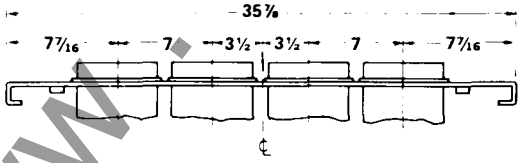

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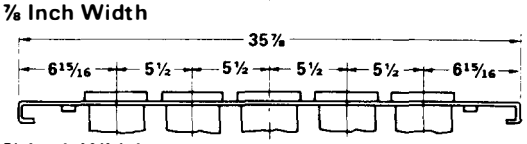

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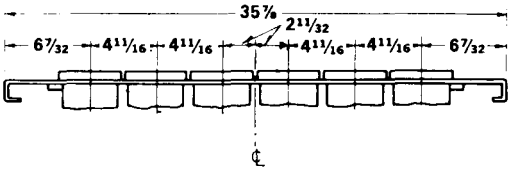
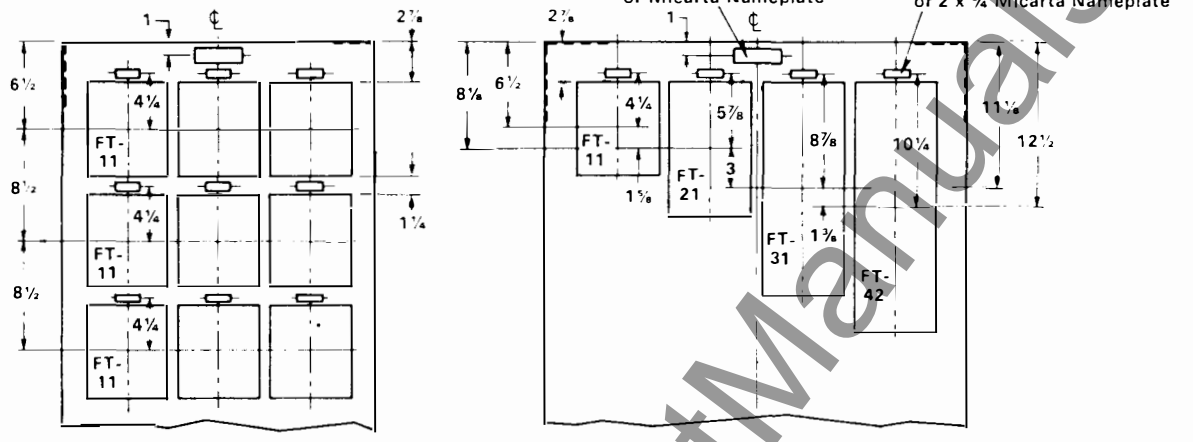


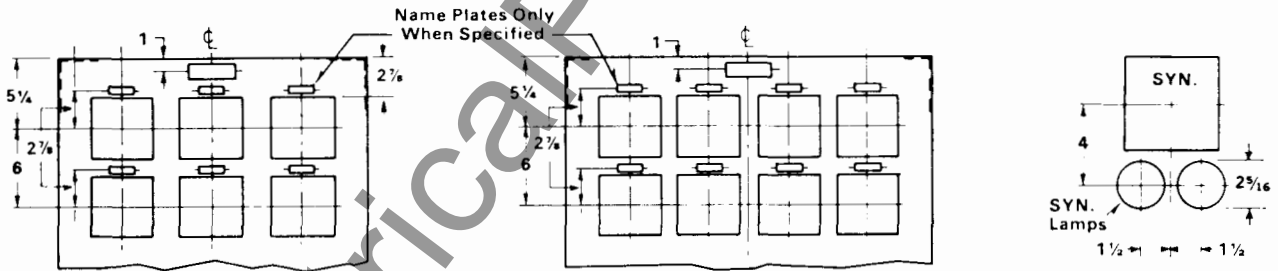
Relay Systems

Vertical Distances in Inches Between Relays and Instruments

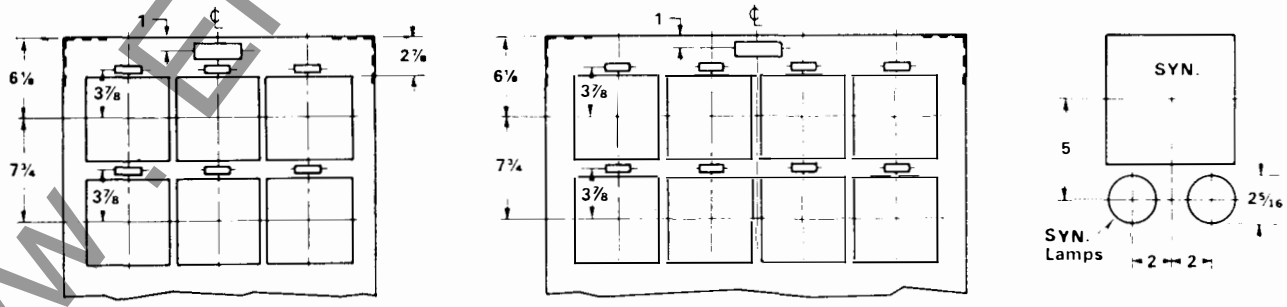
Relays (1¼" Space Between)



Instruments (4½ Inch Type)

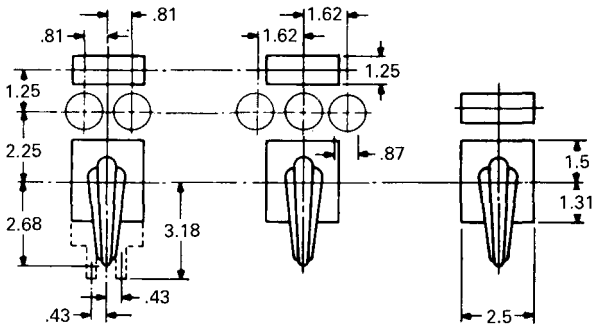


Instruments (6½ Inch Type)



Relay Systems

Standard Arrangement of Type W Switch With Rectangular Indication Lamp



- Minimum horizontal distance between control switches with pistol grip handle – 5.5 inches.
- Minimum horizontal distance between instrument switches with round notched handle – 3 inches.
- Minimum vertical distance between switches with lamps – 7.5 inches.
- Minimum vertical distance between switches without lamps – 5.5 inches.
- Minimum horizontal distance between control switches with pistol grip and instrument switches with round handle – 3.5 inches.

Typical Arrangement of Type W-2 Switch With Type EZC Indicating Lamps

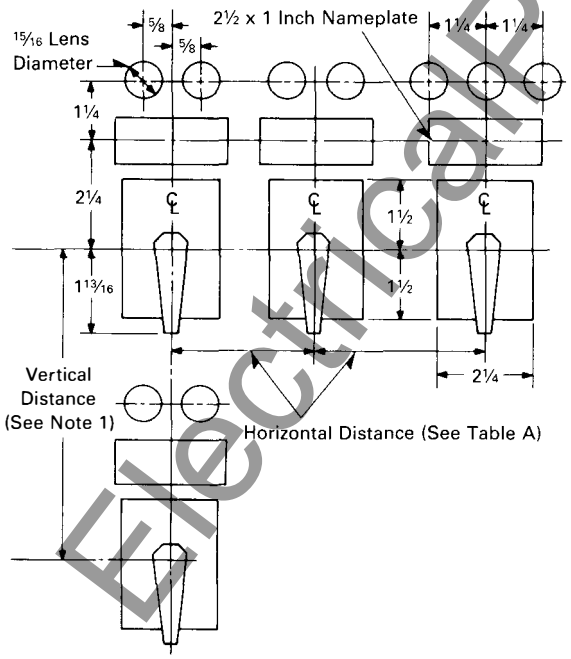


Table A

Switch Contact Frame Size	Number of Lamps Above Each Switch		Horizontal Distance
	Sw. 1	Sw. 2	
6	0	0	3
12	0	0	5½
6	2	2	3
12	2	2	5½
6	3	3	4¼
12	3	3	5½
6	2	3	3-5⅝
12	2	3	5½

Note 1
Vertical Distance Between Switches
With Lamps and Nameplate – 7 Inches
Without Lamps/With Nameplate – 5½ Inches
Without Lamps or Nameplate – 5½ Inches

Relay Systems

Assembly and Wiring

Assembly
After careful verification of specifications and style numbers, the components are mounted on the panels in accordance with customer approved lay-out drawings. Auxiliary devices are normally mounted in the rear of the structure using universal mounting brackets and/or hinged rear auxiliary equipment panels with consideration being given to allowing free access to the back of the front panel components.

Wiring
Following assembly of the components in the panel, experienced wiremen make point-to-point connections according to the system wiring diagrams following standard practices which result in neat appearing serviceable panels which feature:

Top or Bottom Cable Entrances — Raceways for housing and protecting the purchaser's incoming leads are suitable for either top or bottom cable entrances, or both.

Incoming and Outgoing Leads — Connections are made to terminal blocks which are identified on the connection diagram. Terminal blocks are mounted vertically on both sides of the panel to minimize the length of wire runs.

Crimp Type Connections — Insulated crimp (ring type, vinyl, self insulated with insulation grip) type terminals and connections are standard and assure the best of electrical and mechanical connections.

Readily Accessible Internal Wiring — Internal wiring is routed through readily accessible channels with snap-on covers. Exposed wire bundles which require plastic wire ties are nearly eliminated and field changes can be made without disturbing the appearance or continuity of the internal wiring.

Easy Unit-to-Unit Wiring — Wiring trays are provided at the top for front-to-back panel and unit-to-unit wiring. These eliminate difficult threading of wire through restricted raceways and simplify factory wiring and field changes.

Except where otherwise specified by the customer or physically impractical, standard barrier type molded nylon terminal blocks, crimp type insulated ring lugs and the following types and sizes of wire are used for the systems shown in the table above:

Type System	Wire Size	No. of Strands	Dia. of Strand	Type Insulation	Description	Color	Where Used
Electro-mechanical	#14	41	0.010	SIS	Cross Linked Polyethylene	Gray	All Circuits
Solid State	#14	65	0.010	SIS	Cross Linked Polyethylene	Gray	Current Circuits
	#16	19	0.010	PVC	Polyvinyl Chloride	Black	AC supply, potential, trip and breaker failure circuits.
	#20	7	0.0126	PVC	Polyvinyl Chloride	Black	Remainder Harness Wiring
	#22	7	0.010	PVC	Polyvinyl Chloride	Black	Back-Plane Wiring
Power Line Carrier Teleprotection	#16	19	0.010	PVC	Polyvinyl Chloride	Black	Trip Circuits
	#20	7	0.0126	PVC	Polyvinyl Chloride	Black	Control Circuits

System Test and Verification

In order to ensure that a relay system has been built in agreement with its bill of material and functions in conformance to its related system schematic diagram, the following tests and verifications are performed:

Material Check: All system items are verified against the bill of material as to style number and ratings.

Dielectric Test: In conformance to ANSI-37.90 a dielectric test of 1500V 60HZ for one minute (or equivalent 1800V 60HZ for one second) is applied to all system wiring.

System Functional Test: Connections are made to incoming and outgoing terminal blocks, simulating customer connections. The energized system is then functionally tested to verify its system function in its normal operational mode. Test features of a system are verified by further testing with the system in its test mode.

Continuity Checks: A circuit continuity check is performed on all circuits not verifiable by functional testing. When units are built to customer furnished wiring drawings a 100% continuity check is performed in lieu of functional testing.

Shipping Preparation: All systems and system components are properly prepared for shipment as per established guidelines.

Packaging for Shipment

Domestic Packaging for Relay Systems
The units are wrapped in 10 mil thick polyethylene plastic and mounted on wooden skids. Skids are constructed of lengthwise wooden runners of various widths up to 10 inches depending upon the type of unit. Construction of skids allows a maximum clearance of 2.25 inches for fork lift blades. The deck of the skid is made from 0.75 inch plywood. Units are bolted down through the runners in the base skid with carriage bolts.

Optional Domestic Packaging
As an option, domestically packed units can be enclosed by a slotted crate using 1-inch by 4-inch slats set 1-inch apart. In this case a protective ethafoam collar is placed around the top portion of the unit separating the crate and unit. Lifting lugs are also supplied on the unit which protrude through the top plywood cover of the crate for easy handling by a crane.

Export Packaging for Relay Systems
For overseas shipments, the domestically packed units are completely encased in ⅜ exterior grade plywood framed with 1-inch by 4-inch wood. In addition, the inside walls and top of the crate are lined with water barrier asphaltic paper.

Relay Systems

Final Drawings

Upon completion of the functional testing, final "as shipped", drawings (consisting of all of the approval drawings except the terminal block layouts) and system instruction books (3 ring binder plastic covered type) are supplied. The internal wiring diagrams include any changes that result during functional test. Unless otherwise specified by the customer, quantities, types, and sizes of final drawings and instruction books are supplied for each order.

Description	Quantity	Size (see below)
General Assembly & Floor Plan	Up to 6 paper prints which can be reproduced on readily available copiers.	A
Bill of Material	Up to 6 copies of paper prints which can be reproduced on readily available copiers.	A
AC and DC Schematics	1 Diazo-mylar or up to 6 paper prints.	B, C, D or F
Front and Rear Layout Drawings	1 Diazo-mylar or up to 6 paper prints.	B, C, or D
Electro-Mech Sector	1 Diazo-mylar or up to 6 paper prints.	F
Uniflex Solid State Wiring Diagram Layout	Diazo-mylar or up to 6 paper prints.	C or D
Uniflex Solid State Computer Wiring Diag. List	Up to 6 paper prints	A
Solid State Wiring Diagram Layout	Diazo-mylar or up to 6 paper prints.	C
Solid State Computer Wiring List	Up to 6 copies.	A
System Instruction Books	Up to 6 copies.	A

Drawing Sizes

Size	Dimensions (Inches)
A	8.5 by 11
B	11 by 17
C	17 by 22
D	22 by 34
F	28 by 40

The following typical terminal block layouts and final internal wiring diagrams illustrate the standard drawing formats which are used: Refer to Figs. 1, 2, 3, 4, 5 and 6.

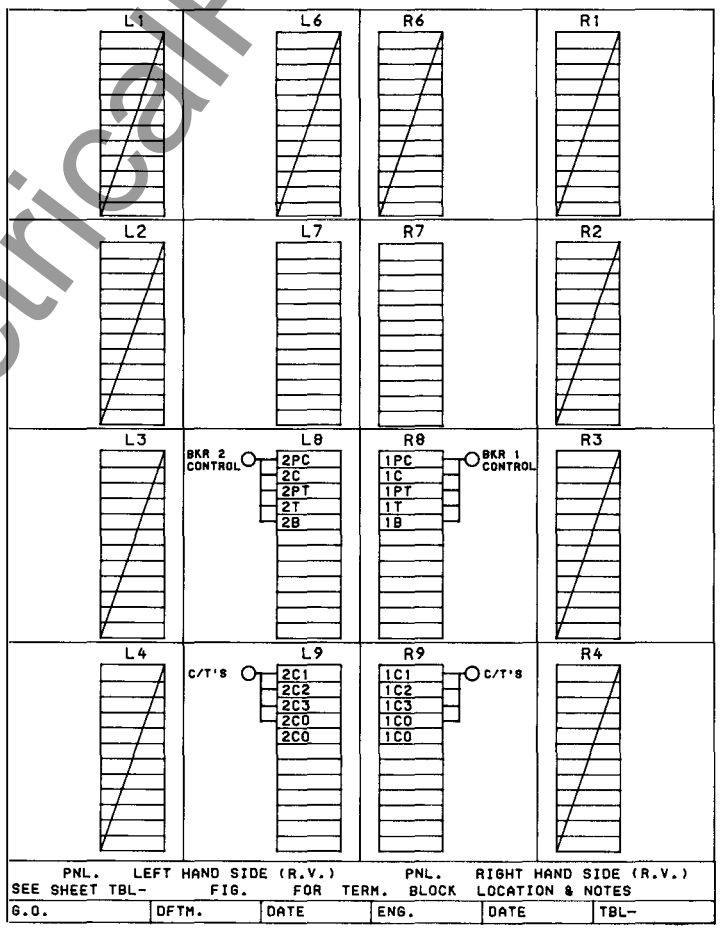


Figure 1 Terminal Block Layouts

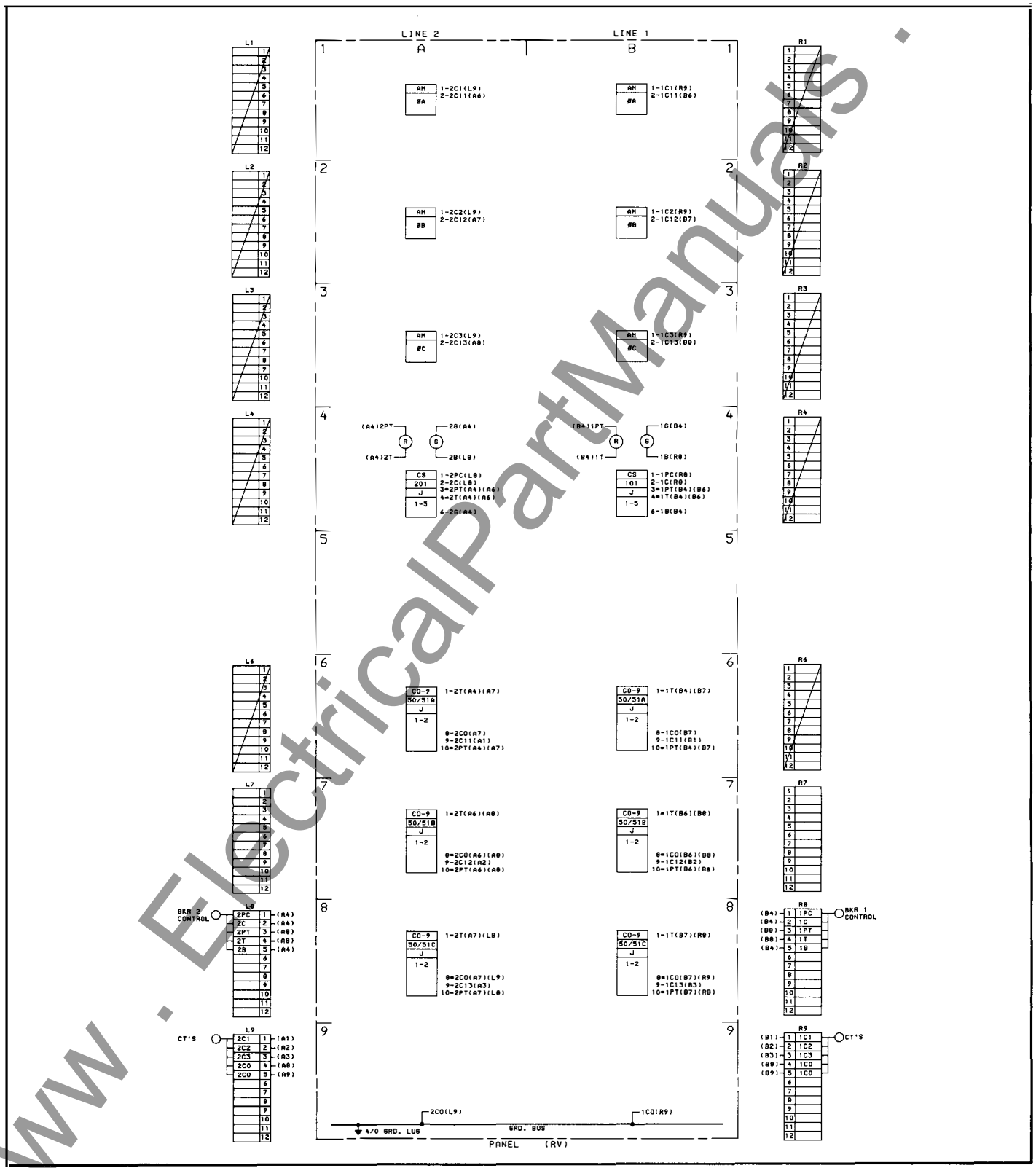


Figure 2 Electro-Mech Sector Wiring Diagram

Relay Systems

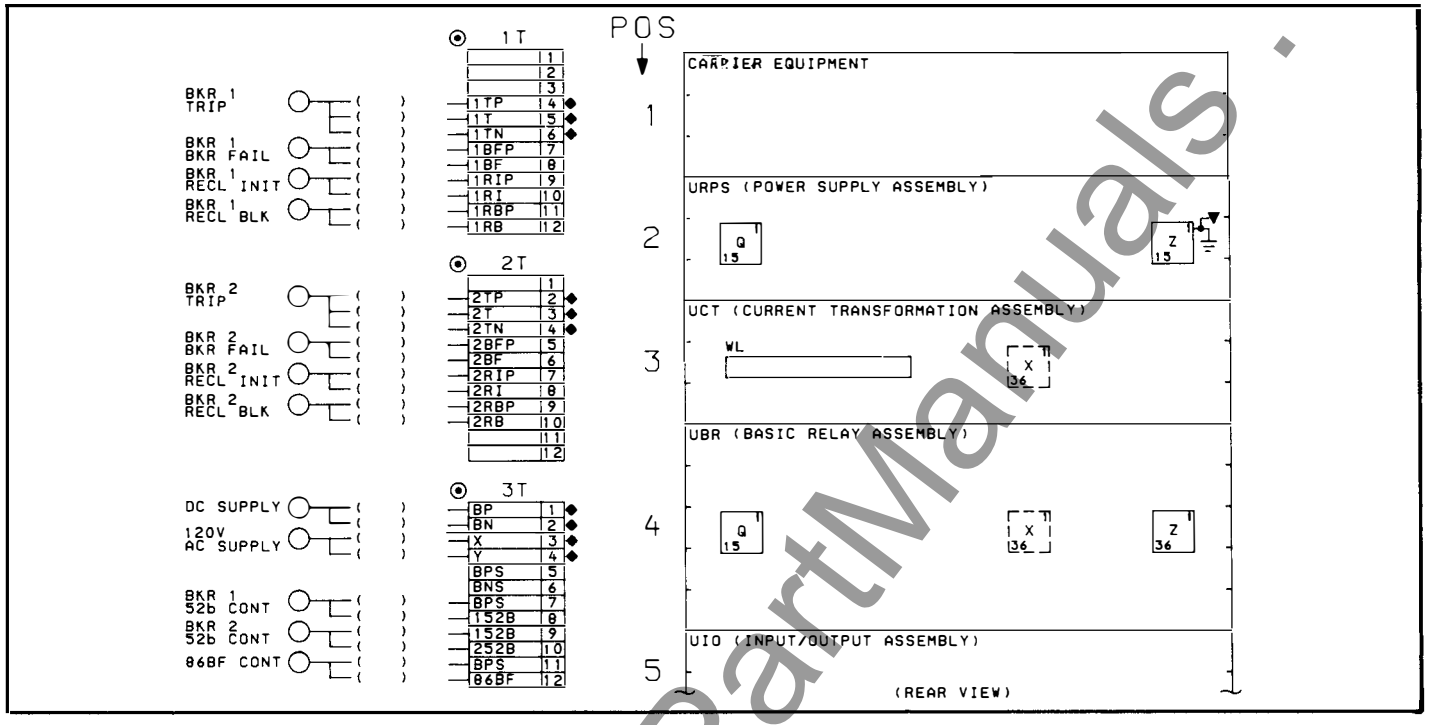


Figure 3 Uniflex Wiring Diagram Layout

WESTINGHOUSE ELECTRIC CORP. CUSTOMER:
R&T DIV. CORAL SPRINGS FL.

UNIFLEX WIRING SYSTEM UNIT NO.1

FROM CAB. POS.	FROM DEV. CON.	FROM PIN NO.	TO CAB. POS.	TO DEV. CON.	TO PIN NO.	SIGNAL NAME	GAUGE
4	Z	2	5	Z	2	COMD	20
4	Z	2	2	Z	2	COMD	20
4	Z	3	5	Z	3	+13VD	20
4	Z	3	2	Z	3	+13VD	20
4	Z	11	5	Y	20	21S	20
4	Z	14	5	Z	14	OARM	20
4	Z	15	5	Z	15	GARM	20
4	Z	16	5	Z	16	BPT	20
4	Z	17	5	Z	17	PT	20
4	Z	18	5	Z	18	RCVR	20
4	Z	19	5	Z	19	START	20

GO: SO: ENG: DFT: DATE: UNIT: 1 TYP.WR: CAB HAR SH.NO: CWL01 SUB: 1

Figure 4 "Uniflex" Computer Wiring List

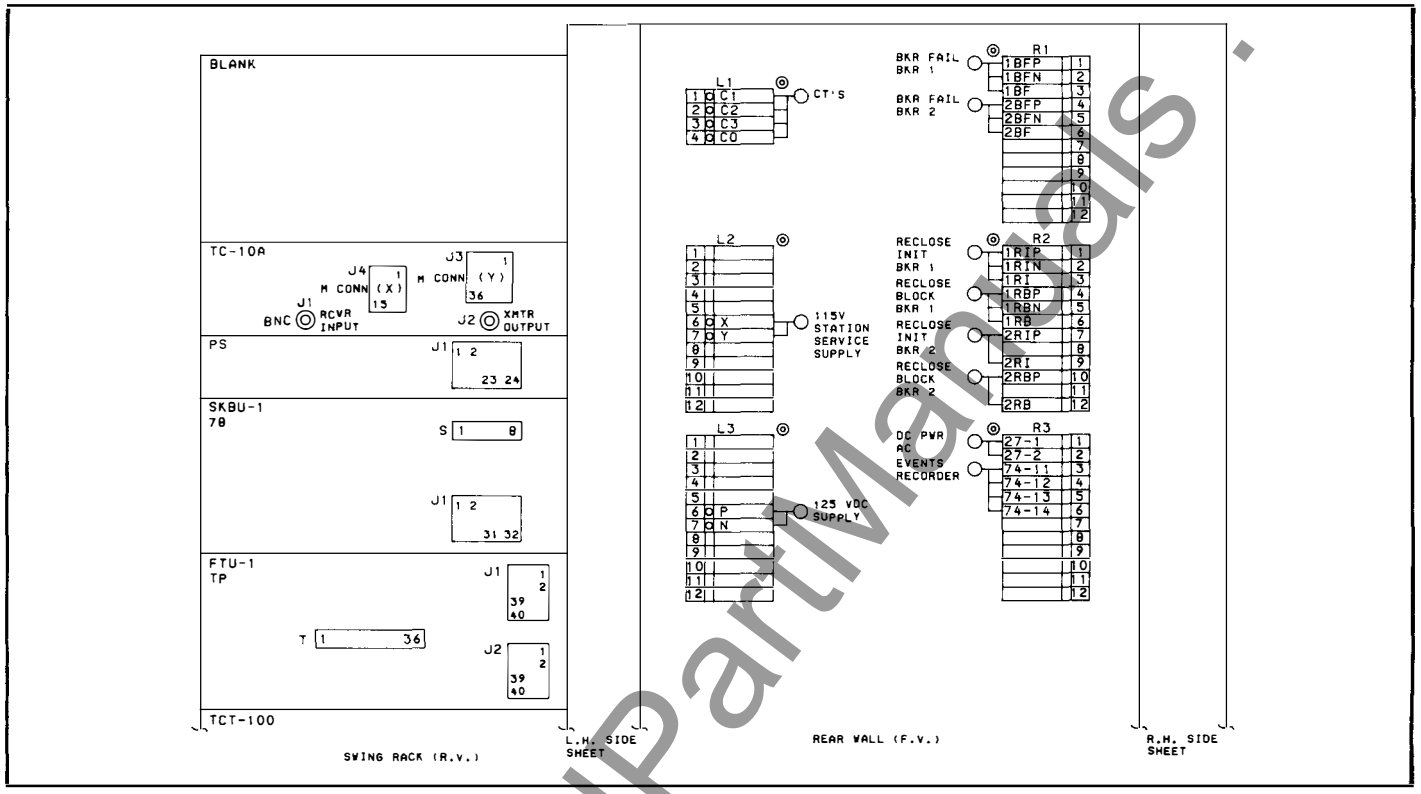


Figure 5 Solid State Wiring Diagram Layout

WESTINGHOUSE ELECTRIC CORP. R&T DIV. CORAL SPRINGS, FL.

COMPUTER WIRING DIAGRAM

FROM DEVICE	FROM TERM	TO DEVICE	TO TERM	SZ	NT
R1	1	95J1	9	20	
	2	TPJ1	12	20	
	3	TPJ1	11	20	
	4	95J1	11	20	
	5	TPJ1	15	20	
	6	TPJ1	14	20	
R2	1	95J1	17	20	
	2	TPJ1	18	20	
	3	TPJ1	17	20	
	4	95J1	25	20	
	5	TPJ1	21	20	
	6	TPJ1	20	20	
	7	95J1	19	20	
	9	TPJ1	23	20	
	10	95J1	27	20	
	12	TPJ1	26	20	
R3	1	95J2	31	20	
	2	95J2	32	20	
	3	95J1	5	20	
TC10J2	J2 R6		1	C	
	J2 R6		2	C	SH
TC10J3	3	PSJ1	5	20	

FROM DEVICE	FROM TERM	TO DEVICE	TO TERM	SZ	NT
TC10J3	4	PSJ1	2	20	
	11	78J1	25	20	
	21	R5	8	20	
	22	R5	9	20	
	23	R5	10	20	
	24	R5	11	20	
	25	95J2	30	20	
	26	R5	4	20	
	30	78J1	7	20	
	31	95J2	25	20	
	33	R5	2	20	
	34	R5	1	20	
TPJ1	4	L2	6	20	
	5	L2	7	20	
	6	L4	5	20	
	7	L5	5	20	
	9	78J1	13	20	
	10	78J1	14	20	
	11	R1	3	20	
	12	R1	2	20	
	14	R1	6	20	
	15	R1	5	20	
	17	R2	3	20	
	18	R2	2	20	
	20	R2	6	20	
	21	R2	5	20	
	23	R2	9	20	

ENGR: DRFT: DATE WDLO: GEN. ORDER: UNIT: 601 SUB: 1 SHEET NO. CWA003

Figure 6 Solid State Computer Wiring List

Relay Systems

Enclosures

A wide variety of enclosures for both indoor and outdoor use are available to provide suitable housing for electro-mechanical, solid state and carrier teleprotection systems, as well as meeting the customer needs where plant or substation space is at a premium. While special structures can be made available, the following standard enclosures are designed to meet (proposed) ANSI C37.21 — (previously designated ANSI C37.20.4).

Type	Description	Application	Page No.
Indoor			
VL	Vertical Open Switchboard	Electromechanical	14
ED	Enclosed Switchboard	Electromechanical	15
DU	Dual Switchboard	Electromechanical	16
DX	Duplex Switchboard	Electromechanical	17
VU	Open Rack Cabinet	Solid State	18
VU-F	Open Rack Cabinet	Solid State and Electromechanical	18
SU-2	Swing Rack Cabinet	Solid State	19
UF	Open Rack Cabinet	Uniflex Solid State	20
UFF	Fixed Rack Cabinet	Uniflex Solid State	21
UFS	Swing Rack Cabinet	Uniflex Solid State	22
OR	84" & 90" Open Rack	Teleprotection	23
OR-S	84" & 90" Self Supporting Open Rack	Teleprotection	23
SU-2A	72" & 90" Swing Rack Cabinet	Teleprotection	24
SU-2F	Fixed Rack with Front & Rear Doors	Solid State & Teleprotection	25
SU-2B	72" & 90" Swing Rack Cabinet	Teleprotection	26
Outdoor			
WP	Weatherproof Swing Rack Cabinet	Electromechanical and Teleprotection	27

Enclosure Standards

All enclosures are manufactured in accordance with the following standards:

- Panels are constructed from highest quality, hot rolled, pickled and oiled sheet steel equal to ANSI-C1010.
- Panel fronts use #11 USS Gauge.
- Side sheets and top members use #13 gauge steel.
- Inside radius of bends is ⅛ inch.
- Bolted together panels edges exposed to view shall not exceed 1/32 inch.
- Flat surfaces on the plane of the panel shall not deviate by more than ⅛ inch.
- Stiffeners are used to prevent warping.
- Heavy components are adequately supported.
- Vents or louvers are used where required. In outdoor equipment filters are used to prevent entrance of insects, rodents, or dust.
- End panels are removable to enable adding future panels.
- Fully concealed type hinges are used on doors.
- Allowable swing of door is at least 105 degrees.
- Stops are provided to prevent damage to hinges or adjacent equipment.
- Clearances shall be uniform and shall not exceed ⅛ inch between edges of doors and adjacent panels.
- Doors for modular type panels have upper and lower latches and "T" type moldarta handles. Swing or fixed rack type and outdoor cabinets use single latch, pistol grip handles. Optional locks are available on the pistol grip type handles.
- Swing racks or panels have a minimum swing-out of 120° allowing easy accessibility to the rear of same.
- All steel parts are degreased, steam-rinsed, phosphatized, steam-rinsed, prime coat painted with epoxy primer, air dried 2 hours and then the finish coats are applied (5 minute flash periods are allowed between final coats). Color of indoor panels is ANSI 61 light gray air dry lacquer (Munsel notation 8.3G 6.10/0.84 gloss 20) whereas outdoor finish is ANSI 70 (Munsel notation 5BH 70/04 gloss 45-65). Other air dry lacquer colors may be supplied and white air-dry lacquer interiors are available as options.

Electromechanical Enclosures

The electromechanical enclosures Type VL, ED, DU and DX feature:

Modular Design
The modular component, or building-block, concept allows the use of standardized basic assemblies, permits easy future expansion, and assures shorter delivery time and low installation cost.

Modern Styling
The attractive, modern styling of the instruments, relays, watthour meters, and the other components contribute to a pleasing overall switchboard appearance and legibility.

Easy Accessibility and Maintenance
Ready accessibility for inspection or maintenance is provided by the self-contained (with integral terminal blocks for outgoing leads) basic panel which serves as the foundation for all Westinghouse relay-instrument switchboards.

Flexibility
Bolted construction features captive floating nuts which contribute to the flexibility of the modular design.

Top or Bottom Cable Entrance
Raceways for housing and protecting the purchaser's incoming leads are suitable for either top or bottom cable entrances, or both. Mounting arrangements for a total of eighteen 12-point terminal blocks per panel are provided in two vertical rows, nine on each side of the basic panel assembly.

Universal Mounting Brackets
Auxiliary devices may be stationary mounted on universal mounting brackets where such manner of mounting does not hinder accessibility to the rear of the front mounted panel components. These brackets can be installed at the factory or in the field without additional drilling.

Flush Trims
End trims are flush with the edge of the panels, and do not add any additional length to the switchboard.

Unobstructed Duplex Walkways
The self-contained design of the basic panel assembly results in clear and unobstructed walkways in the duplex switchboard type. The walkway doors are equipped with handles for opening from the interior.

Shadowless Duplex Section Lighting
A 20-watt fluorescent light is provided in each duplex section from front to back. This gives shadowless lighting for inspection and maintenance.

Relay Systems

Basic Panel Assembly
The nucleus of the four types as standardized by the National Electrical Manufacturers Association, of Westinghouse relay-instrument switchboards is the "basic panel assembly" (with appropriate instruments, relays, etc.)

The basic panel assembly, a self-contained unit with factory wiring complete to conveniently located terminal blocks for the purchaser's incoming leads, is augmented by bolted-on steel components such as floor channels, top sheets, end trims, rear enclosures and wiring trays to form the four designs.

It consists of a 1½ inch deep panel, formed from ⅛ inch thick sheet steel. It may be fixed or hinged, as required.

Vertical side members, which include vertical raceways for factory wiring, are bolted to the right and left sides of the basic panel. These side members also provide separate raceways to house, protect, and conceal the purchaser's incoming leads.

Provision for mounting terminal blocks to receive factory wiring and incoming leads is also provided in the basic assembly.

Hinged rear auxiliary equipment panels are provided on the rear of the assembly as required. These are approximately 24 inches high and are used in combinations of 1, 2, or 3 on a single panel assembly according to the size, location and amount of auxiliary equipment to be accommodated. When opened, the hinged rear panels allow free access to the back of the front panel components.

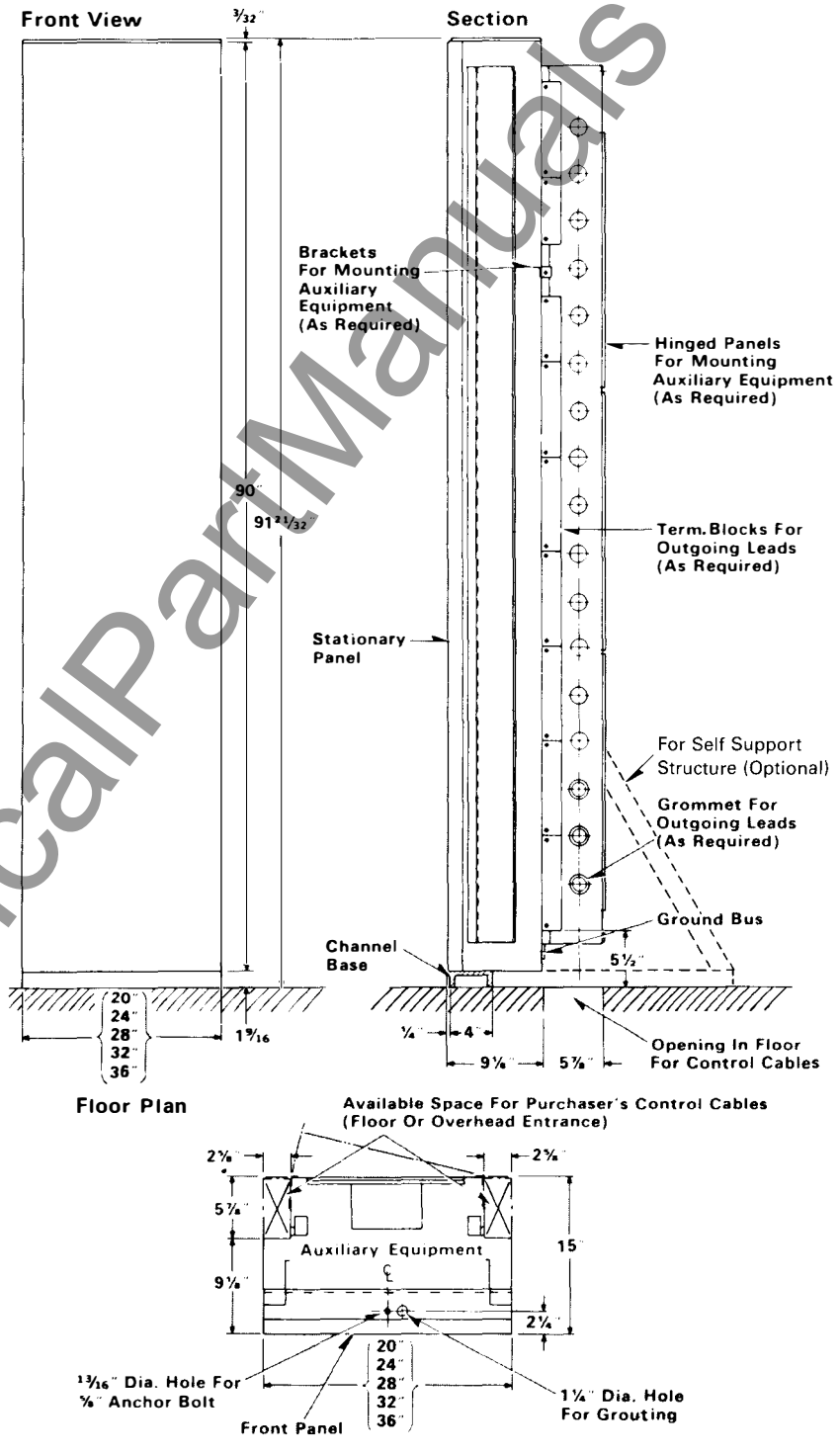
The assembly is 90 inches high and 15 inches deep. Widths are 20, 24, 28, 32 and 36 inches.

The basic panels are interchangeable on all of the four types of switchboards.

Blank panels reserved for future circuits may be replaced with factory-wired panels complete to self-contained terminal blocks. Coiled up leads, which previously necessitated forming of connections to terminal blocks in the field, have been eliminated.

Because of the bolted construction, vertical switchboard panels (basic panels with end trims) can be converted to an enclosed switchboard, dual switchboard, or duplex switchboard by the addition of the proper bolted steelwork.

Basic Panel Assembly Dimensions In Inches



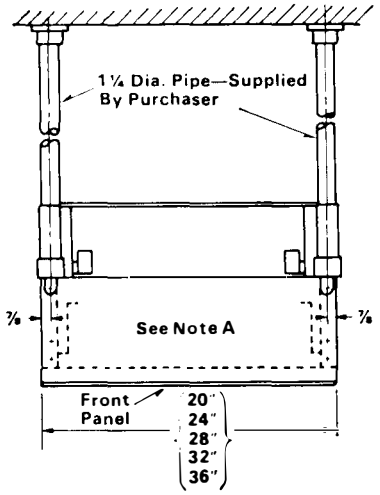
Relay Systems

Vertical Switchboard, Type VL

The Westinghouse vertical switchboard consists of basic panel assemblies, and necessary bolted-on floor channels, end trims, top trims, and support brackets.

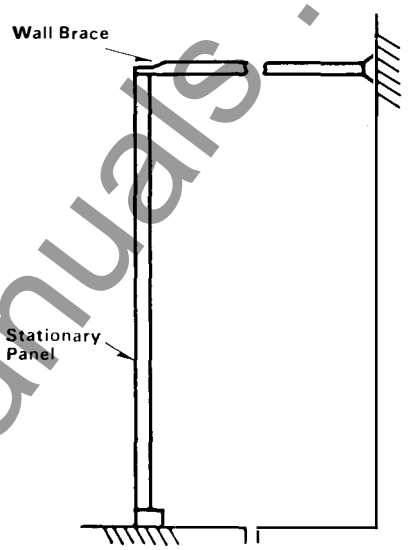
Overall depth of the assembly is 15 inches.

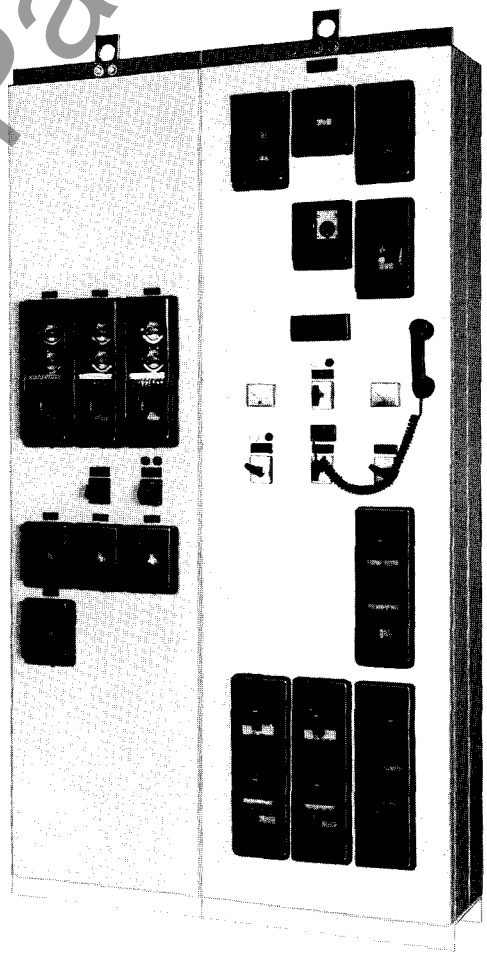
Typical Unit Plan View



Note A: See dimension drawing on page 13 for basic panel assembly.

Vertical Switchboard — A control switchboard composed only of vertical panels.





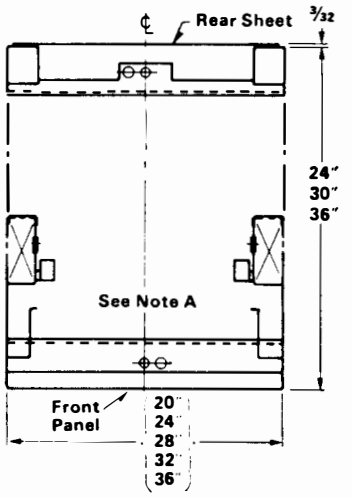
Relay Systems

Enclosed Switchboard, Type ED

The Westinghouse enclosed switchboard consists of basic panel assemblies, and necessary bolted-on floor channels, top sheet, and rear enclosure covering the back and ends of the entire structure. Access to the enclosure is provided by bolted-on removable covers. Hinged flat rear doors are optional.

Standard depths are 24, 30, and 36 inches.

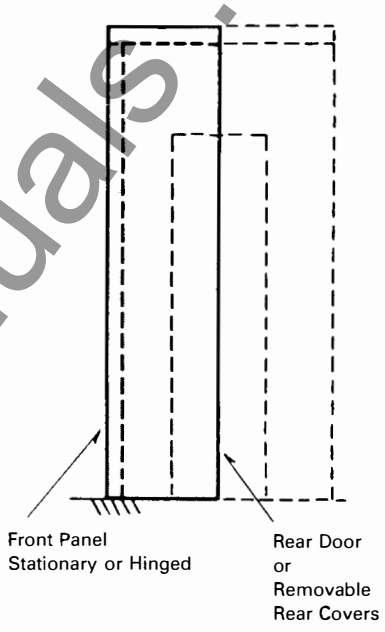
Typical Unit Plan View

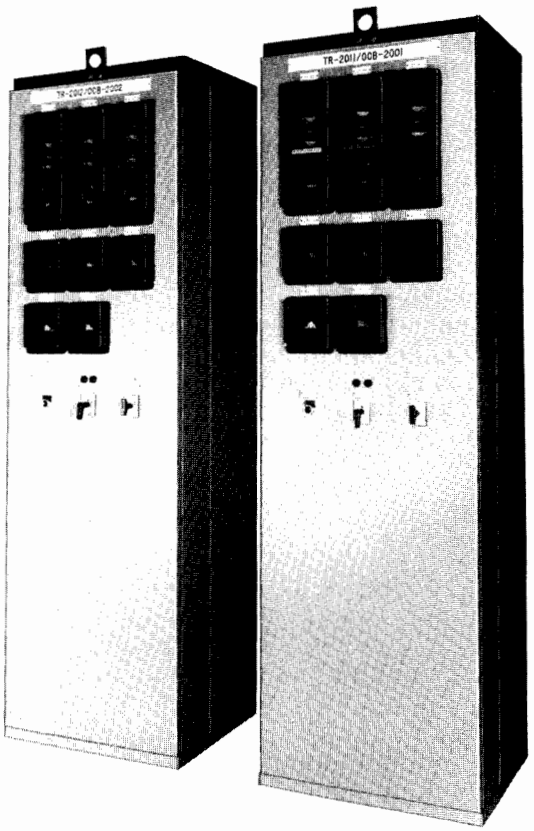


Note A: See dimension drawing on page 13 for basic panel assembly.

Enclosed Switchboard — A dead-front switchboard that has an overall sheet metal enclosure (not grille) covering back, top, and ends of the entire assembly.

Note: Access to the interior of the enclosure is usually provided by doors or removable covers.





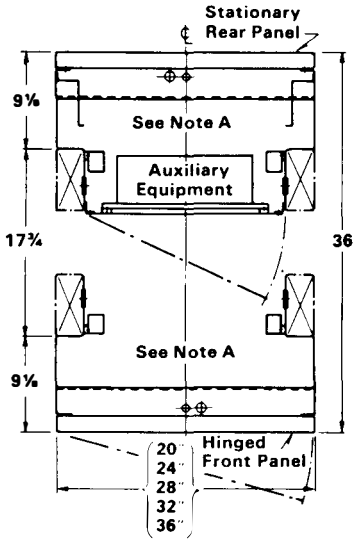
Relay Systems

Dual Switchboard, Type DU

The Westinghouse dual switchboard is a structure with front and rear basic panel assemblies (with front *or* rear hinged panels) placed back-to-back and augmented by bolted-on floor channels, top sheet, wiring trays, and end trims.

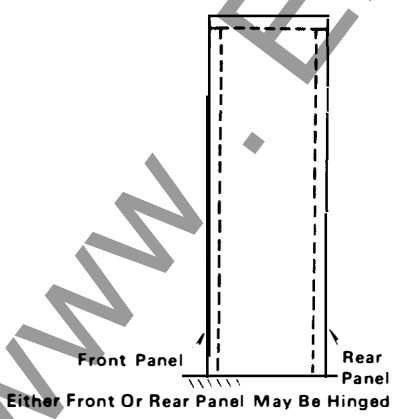
Standard recommended depth is 36 inches. However, a 30-inch depth is available for installations where space will not permit the 36 inches. Space limitations with the 30 inch depth panel do not permit use of vertical raceways.

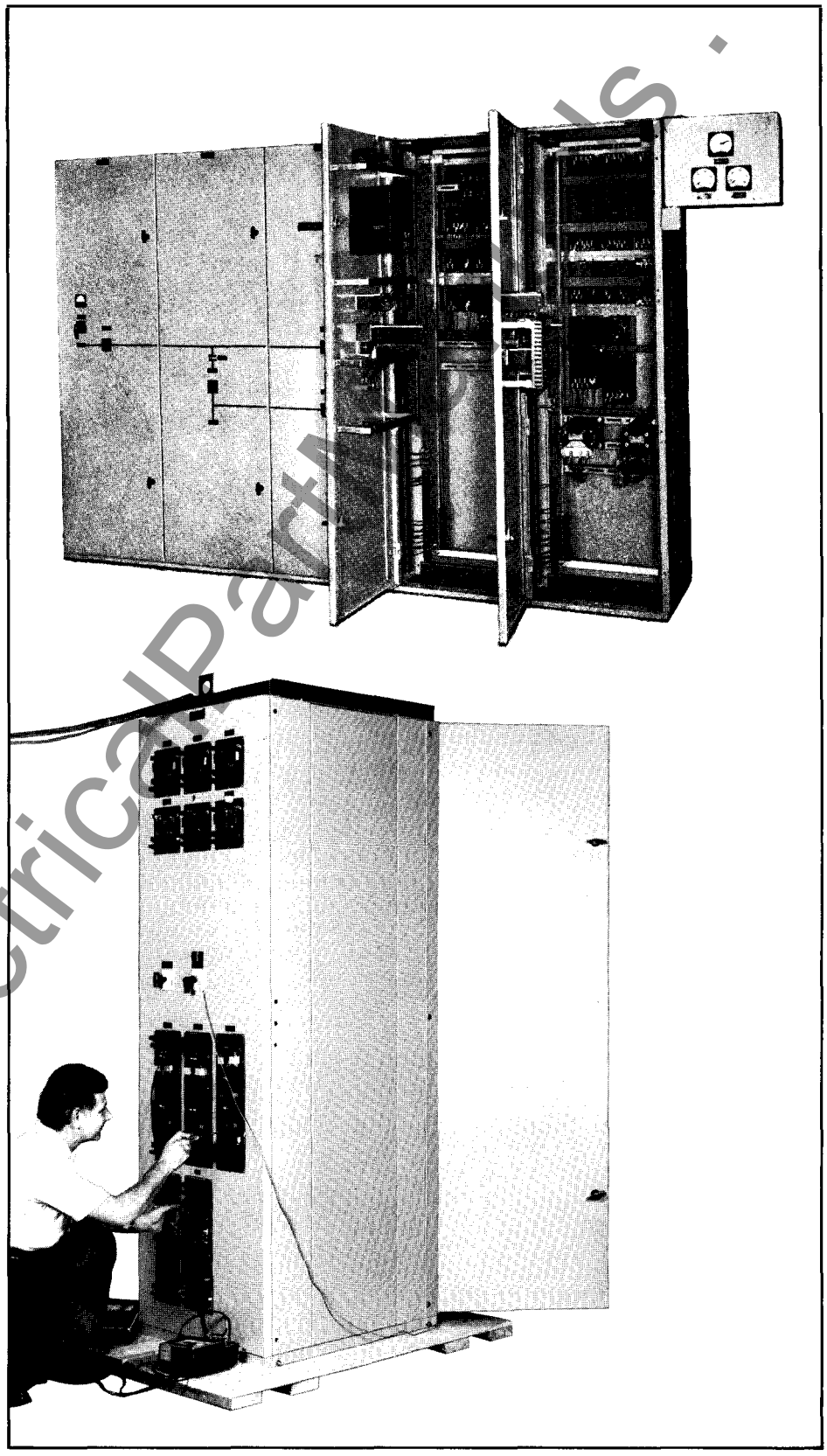
Typical Unit Floor Plan



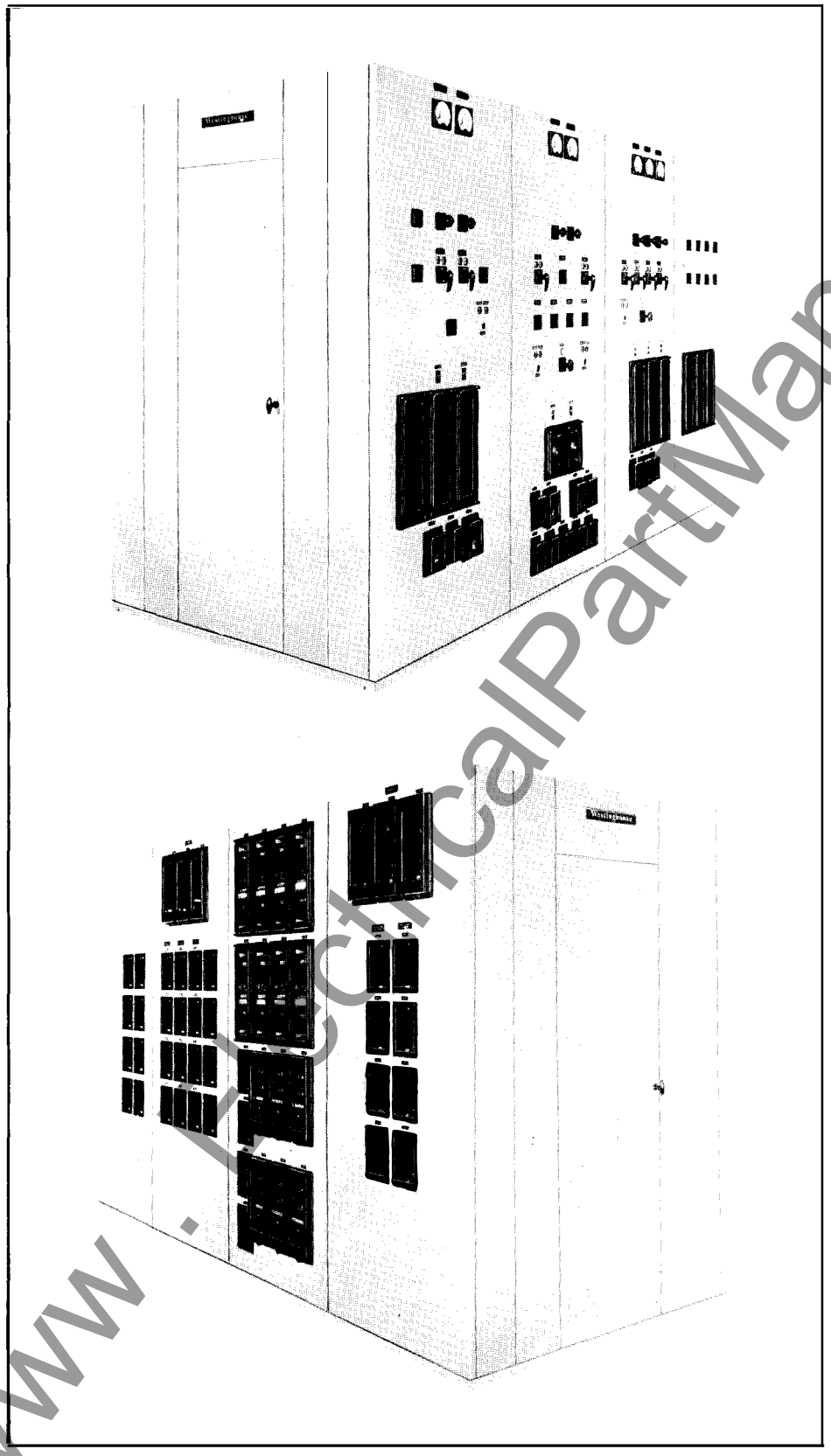
Note A: See dimension drawing on page 13 for basic panel assembly.

Dual Switchboard — A control switchboard with front and rear panels separated by a comparatively short distance (no aisle) and enclosed at both ends and top. The panels on at least one side are hinged for access to the panel wiring.





Relay Systems

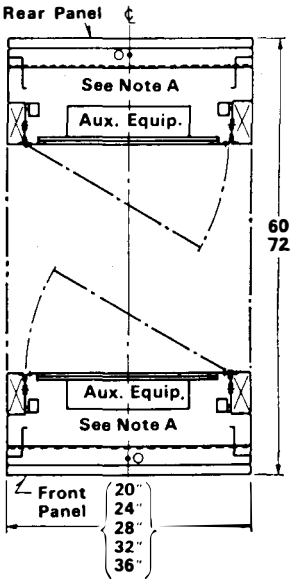


Duplex Switchboard, Type DX

The Westinghouse duplex switchboard consists of basic panel assemblies placed back-to-back at sufficient distance to provide a tunnel-type walkway between the assemblies. Bolted-on floor channels, top sheets, wiring trays, left and right end trims with access doors are provided to form a complete duplex switchboard with uninterrupted walkway running the entire length of the structure.

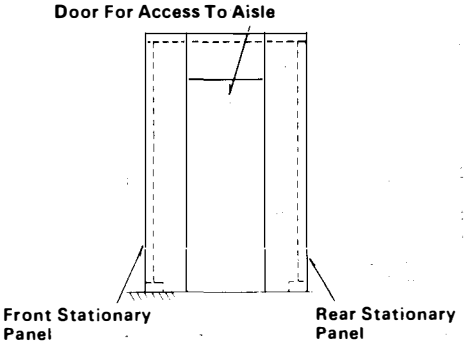
Standard depths are 60 and 72 inches. The 72 inch depth provides a spacious 42 inch wide walkway. Where space is at a premium, the 60 inch deep design may be used to advantage. The walkway in the 60 inch deep design is 30 inches wide, which is adequate for normal movement.

Typical Unit Floor Plan



Note A: See dimension drawing on page 13 for basic panel assembly.

Duplex Switchboard — A control switchboard consisting of panels placed back-to-back and enclosed with a top and ends (not grille). Access space (aisle) with entry doors, is provided between the rows of panels.



Relay Systems

Solid State and Teleprotection Enclosures

Solid state and teleprotection enclosures feature:

Adequate Shielding and Isolation — Cable troughs and/or surge protection packages (SPP's) are used to provide shielding and isolation of the solid state digital logic from the external noisy yard environment.

Grouping and Separation of Harnesses — Input-output harness wiring (noisy wiring) which connect to the terminal blocks and harness wiring which interconnect digital logic assemblies are located on opposite sides of the panel.

Isolation of Analog Signals — Harness for low energy analog signals is shielded twisted pair for each signal and its associated common and these harnesses are separated from other harnesses in the cabinet.

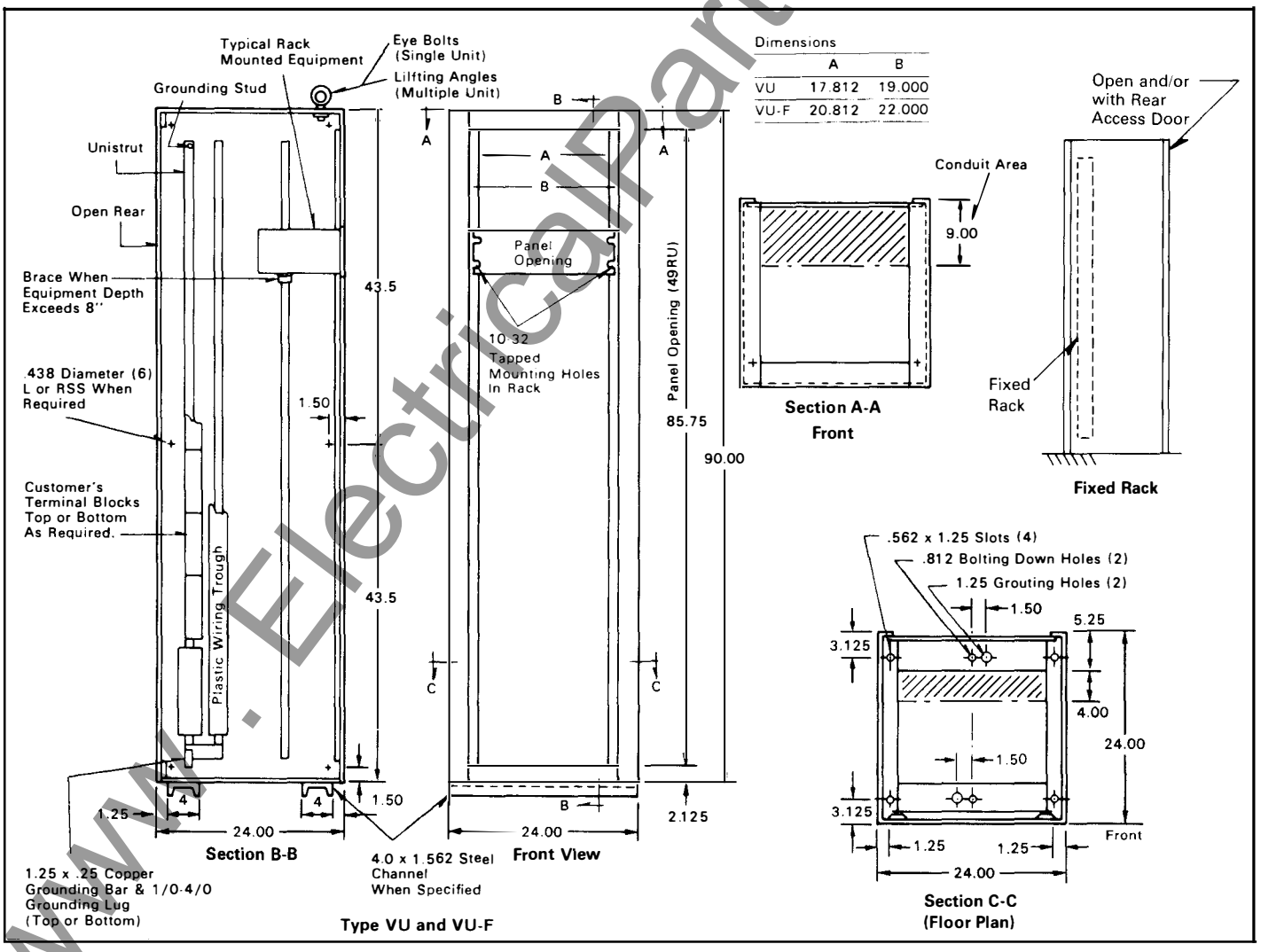
Solid State Relay Enclosures

Design Features
- Compact units 24" x 24" make best utilization of user's available floor space.
- Easy access wiring with all structures.
- Type VU-F rack permits mounting of 3 Flexitest relay cases across.
- Pre-drilled and tapped mounting holes allow for any combination of rack mounted equipment.

Type VU Relay Rack
- Rear access.
- 49 rack units.

Type VU-F Relay Rack
- Rear access.
- 49 rack units.
- Allows up to 3 FT cases across, in addition to rack mounted equipment on the same structure.

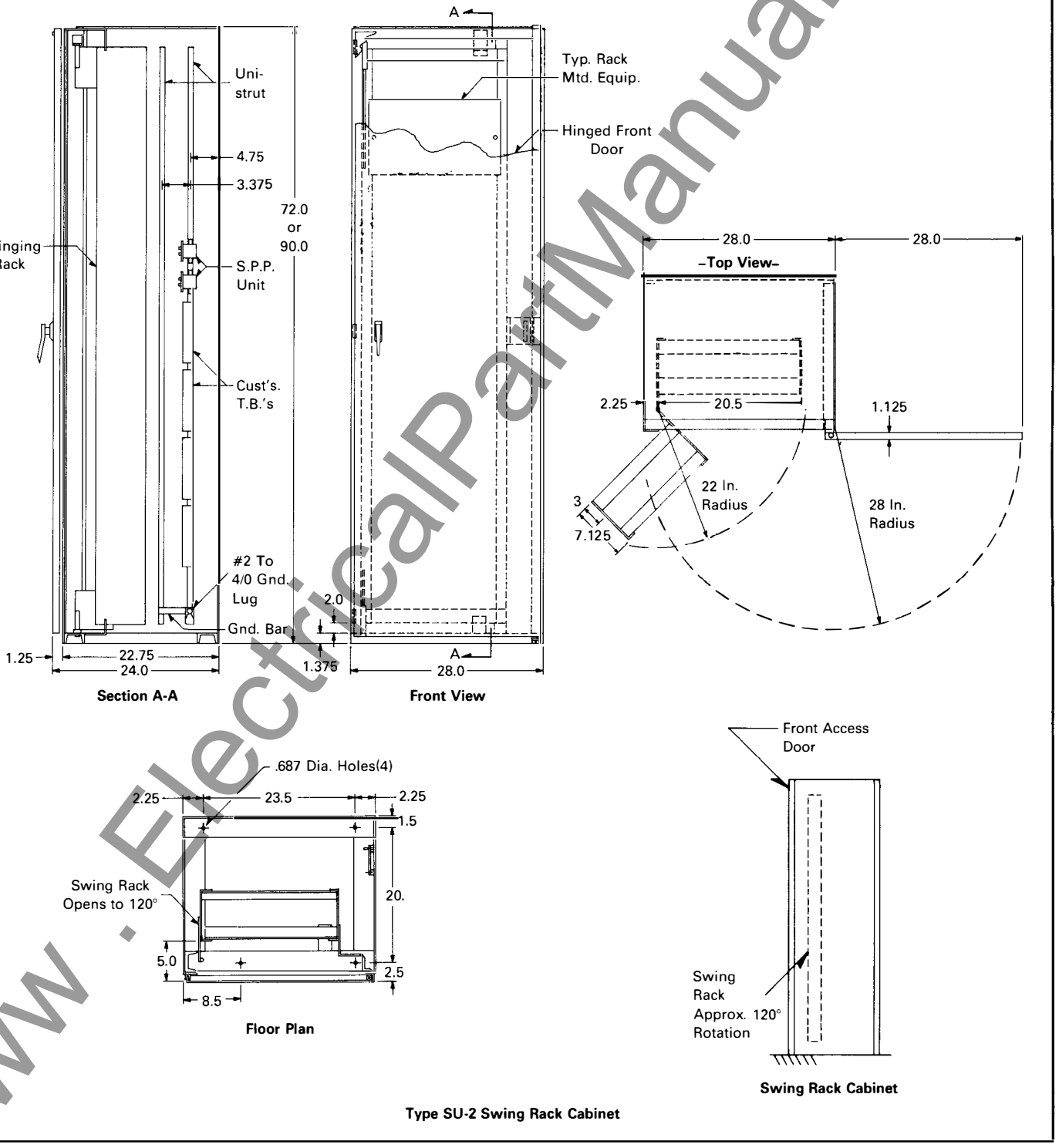
Fixed Rack (Cabinet) — An assembly enclosed at top and sides, either open or with door(s) for access, with a top to bottom front panel opening for equipment mounting (e.g., nominal 19-inch wide chassis and subpanel assemblies).



Relay Systems

Type SU-2 Swinging Rack Cabinet
- Front access.
- 46 rack units.

Swing Rack Cabinet — An assembly enclosed at the top, sides, and rear with front hinged door for front access having a swing open frame for equipment mounting (e.g., nominal 19-inch wide chassis in sub-panel assemblies).

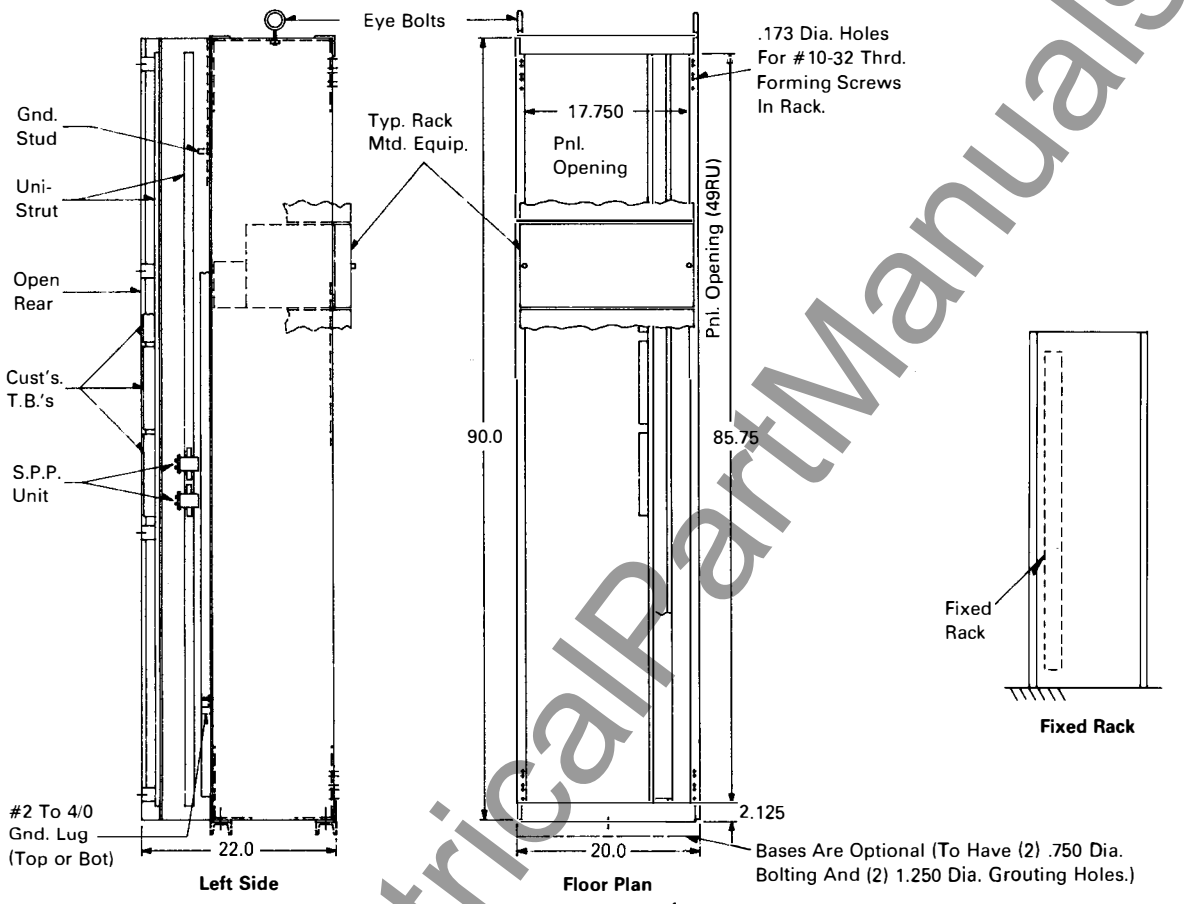


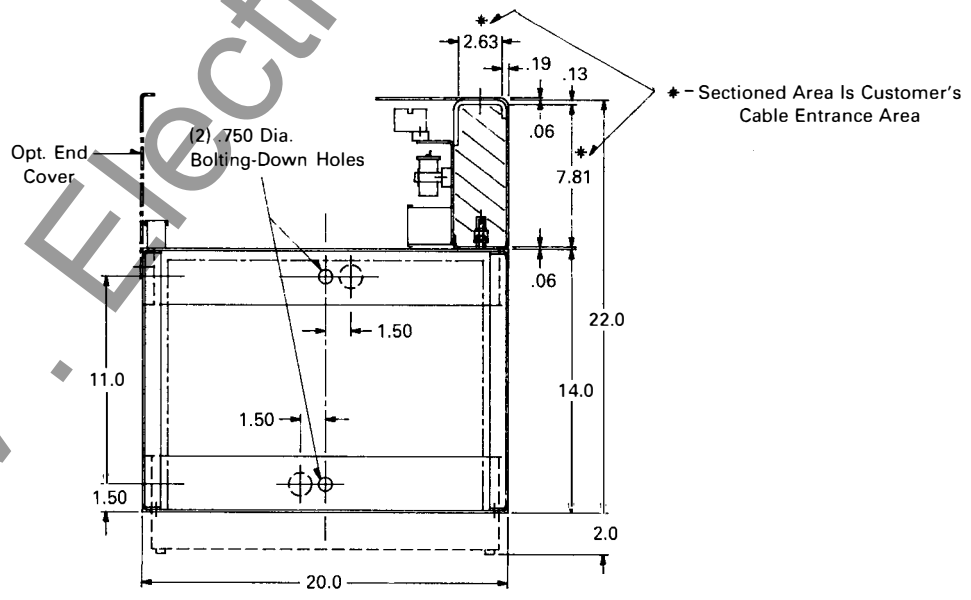
Type SU-2 Swing Rack Cabinet

Relay Systems

Type UF
- Rear access.
- 49 rack units.

Fixed Rack (Cabinet) — An assembly enclosed at top and sides, either open or with door(s) for access, with a top to bottom front panel opening for equipment mounting (e.g., nominal 19-inch wide chassis and subpanel assemblies).

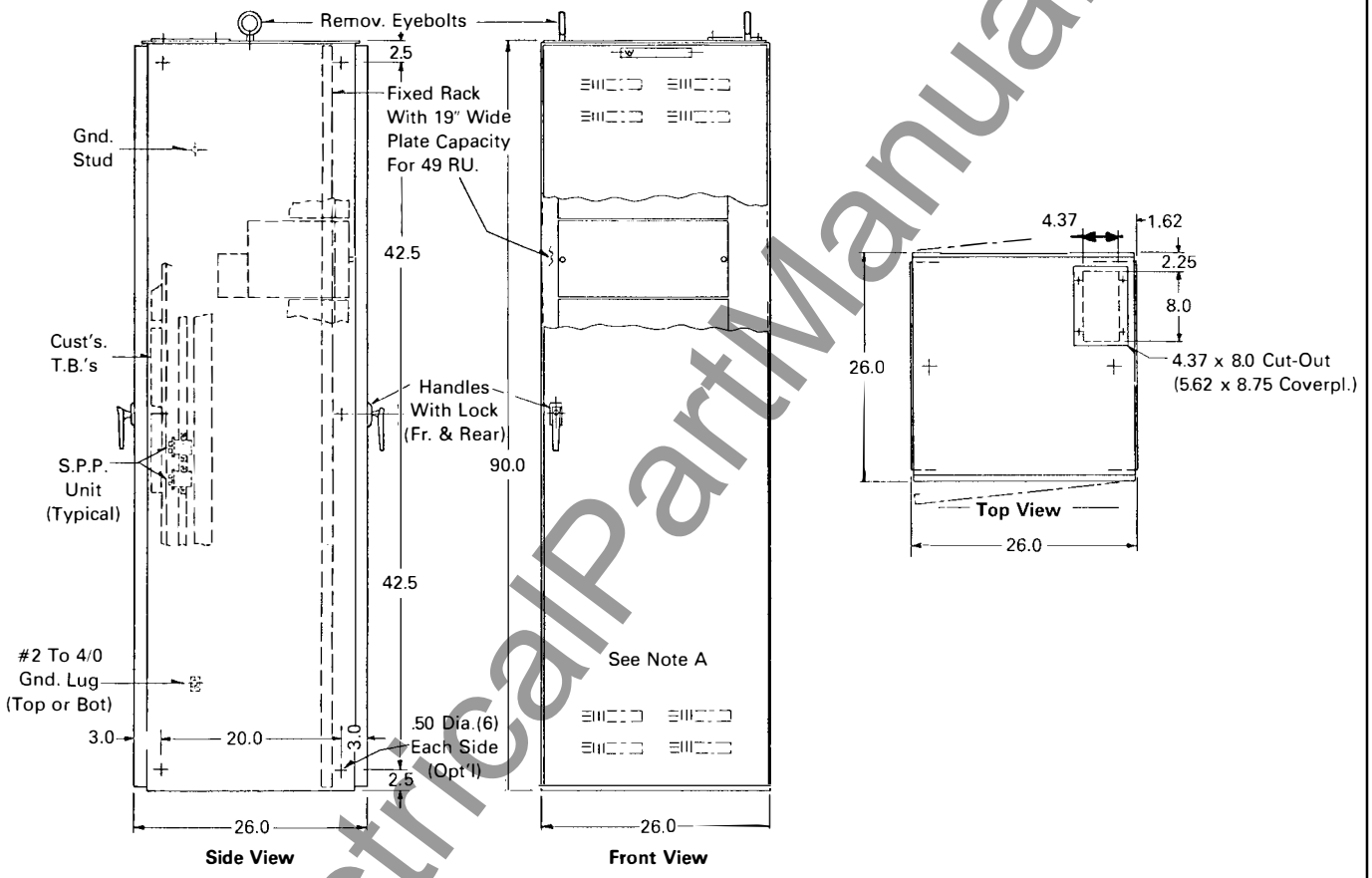




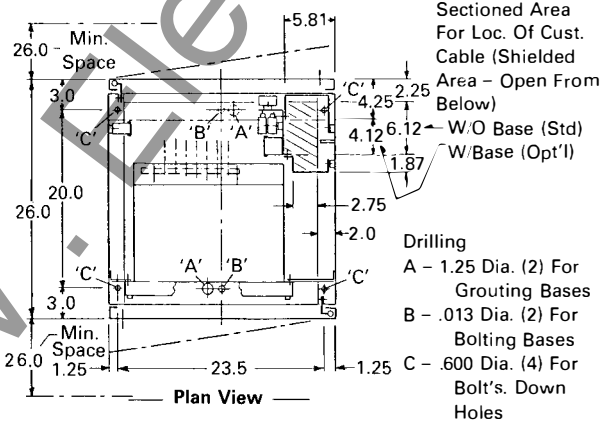
Relay Systems

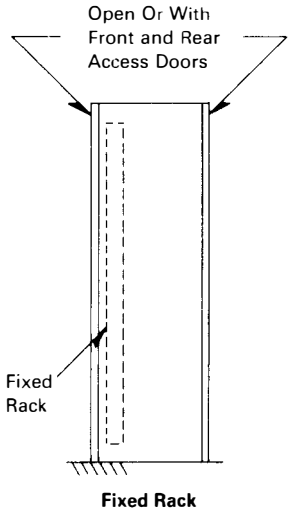
Type UFF
- Front and rear access.
- 49 rack units.

Fixed Rack (Cabinet) — An assembly enclosed at top and sides, either open or with door(s) for access, with a top to bottom front panel opening for equipment mounting (e.g., nominal 19-inch wide chassis and subpanel assemblies).



Note A: Can be supplied with optional viewing window.



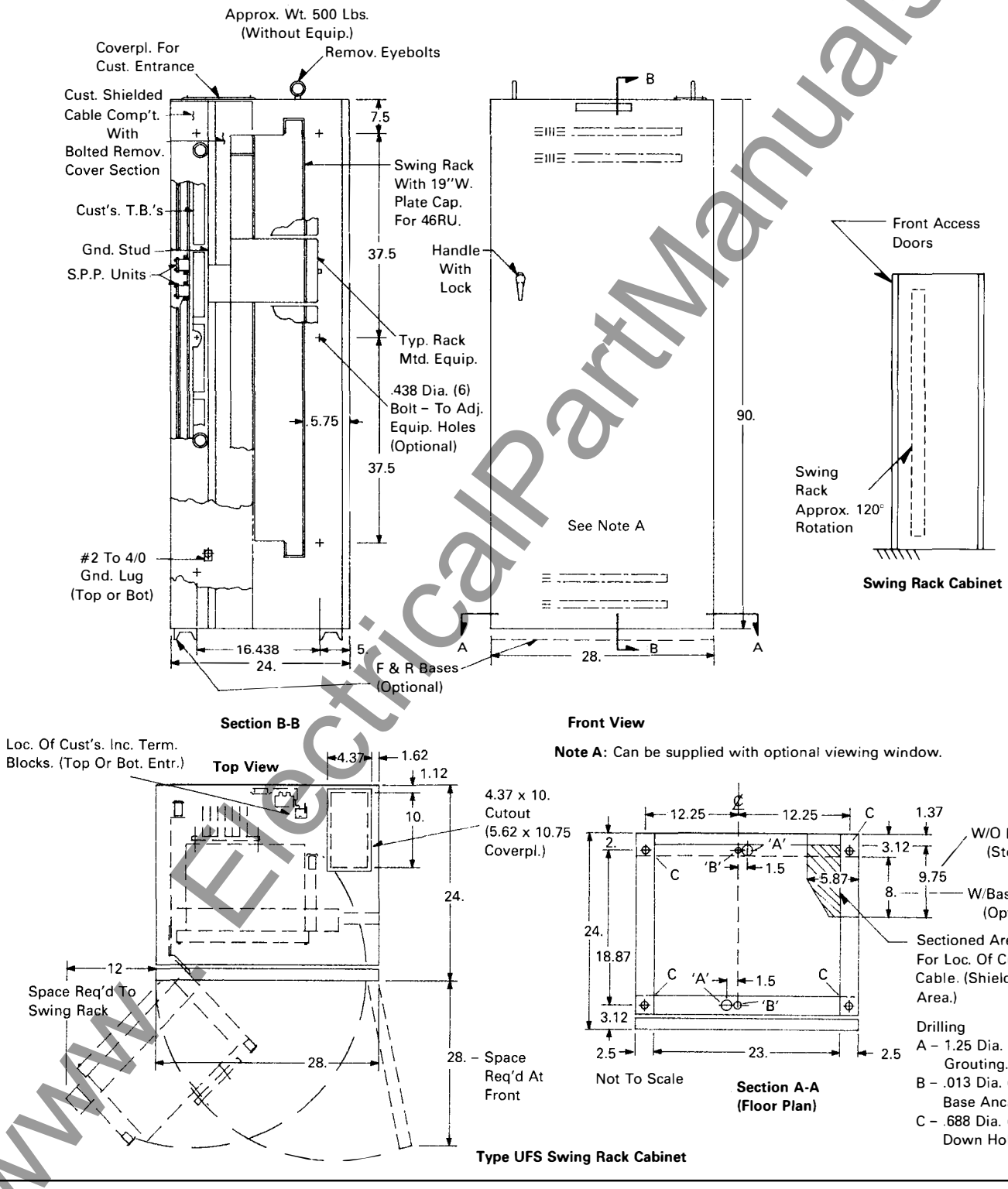


Type UFF Fixed Rack Cabinet

Relay Systems

Type UFS
- Front access.
- 49 rack units.

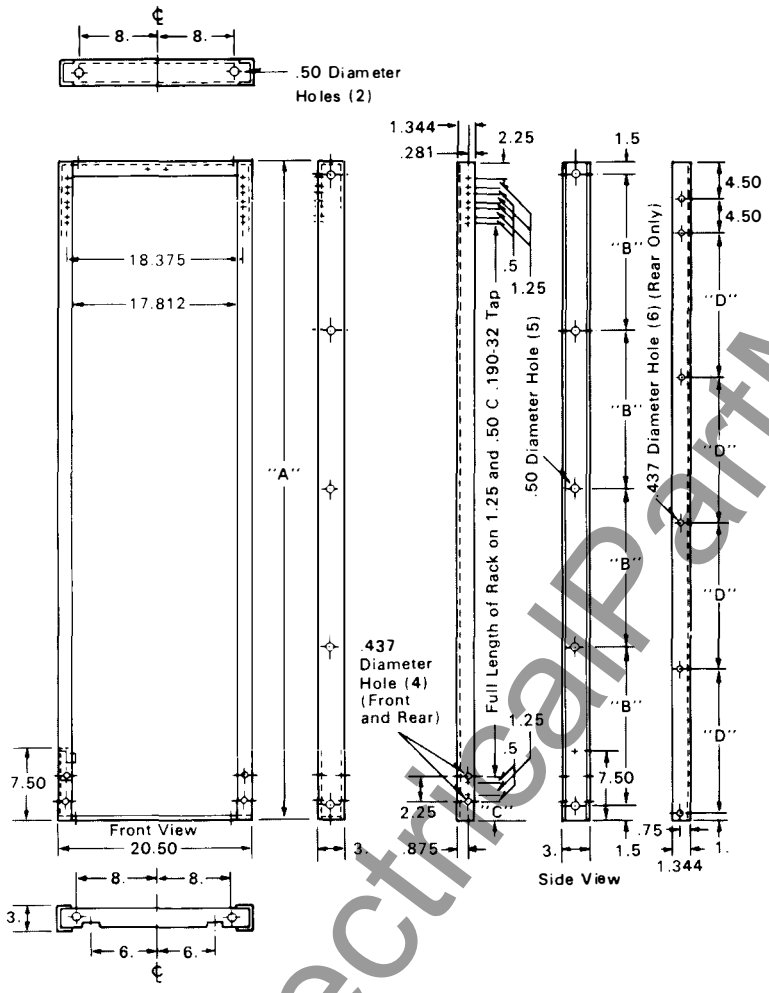
Swing Rack Cabinet — An assembly enclosed at the top, sides, and rear with front hinged door for front access having a swing open frame for equipment mounting (e.g., nominal 19-inch wide chassis in sub-panel assemblies).

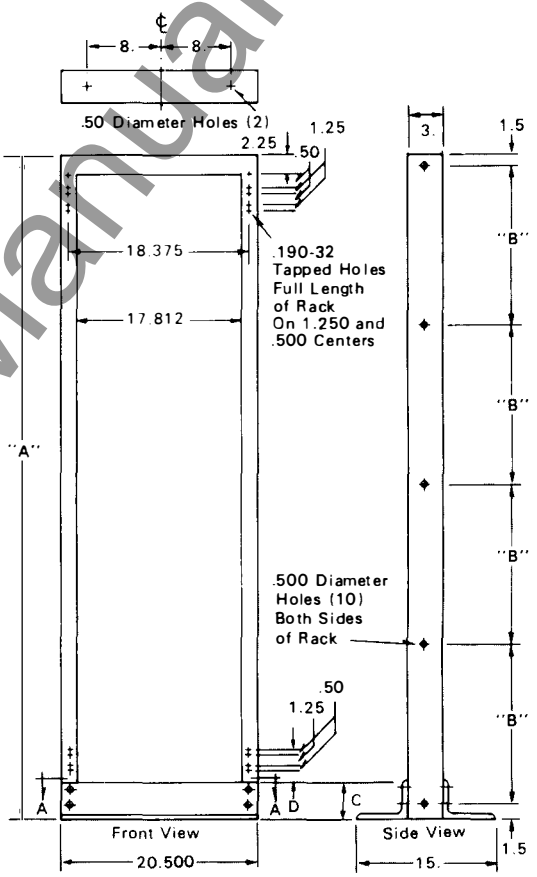


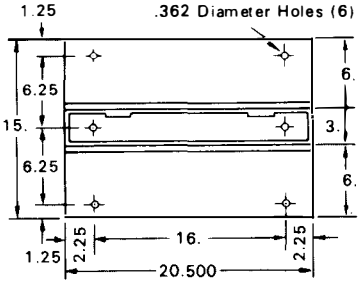
Relay Systems

Teleprotection Enclosures

- Compact 16" x 26" indoor and outdoor communication system cabinets.
- Swing rack design permits easy access to equipment.
- Pre-drilled and taped mounting holes on alternate 1¼" and ½" center lines for rack mounting of any equipment combination or interchanging of equipment.







View "AA"

Dimensions

A	B	C	Quantity of 10-32 Holes	Quantity of .437 Holes	Rack Units
90.	21.75	2.	97	4	49
84.	20.25	1.25	91	4	46

84" and 90" High Relay Rack
(User must supply necessary bracing)

Dimensions

A	B	C	D	E	Rack Units
84.	20.25	4.	.75	1.25	44
90.	21.75	6.	1.35	2	46

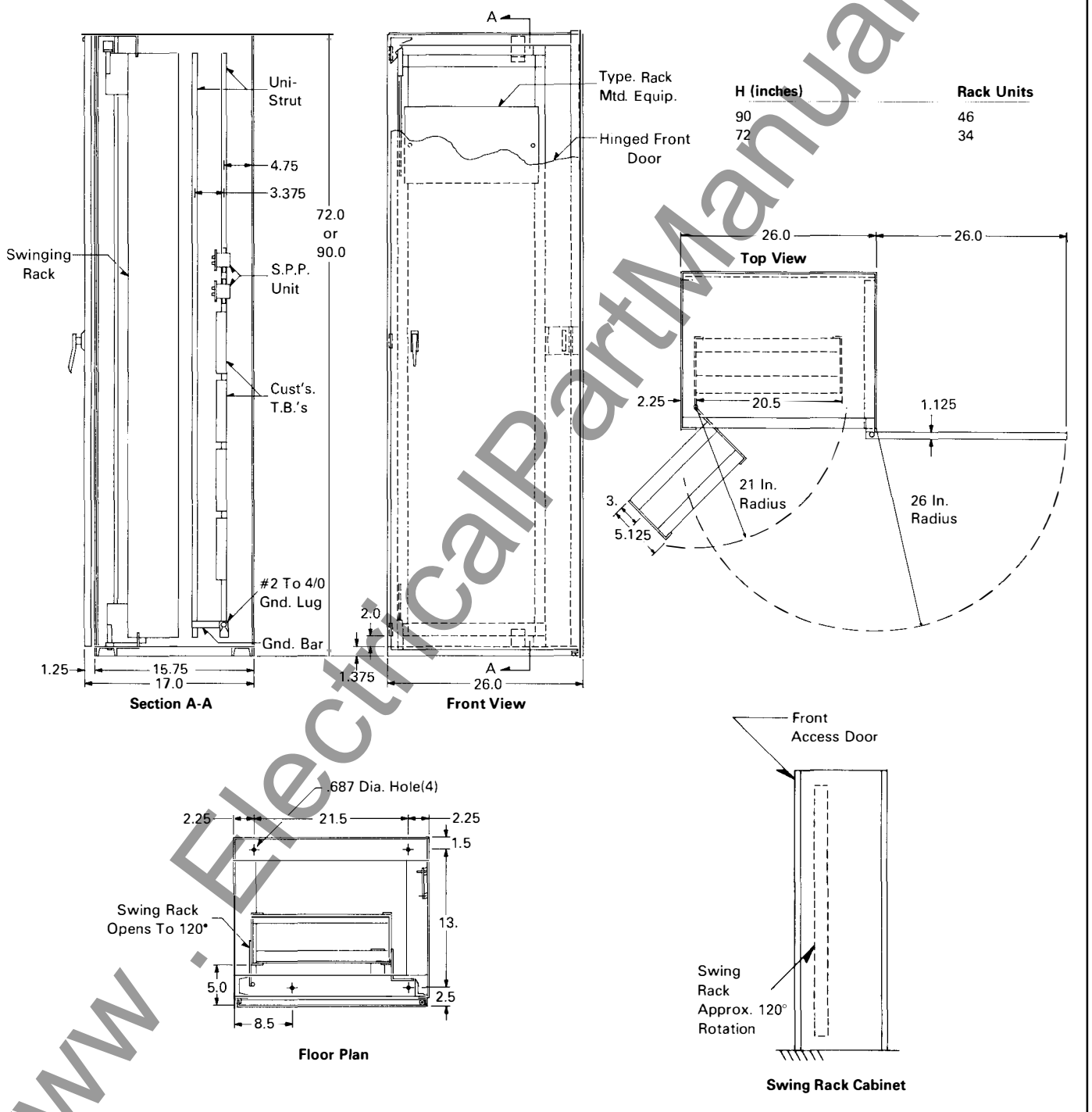
84" and 90" High

Self-Supporting
Open Relay Racks

Relay Systems

Type SU-2A
- Front access.
- 46 rack units.

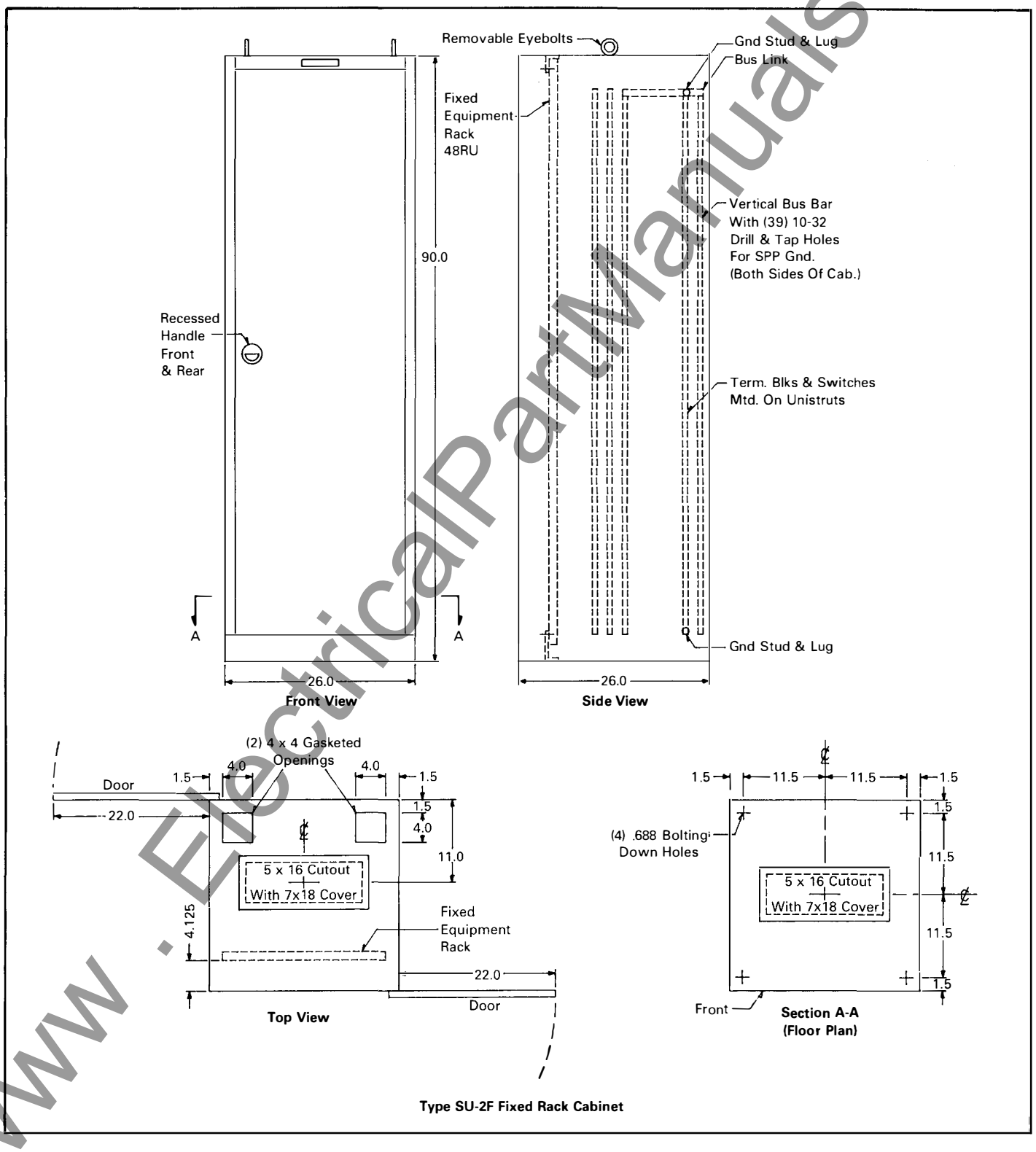
Swing Rack Cabinet — An assembly enclosed at the top, sides, and rear with front hinged door for front access having a swing open frame for equipment mounting (e.g., nominal 19-inch wide chassis in sub-panel assemblies).



Type SU-2A Swing Rack Cabinet

Relay Systems

Type SU-2F
- Front and rear access.
- 48 rack units.

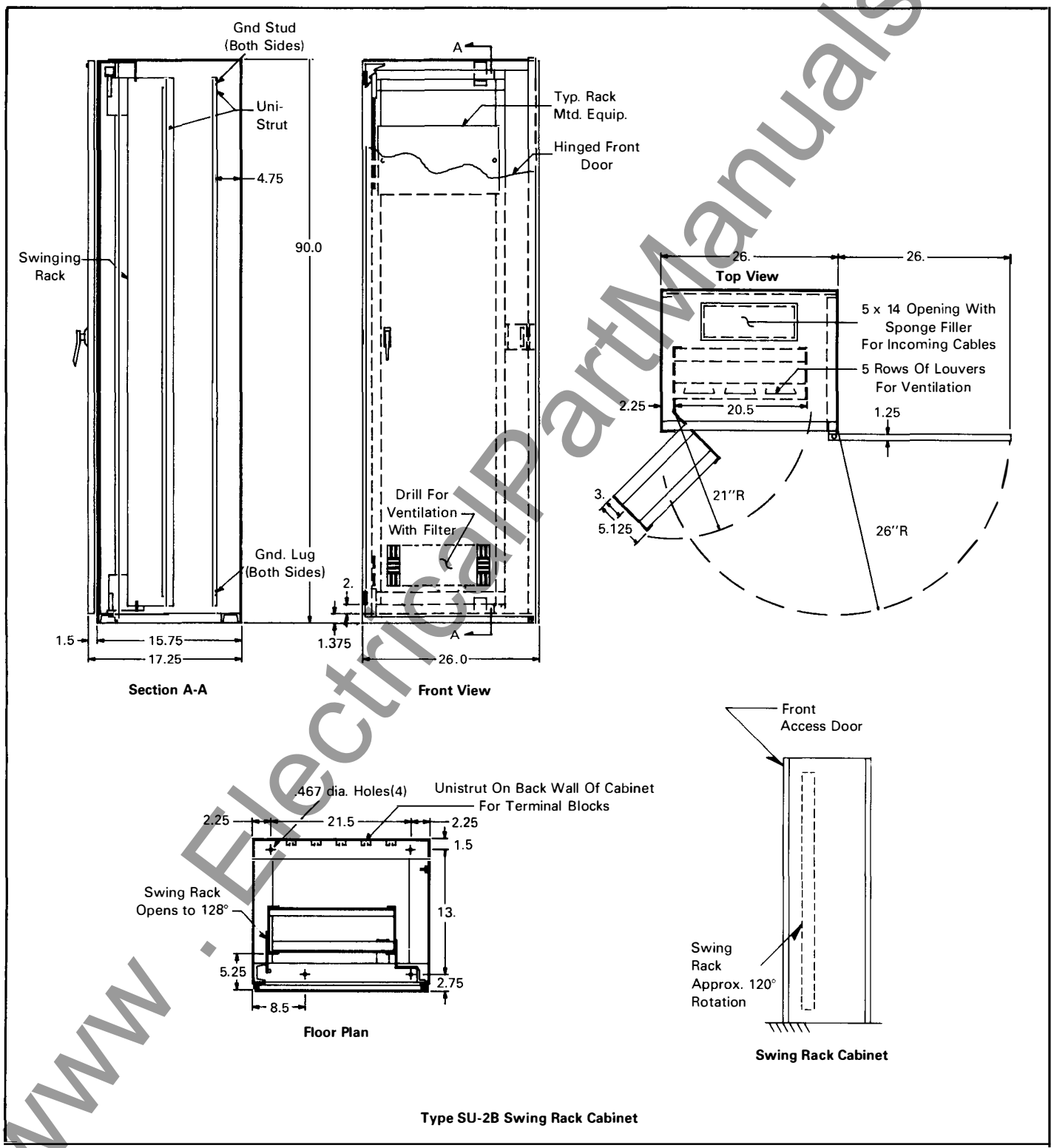


Type SU-2F Fixed Rack Cabinet

Relay Systems

Type SU-2B
- Front access.
- 46 rack units.

Swing Rack Cabinet — An assembly enclosed at the top, sides, and rear with front hinged door for front access having a swing open frame for equipment mounting (e.g., nominal 19-inch wide chassis in sub-panel assemblies).



Type SU-2B Swing Rack Cabinet

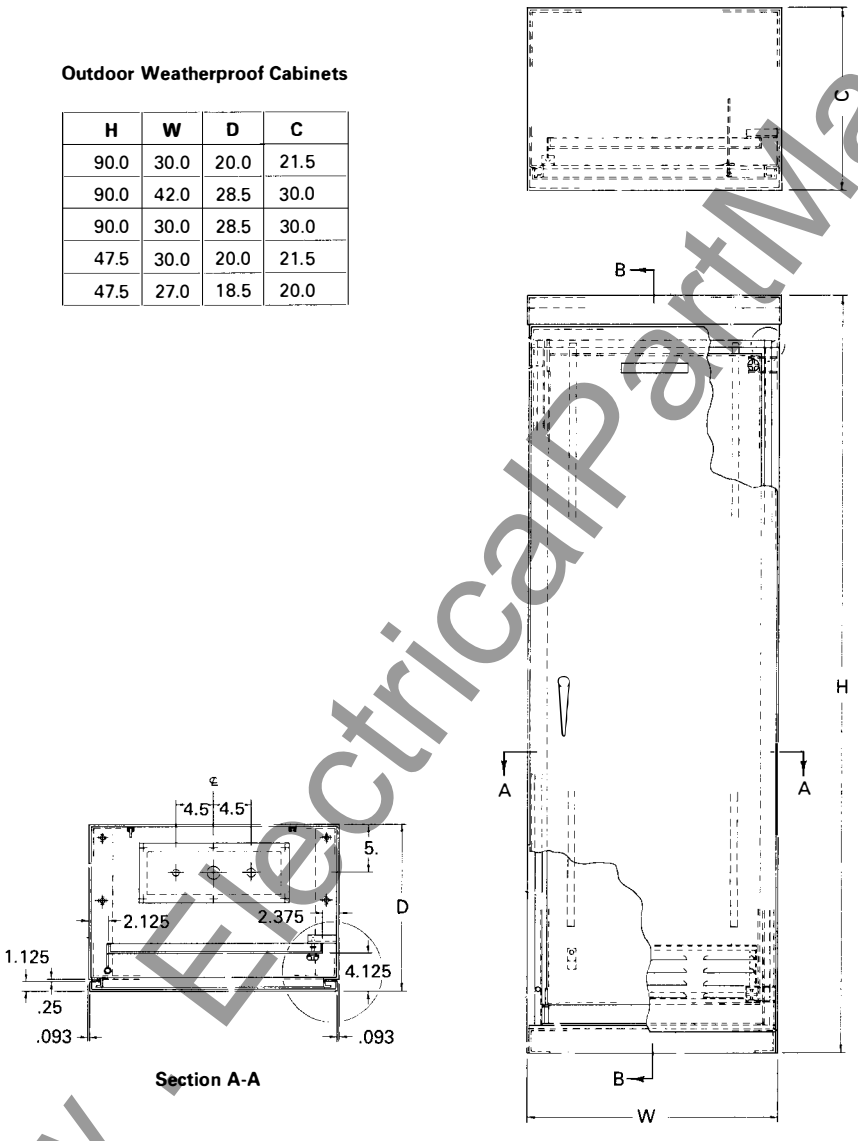
Relay Systems

Outdoor Enclosures

- Front overhang with channel lip from opening.
- Easily rear accessible swing rack or panel.
- Bottom cable entrance.
- Optional heaters with or without thermostats.

Outdoor Weatherproof Cabinets

H	W	D	C
90.0	30.0	20.0	21.5
90.0	42.0	28.5	30.0
90.0	30.0	28.5	30.0
47.5	30.0	20.0	21.5
47.5	27.0	18.5	20.0

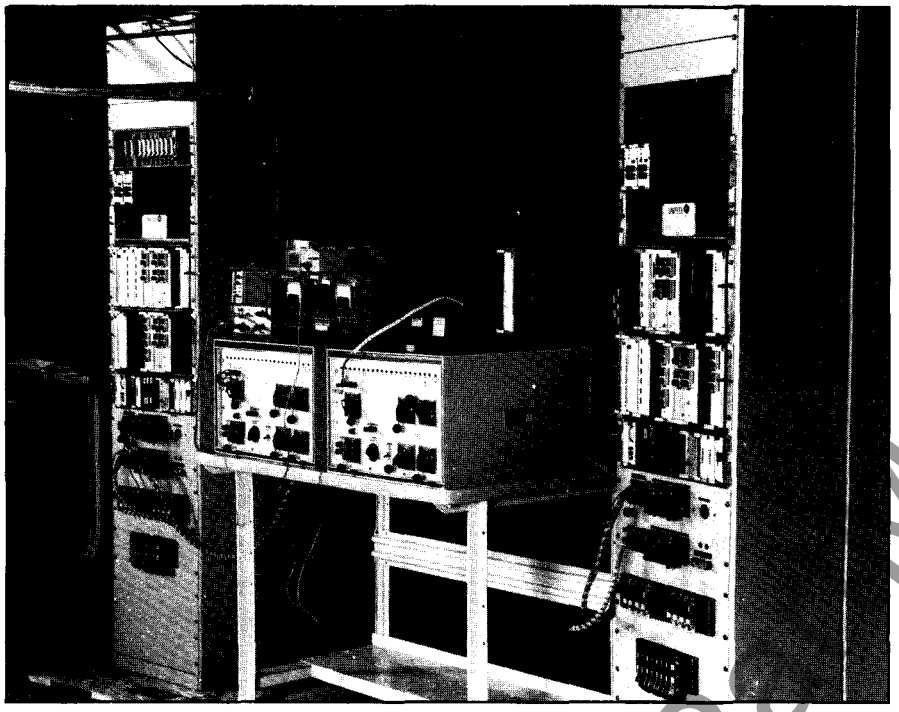


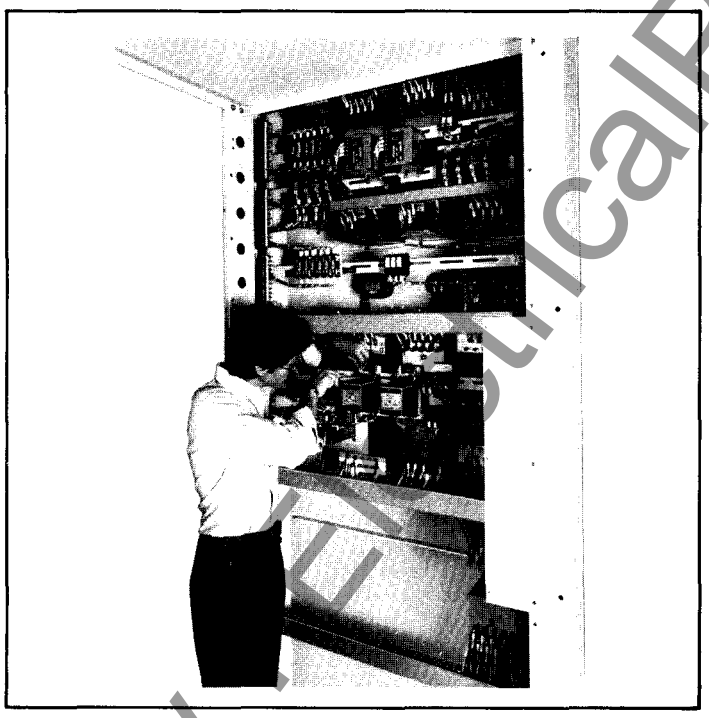
Section A-A

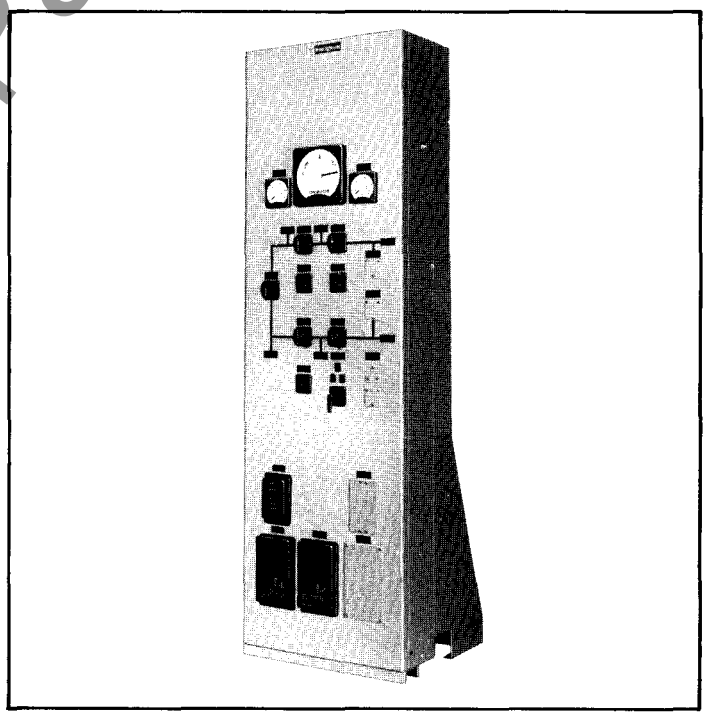
Section B-B

Outdoor Cabinet

Relay Systems







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