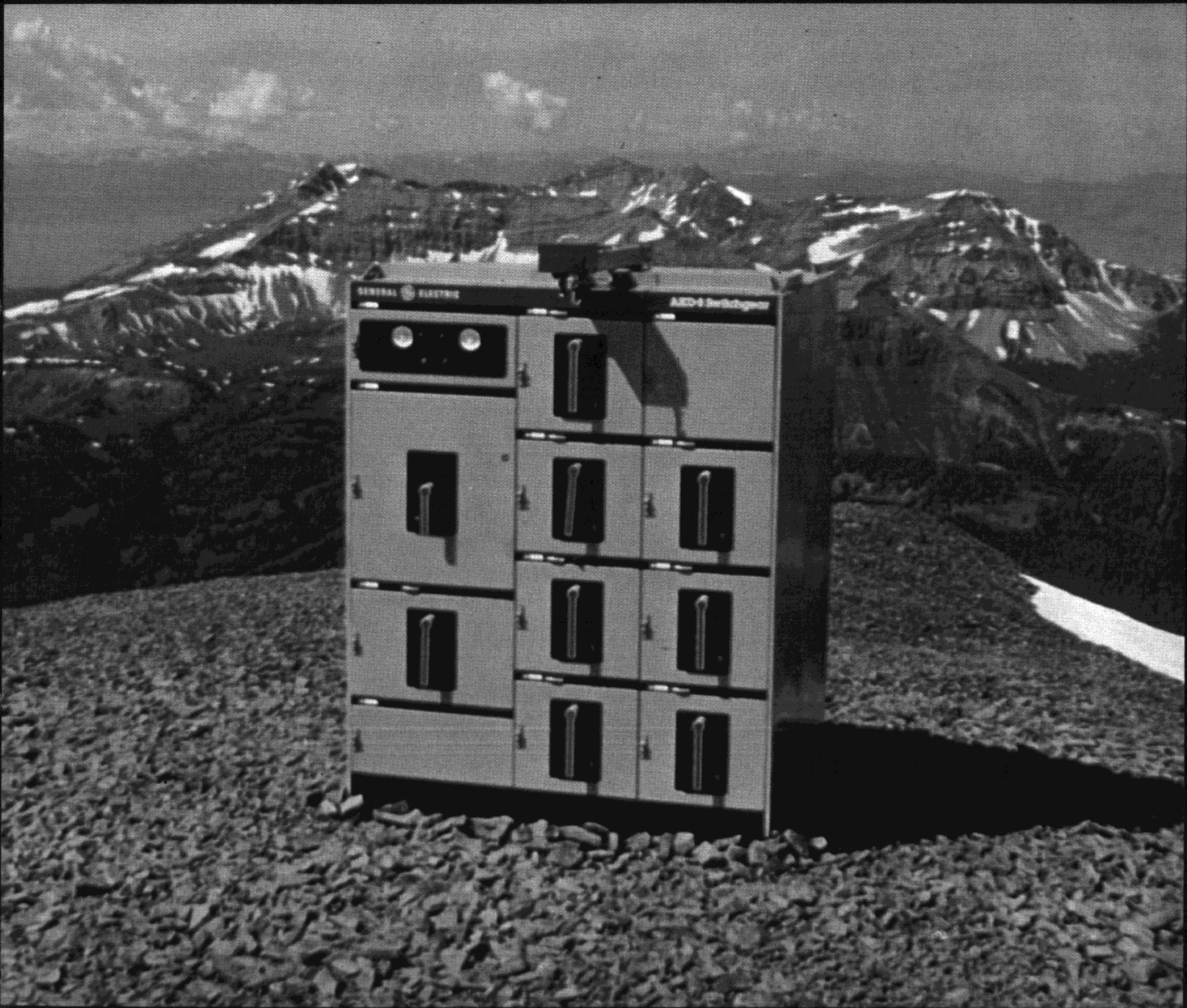


The Pinnacle
of Protection



AKD-8

**Low Voltage
Switchgear**



GENERAL  ELECTRIC

AKD-8 Specifications Data

*General Electric type AKD-8 low-voltage switchgear has reached new heights in power distribution and protection equipment with a number of equipment and power circuit breaker innovations and improvements. All of the field-proven customer benefits of preceding GE switchgear equipment and breakers have been blended with new design ad-

vances to produce an equipment offering that meets or exceeds your present and future needs for safety, reliability, maintainability, convenience, economy and continuity of service.

System Safety and Reliability

Both standard and optional features are available with

AKD-8 switchgear to provide electrical distribution equipment that will meet the increasing industry emphasis on system reliability and operating personnel safety.

- True closed door draw out (figure 2)—is standard construction with all AKD-8 switchgear equipment. The breaker compartment doors remain stationary and closed

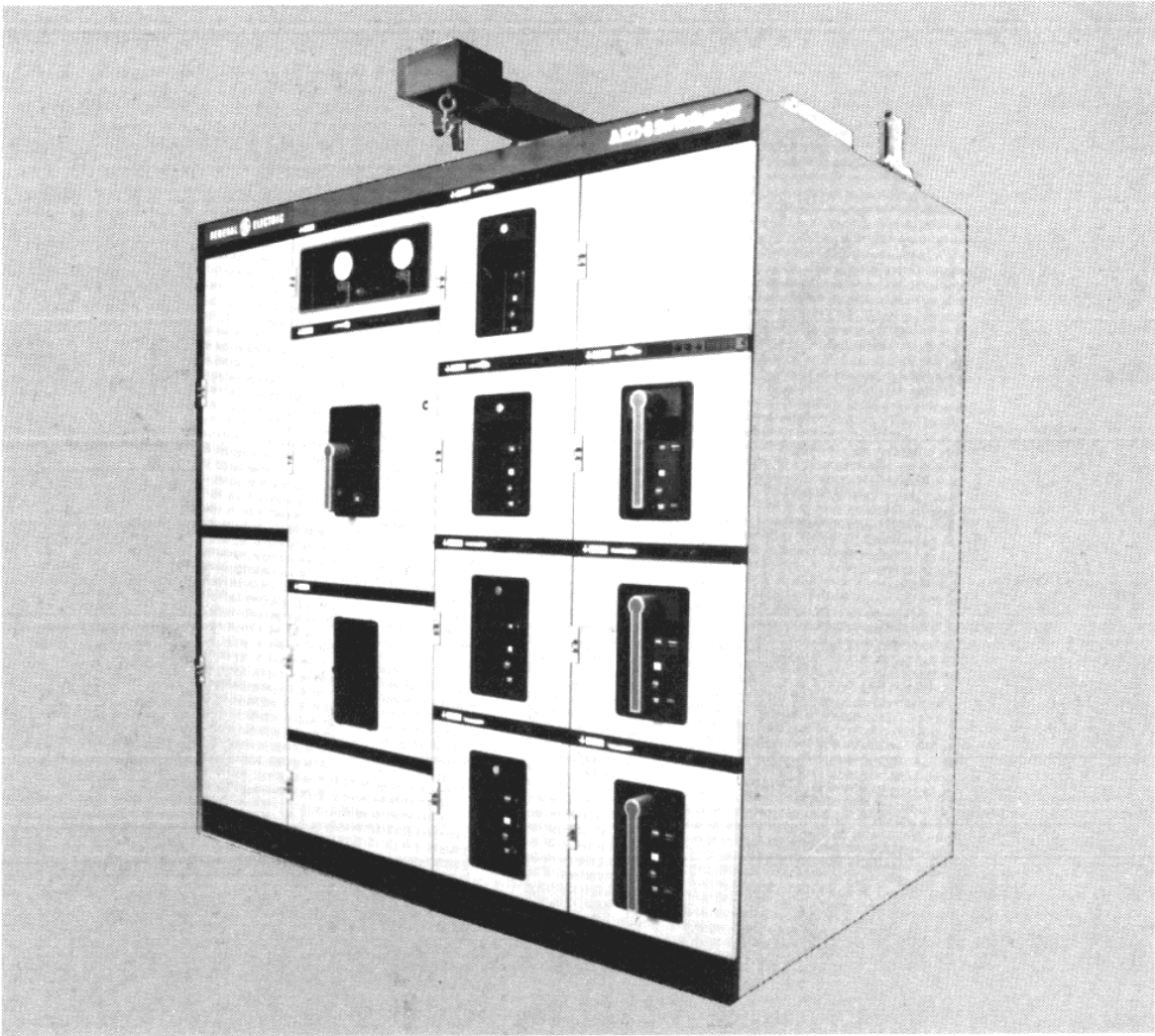


Fig. 1

Table of Contents

Page

Specifications Data	2
Low Voltage Circuit Breakers with MicroVersaTrip	6
Solid State Programmers	8
Accessories	9
Typical Dimensions	11
The Load Center Principle	15
Application Tables	17
Low Voltage Switchgear	21
Guide Form Specifications	23

The information contained in this publication is intended to provide only a general summary of application data.

AKD-8 Specifications Data

while the breaker is racked out from the connected, thru test to the disconnected position.

- Breaker compartment doors are provided without ventilation slots to protect operators from hot ionized gases vented by the breaker during circuit interruption. Additionally the breaker compartment (figure 3) is enclosed in grounded steel bar-

riers to minimize the possibility of fault communication.

- Primary disconnect shutters (figure 4)—are optionally available to provide protection against contact with the energized primary disconnects when the breaker is removed from its compartment.

- For maximum dependability and short-circuit strength

vertical buses (figure 5) are nested and bolted to a molded, glass-reinforced polyester base providing a rigid support structure and inserting solid insulation between adjacent bus bars. Standard bracing is 50,000 RMS symmetrical, with up to 200,000 RMS symmetrical optionally available.

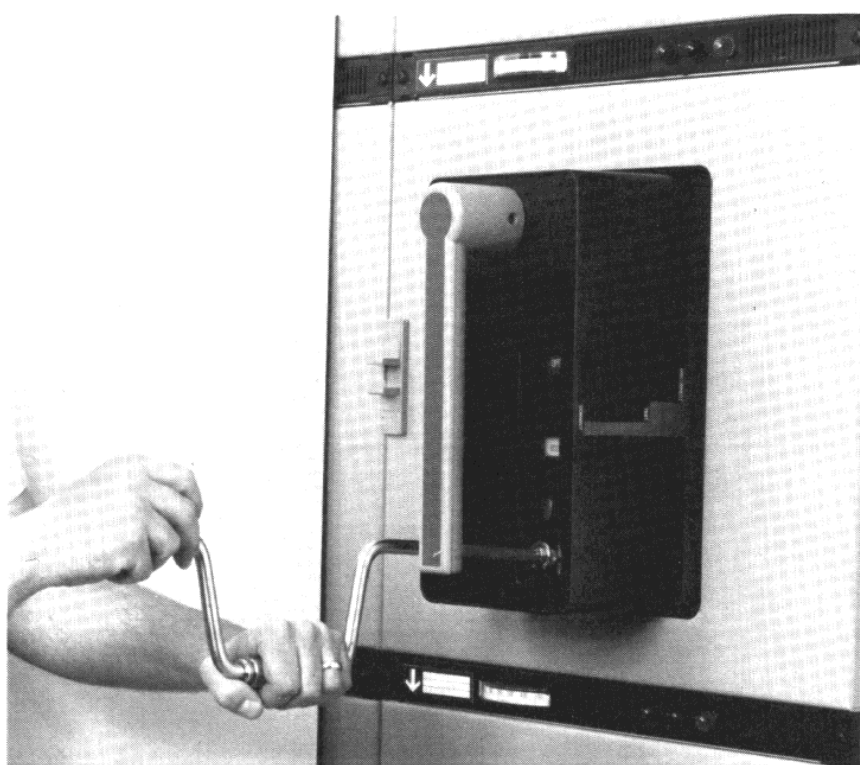


Fig. 2

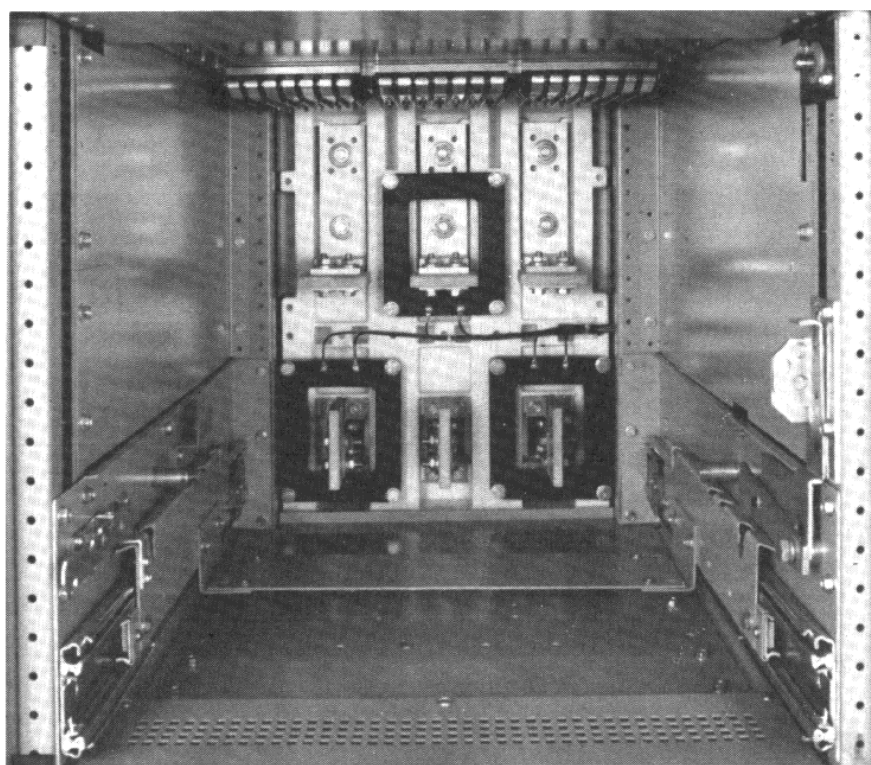


Fig. 3

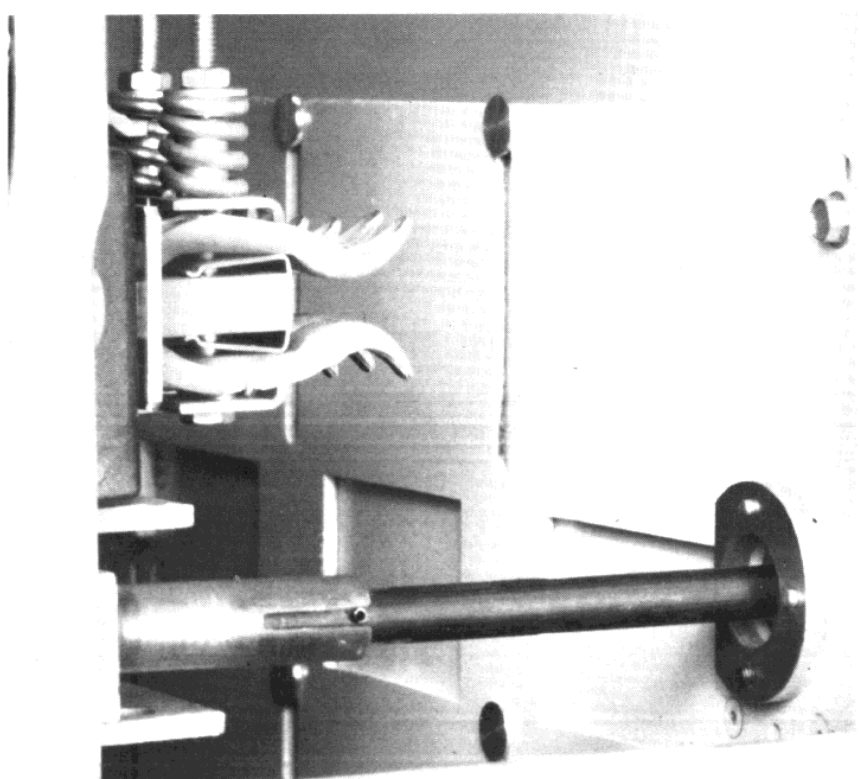


Fig. 4

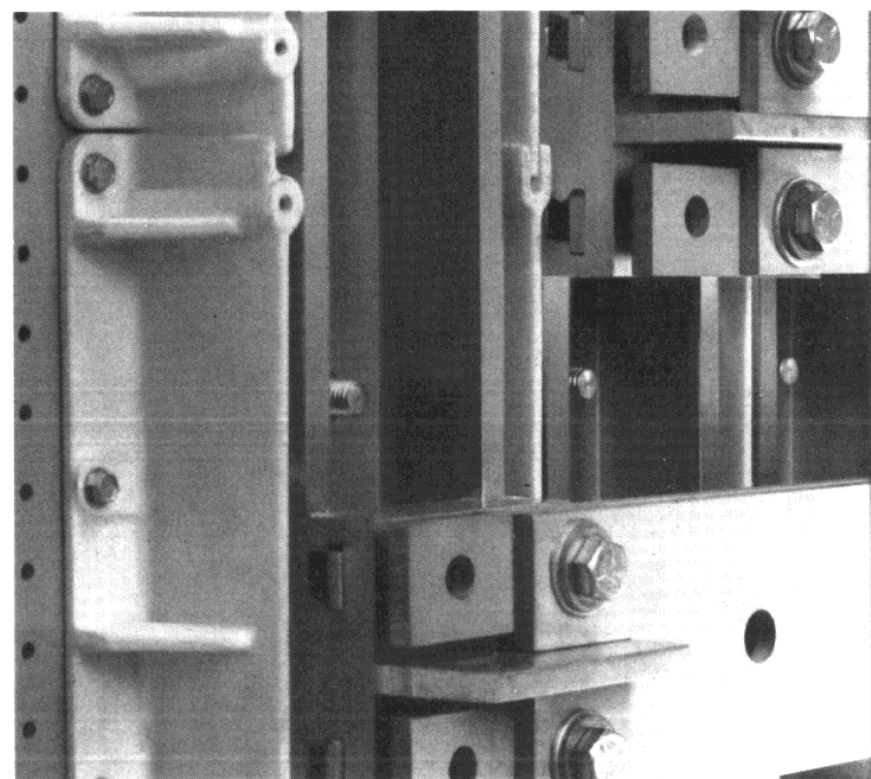


Fig. 5

- An optional completely insulated/isolated bus bar (figure 6) system is available so that the only exposed energized parts in the rear power cable compartment are the outgoing feeder connections.
- Welded bus—aluminum bus is standard with welded main and vertical bus joints throughout. Bolted copper bus is optional. The switchgear bus bar capacity

matches the rating of the main circuit breakers.

- AKD-8 switchgear is designed and manufactured, to meet or exceed ANSI-C37.20—and NEMA SG-5 switchgear standards. It is also listed by Underwriters' Laboratories, Inc.

Ease of Installation and Maintenance

- Conduit entrance area—over 50% more space for outgoing cables than previous designs. This increased space gives you easier, faster equipment installation and simplifies routine inspection and maintenance of cable connections.

AKD-8 Specifications Data

- A standard slide-out instrumentation tray (figure 7) is located above each breaker compartment eliminating cross-hinge wiring. When required, horizontal-edgewise ammeter switches and indicating lights can be



Fig. 6

AKD-8 Specifications Data

mounted on the front of the tray. Additionally, fuses for close and trip circuits can be mounted inside the tray, being accessible with the tray pulled out. Routine wiring inspections and fuse checks or fuse replacements can be performed with the breaker compartment door remaining closed so that operators are protected from energized primary circuits.

- The design modularity of AKD-8 switchgear provides simplified installation. Switchgear sections are available in two widths—22 and 30 inches, and GE AKR 30/50 low voltage power circuit breakers can be stacked four high all resulting in reduced floor space requirements. The 12 gauge modular designed steel frame results in flexibility in arrangement of

breakers and associated components.

General Electric's new AKD-8 Low Voltage Switchgear can help you meet today's challenges for greater productivity, increased operator safety and improved equipment reliability and maintainability.

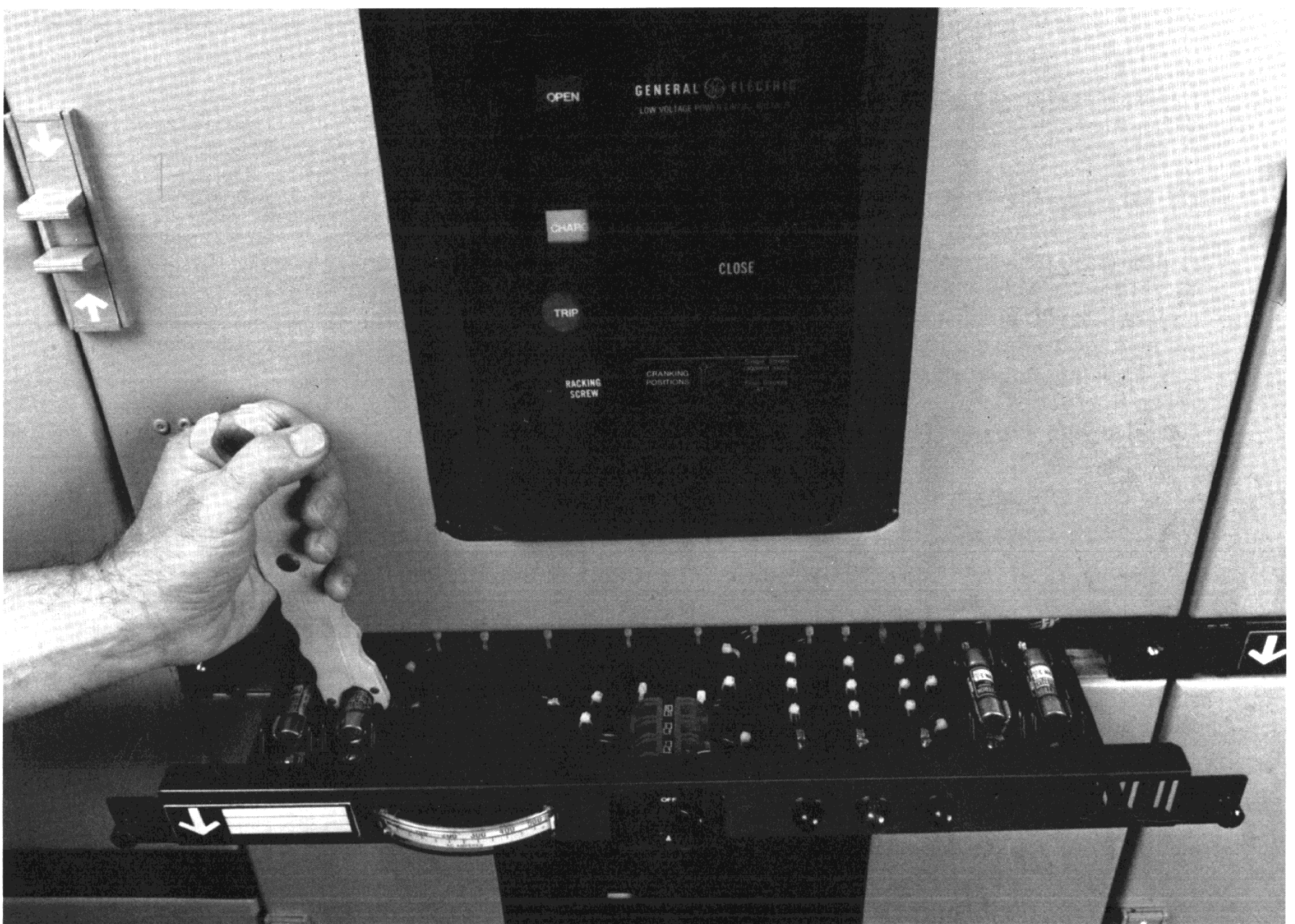


Fig. 7

The time proven, rugged AKR breaker design includes spring-operated, stored-energy mechanisms for manual or electrical operations. The stored-energy mechanism uses a quick-make, quick-break operation to assure positive, high-speed breaker closing independent of the operating force. Positive, controlled closing prevents undesirable arcing be-

tween movable and stationary contacts, resulting in longer contact and breaker life. AKR breaker elements are rugged switching overload and short-circuit protective devices for main, tie or feeder circuits. They are capable of performing a wide variety of control functions such as motor starting and automatic throwover. Five AKR breakers now

form the complete family of breakers from 800 to 4000 ampere frame size that are used in AKD 8 Switchgear. They are all built with superior basic breaker features that provide:

- clean, quiet stored-energy interruption
- increased breaker endurance
- simplified maintenance

**AKD-8
Type AKR
Low-Voltage
Circuit Breakers
with
MicroVersaTrip®**

<p>AKR-30</p> <ul style="list-style-type: none">• 800-ampere frame size• standard 30,000-ampere interrupting and short-time capability (480 volts)• optional 42,000-ampere extended interrupting and short-time capability (480 volts)• space saving, four-high stacking — 22" wide sections• available with integral fusing	<p>AKR-50</p> <ul style="list-style-type: none">• 1600-ampere frame size• standard 50,000-ampere interrupting and short-time capability (480 volts)• optional 65,000-ampere extended interrupting and short-time capability (480 volts)• space saving, four-high stacking — 22" wide sections• available with integral fusing
<p>AKRT-50H</p> <ul style="list-style-type: none">• 2000-ampere frame size• standard 65,000-ampere interrupting and short-time capability (480 volts)• space saving, four-high stacking — 22" wide sections	<p>AKR-75</p> <ul style="list-style-type: none">• 3200-ampere frame size• standard 65,000-ampere interrupting and short-time capability (480 volts)• three-high stacking — 30" wide sections
<p>AKR-100</p> <ul style="list-style-type: none">• 4000-ampere frame size• standard 85,000-ampere interrupting and short-time capability (480 volts)• three high stacking — 30" wide sections	<p>All AKR breakers are furnished with:</p> <ul style="list-style-type: none">• 5-cycle closing• manual or electrical operation• provision for a full line of accessories

AKD-8

Type AKR

Low-Voltage

Circuit Breakers

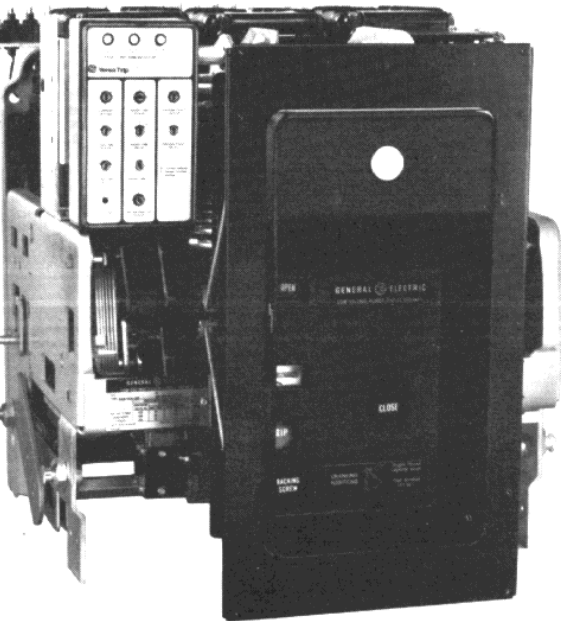
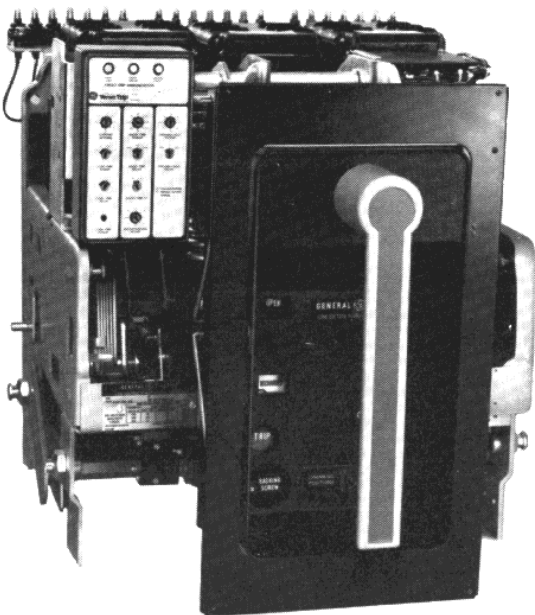


TABLE 9.1 – Summary of Breaker Ratings used in AKD-8 Switchgear

AC Voltage Rating 60 Hertz	Breaker Type	Maximum Breaker Frame Rating (Amperes)	30 cycle Short-time Rating in Symmetrical current (Amperes)	Short Circuit Rating Symmetrical current (Amperes)	
				With Instantaneous Trips	Without Instantaneous Trips
600	AKR-30	800	30,000	30,000	30,000
	AKR-30H	800	42,000	42,000	42,000
	AKR-50	1600	42,000	42,000	42,000
	AKR-50H	1600	65,000	65,000	65,000
	AKRT-50H	2000	65,000	65,000	65,000
	AKR-75	3200	65,000	65,000	65,000
	AKR-100	4000	85,000	85,000	85,000
480	AKR-30	800	30,000	30,000	30,000
	AKR-30H	800	42,000	42,000	42,000
	AKR-50	1600	50,000	50,000	50,000
	AKR-50H	1600	65,000	65,000	65,000
	AKRT-50H	2000	65,000	65,000	65,000
	AKR-75	3200	65,000	65,000	65,000
	AKR-100	4000	85,000	85,000	85,000
240	AKR-30	800	30,000	42,000	30,000
	AKR-30H	800	42,000	50,000	42,000
	AKR-50	1600	50,000	65,000	50,000
	AKR-50H	1600	65,000	65,000	65,000
	AKRT-50H	2000	65,000	65,000	65,000
	AKR-75	3200	65,000	85,000	65,000
	AKR-100	4000	85,000	130,000	85,000

TABLE 9.2 – AKRU Fused Breaker Ratings

AKRU Fused Breaker Type	Frame Size (Amperes)	Maximum AC Voltage	CLF Fuse Ratings Amperes ¹		Interrupting Rating (Amperes) Symmetrical current
			Min.	Max.	
AKRU-30	800	600	300	1600	200,000
AKRU-50	1600	600	450	2500	200,000

NOTE: AKRT-50H, AKR-75 and AKR-100 breakers are not available with integral fusing. Fuses cannot be used in series with all of these breakers, but they must be mounted in a separate switchgear compartment below the breaker compartment. CLF fuse ratings for AKRT-50H are 1000-2500 amperes; for AKR-75 are 2000-3000 amperes, and for AKR-100 are 2000-4000 amperes

¹ The maximum fuse rating is the largest fuse which tests show will result in proper performance of the breaker and fuse in combination under short circuit conditions. Only G.E. type CLF fuses should be used for proper coordination.

TABLE 9.3 – Solid State Trip Devices

Breaker Type	Frame Size (Amperes)	Overcurrent Trip Devices and Ampere Ratings	
		Fixed Sensors	Tapped Sensors
AKR-300	800	100-800 Amperes	100-800 Amperes
AKR-50	1600	300-1600 Amperes	300-1600 Amperes
AKRT-50H	2000	800-2000 Amperes	800-2000 Amperes
AKR-75	3200	1200-3200 Amperes	1200-3200 Amperes
AKR-100	4000	1600-4000 Amperes	1600-4000 Amperes

MicroVersaTrip, with its advanced solid-state circuitry, builds upon our past protection package to result in a miniaturized and standardized state of the art protection programmer.

Expanded functions, allowing increased versatility and coordination are now available in a single, self-contained programmer normally requiring no external relaying, power supply or accessories.

New and unique integral functions, such as a long-time timing light, short-time I²t switch, high range instantaneous, and zone selective interlock provide the basis for the most flexible and useful breaker design presently available anywhere.

Gold-plated surfaces on all electrical connectors and adjustments assure long-lasting and positive electrical contact.

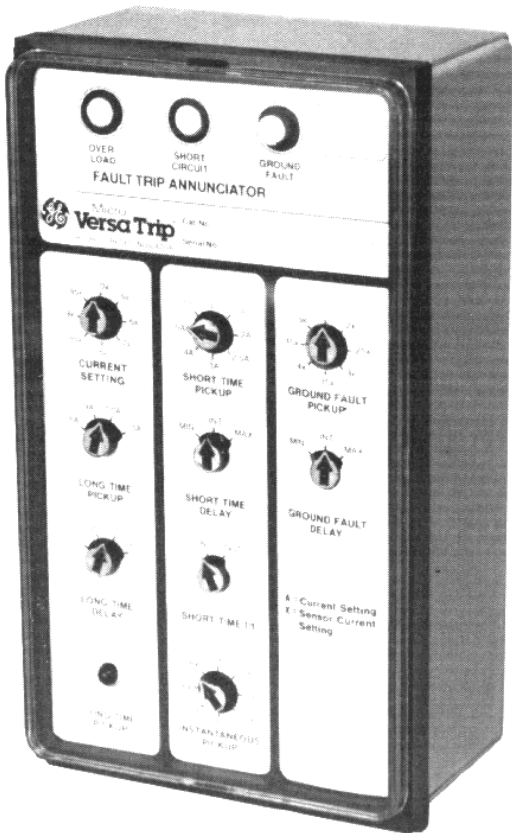
Conformal epoxy coatings

are given to each printed circuit card to prevent moisture absorption, fungus growth, and signal leakage. A metallic enclosure protects against hi-fault interruption arcs, magnetic interference, dust, and other contaminants.

Internal circuitry is designed to reduce system down time by analyzing any overcurrent fault and visually identifying its cause as an overload, short circuit, or ground fault. Both local and

AKR Breakers in AKD-8 Switchgear Use MicroVersaTrip[®] Solid-state Programmers

remote indication is available to aid in testing and identifying the existence of an overcurrent condition.



MicroVersaTrip with Fixed or Tapped Sensors for Added Flexibility

- | | |
|--------------------|---|
| STANDARD FUNCTIONS | <ul style="list-style-type: none">Adjustable current settingAdjustable long-time pickupAdjustable long-time delayLong-time timing light (local)Adjustable instantaneous pick upRemote long-time timing lightAdjustable short-time pick up and delay |
| | or |
| OPTIONAL FUNCTIONS | <ul style="list-style-type: none">Adjustable short-time pick up and delay with adjustable high range instantaneousShort-time I²t with in-out switch¹Adjustable ground fault pick up and delay³Overload and short-circuit fault indication targets for local only or local and remote indication |
| | or |
| | <ul style="list-style-type: none">Overload, short circuit, and ground fault targets for local only or local and remote indicationZone selective interlocking for short time only¹ or ground fault² only or short time and ground fault |

¹ Short time delay if required
² Ground fault required
³ Includes overload, short circuit, and ground fault targets (local)

TRIP ADJUSTMENT CHARACTERISTICS AKR WITH MICROVERSATRIP

Frame Size	Maximum Rating (Amps)	Fixed Sensors	Tapped Sensors	Current Setting (Multiple of Sensor Current Rating)	Long-time		Short-time		Adjustable Instantaneous Pickup (Multiple of Sensor Current Rating)	Short-time I ² t 1 (Seconds)	Ground Fault	
					Pickup (Multiple of Current Rating)	Delay 1 (Seconds)	Pickup (Multiple of Current Rating)	Delay 2 Seconds			Pickup (Multiple of Sensor Current Rating)	Delay 2 (Seconds)
AKR-30 AKR-30H	800	100, 150, 225, 300, 400, 600, 800	100, 150, 225, 300 or 300, 400, 600, 800	5, 6, 7, 8, 85, 9, 95, 1.0	8, 9, 1.0, 1.1	2.5, 5, 10, 21	1.5, 2, 2.5, 3, 4, 5, 7, 9	0.10, 0.22, 0.36	1.5, 2, 2.5, 3, 4, 6, 8, 10	0.4	.2, 25, 3, .35, 4, .45, 5, 6	0.10, 0.22, 0.36
AKR-50 AKR-50H	1600	300, 400, 600, 800, 1200, 1600	300, 400, 600, 800 or 600, 800, 1200, 1600	"	"	"	"	"	"	"	"	"
AKRT-50H	2000	800, 1200, 1600, 2000	800, 1200, 1600, 2000	"	"	"	"	"	"	"	"	"
AKR-75	3200	1200, 1600, 2000, 3200	1200, 1600, 2000, 3200	"	"	"	"	"	1.5, 2, 2.5, 3, 4, 5, 7, 9	"	2, 22, 24, 26, 28, 30, 34, 37	"
AKR-100	4000	1600, 2000, 3000, 4000	1600, 2000, 2000, 3200	"	"	"	"	"	"	"	2, 22, 24, 26, 28, 3	"

¹ Time delay shown at 600% of ampere setting at lower limit of each band

² Time delay shown at lower limit of each band
All pickup tolerances are ± 10%.
Ground Fault pickup not to exceed 1200 amperes

Shunt Trip

Offers remote electrical tripping of breaker. Usually controlled by a switch or pushbutton, it may also be used in conjunction with protective relays for automatic tripping.

The shunt trip coil is rated for intermittent duty. When factory installed it is supplied with a cutoff switch which automatically removes control power following a breaker trip.

Undervoltage Trip (UV)

Protects against harmful drops in line voltage by automatically tripping the breaker. This device is set to pickup at approximately 85% of bus voltage and drop out between

30% and 60%.

The UV device is also available with an optional static time-delay unit. This offers a field adjustable 2 to 6 second delay between under-voltage fault and breaker trip to prevent potential nuisance tripping due to momentary loss of voltage.

The time-delay unit is mounted external to the breaker. It is rated 125 or 250 VDC or 208/240 VAC, 50 or 60 Hz. For any other AC source voltage, a control power transformer with a 240 volt secondary rated at least 100 VA is required.

Key Interlock Provision

Prevents operation of a remote function unless the

breaker has been tripped. Provision is made to accept a lock assembly furnished by purchaser (GEE or Kirk).

Auxiliary Switch

Used for remote indication of breaker main contact position. Available in groupings of four contacts (two stages) or ten contacts (five stages). Each stage is composed of one "a" Type (N.O.) contact and one "b" Type (N.C.) contact. All contacts feature rugged double break construction.

Operations Counter

A 5-digit, non-resettable counter actuated by the breaker cam shaft. Mounts on breaker.

Type AKR Breakers

Accessories

CONTROL VOLTAGE			Shunt Trip Amperes	
Nominal		Operating Range	Inrush	Sustained
Dc	48	28-56	4.5	4.5
	125	70-140	1.9	1.9
	250	140-280	1.0	1.0
60 Hz. Ac	120	104-127	12.3	10.8
	208	175-225	3.2	2.6
	240	208-254	3.9	3.4
	480	416-508	3.4	3.1
	575	475-625	2.8	2.5

Control Voltage		UV Coil Amperes	
		Inrush	Sustained
Dc	48	0.20	0.20
	125	0.07	0.07
	250	0.04	0.04
60 Hz. Ac	120	0.66	0.24
	208	0.51	0.17
	240	0.37	0.12
	480	0.23	0.08
50 Hz. Ac	120	0.75	0.25
	208	0.30	0.10
	240	0.34	0.11
	480	0.20	0.07

CB Main Contacts	Auxiliary Switch Position	
	"a" Contact	"b" Contact
Open or Tripped	Open	Closed
Closed	Closed	Open

Control Voltage		Auxiliary Switch Interrupting Ratings (Amperes)	
		Non-Inductive	Inductive
Dc	48	25 ①	15 ①
	125	11 ①	6.3 ①
	250	2	1.8
Ac	115	75 ①	50 ①
	240	50 ①	25 ①
	480	25 ①	12 ①

① Limited to 5A continuous rating of #16 wire on drawout breakers.

Bell Alarm With Lockout

The bell alarm operates one "a" and one "b" contact; or, two "a's" or two "b's". It is activated when the breaker is tripped by any means (automatic) other than the manual trip button or the shunt trip device.

The contacts may be used for remote indication of an automatic trip.

The lockout feature is available to mechanically lock the breaker "open" when the device is activated. "Reset" is accomplished through operation of the manual trip button or shunt trip device.

The bell alarm is available without the lockout feature when so specified.

Electric Lockout

The electric lockout device provides a means of electrically interlocking breakers so

that two cannot be closed at the same time. This electro-mechanical device consists of a coil whose winding must be energized to close the breaker. Once the breaker is closed, loss of voltage will not trip the breaker. A bypass interlock is provided for initial startup. Refer to the UV device for ratings and coil characteristics.

Auxiliary switches for cross-interlocking breakers must be ordered separately.

MicroVersaTrip Test Set Cat. No. TVTS1

A portable instrument for field checking the performance of MicroVersaTrip solid-state trip devices.

Verifies the following:

- Pick-up calibrations and time-delay; characteristics of various trip elements;
- Ability of the flux-shift trip device to trip the breaker;

- Target indicator operation;
- Phase sensor continuity.

Required input: 105-125V ac 50/60Hz.

Remote Close Solenoid for Manually-Operated AKR-30, 50, AKRT-50H Breakers

Provides a means to electrically close the above breakers from a remote location. May be controlled by a switch or pushbutton for five-cycle closing. Breaker must be charged locally. Available ratings:

Control Voltage		Amperes	
		Inrush	Sus-tained
Dc	48	2.7	0.58
	125	1.3	0.32
	250	0.68	0.15
60 Hz. Ac	120	2	0.4
	240	1	0.2

Type AKR Breakers

Accessories

Control Voltage		Bell Alarm Contact Ratings (amperes)	
		Inrush	Contin-uous
Dc	48	2.5	10 ①
	125	2.5	2.5
	250	0.9	0.9
60 Hz. Ac	120	30 ①	10 ①
	240	15 ①	5
	480	7 ①	3

① Limited to 5A continuous rating of #16 wire on drawout breakers

Closing Mechanism Operating Amperes

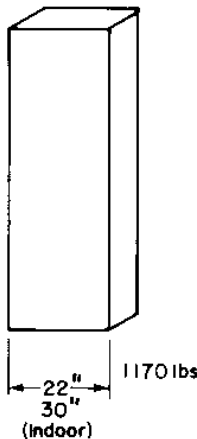
Breaker Frame	120 Volt, 60 Hz (Operating Range 104-127 VAC)			240 Volt, 60 Hz (Operating Range 208-254 VAC)			125 Volt, Dc (Operating Range 100-140 VDC)			250 Volt, Dc (Operating Range 200-280 VDC)		
	Inrush	Sus-tained	Recom-mended Fuse Size	Inrush	Sus-tained	Recom-mended Fuse Size	Inrush	Sus-tained	Recom-mended Fuse Size	Inrush	Sus-tained	Recom-mended Fuse Size
AKR-30 AKR-50 AKRT-50	25	5	6	12	3	6	27	5	6	13	3	6
AKR-75 AKR-100	25	8.1	10	12	3.5	10	27	7	10	13	3.2	10

Typical Dimensions Type AKD-8 Switchgear Sections

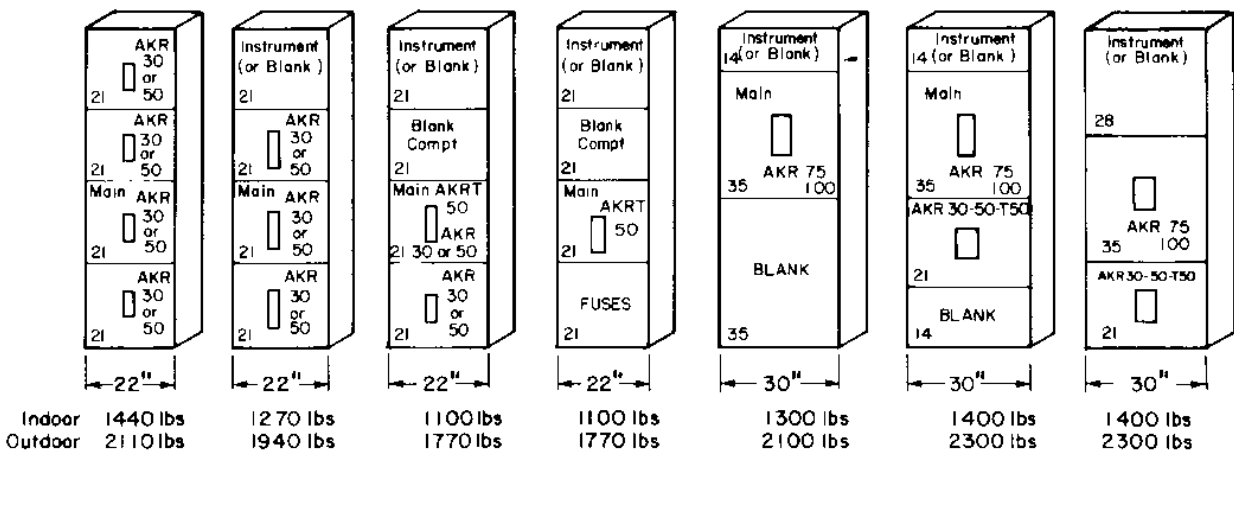
Shortest possible
shipment assured
when you select from
these standard
arrangements

Auxiliary Section

1. Transition to transformer
2. Cable or busway entrance unit for free standing switchgear equipment.

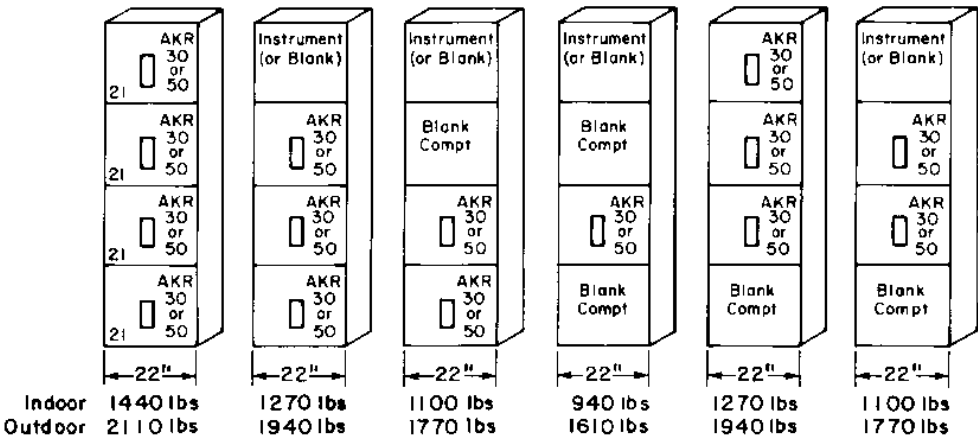


Main Breaker Sections

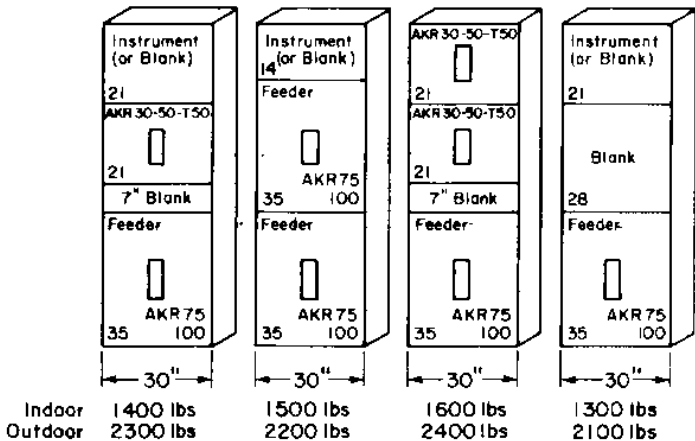


Feeder Breaker Sections (Combinations)

FOR AKR-30, AKR-50



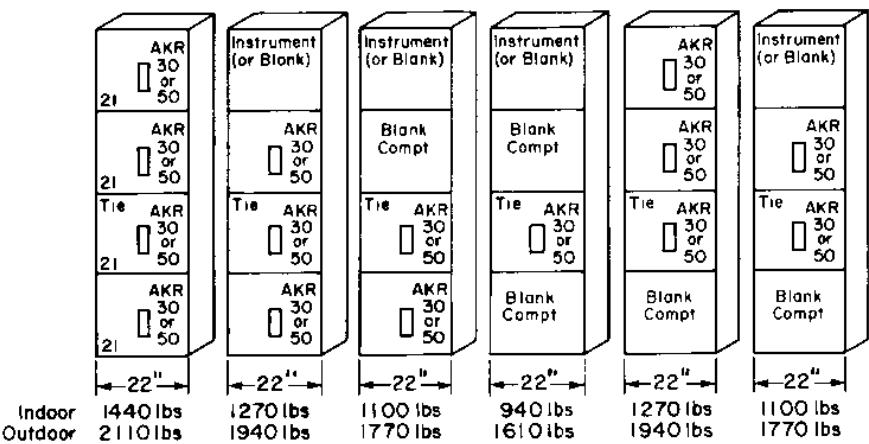
FOR AKR-30, AKR-50 AKRT-50, AKR-75



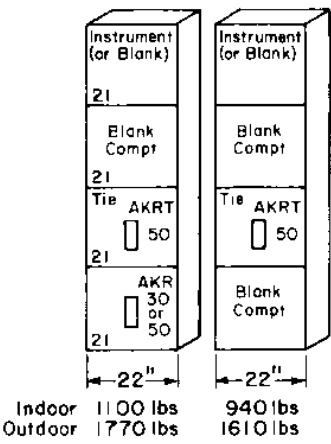
Typical
Dimensions
Type AKD-8
Switchgear
Sections

Tie Breaker Sections (Combinations)

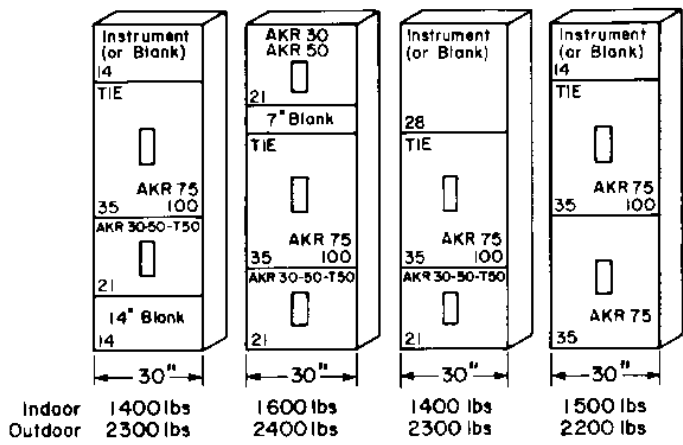
FOR AKR-30, AKR-50



FOR AKR-30, AKR-50
AKRT-50



FOR AKR-30, AKR-50
AKRT-50, AKR-75



BREAKER WEIGHTS
(Add to unit weights on pages 18 and 19)

	Type	AKR-30	AKR-50	AKRT-50	AKR-75	AKR-100
Operation	Manual	200	210	220	420	495
	Electrical	205	215	225	480	555

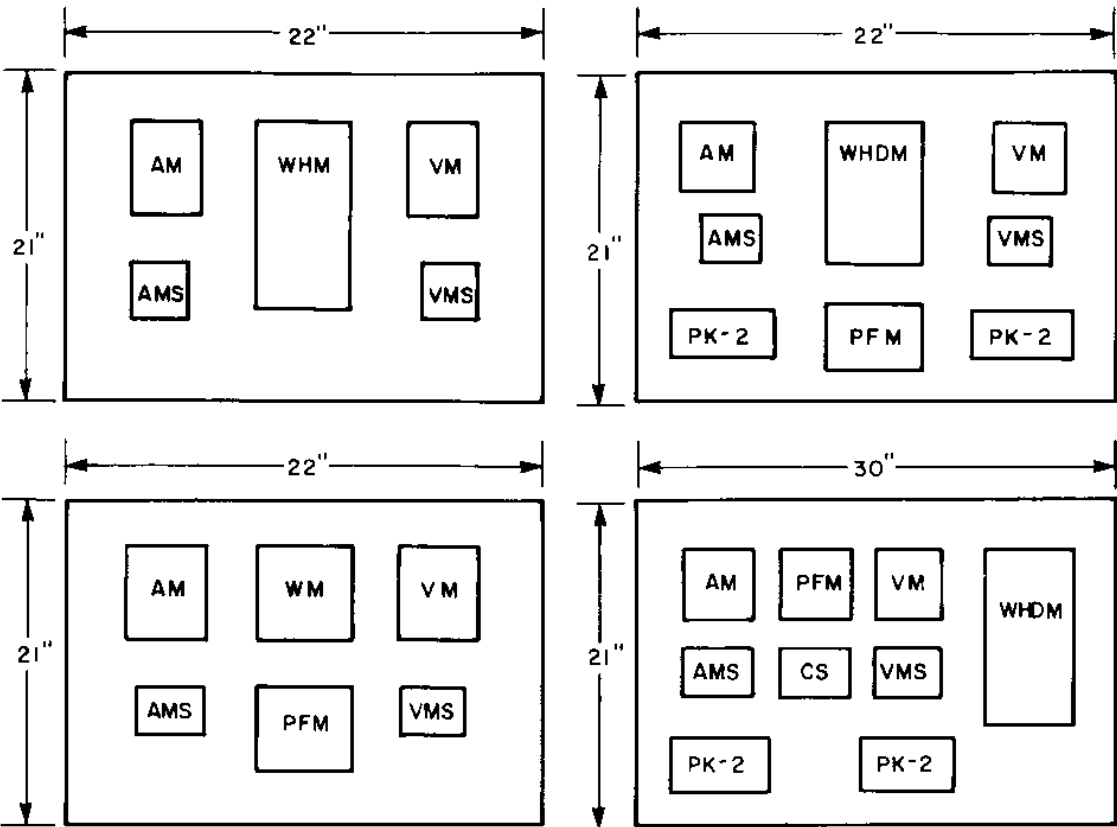
FUSED ROLLOUT WEIGHTS

	Type	AKRU-30	AKRU-50	4000A. Fused Rollout For Use With AKR-75 BKR (Bkr. In Separate Comp't)	4000A. Fuse Rollout For Use With AKR-100 BKR (Bkr. In Separate Comp't)	2000A. Fuse Rollout For Use With AKRT-50 BKR (Bkr. In Separate Comp't)
Operation	Manual	245	253	300 ①	400 ①	250 ①
	Electrical	250	260			

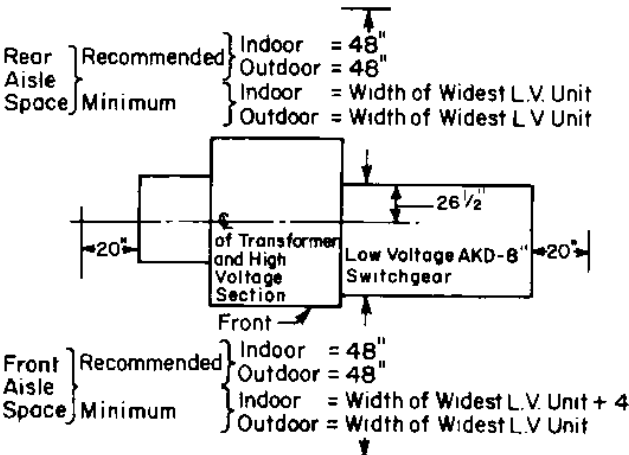
① Add breaker weight from table above.

Typical Dimensions Type AKD-8 Switchgear Sections

Standard Instrument Panel Arrangements



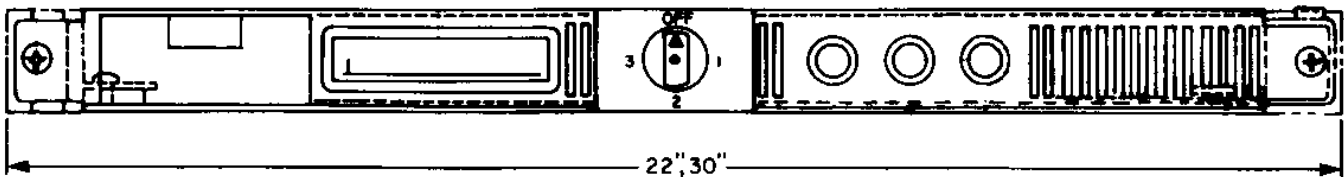
Typical Floor Plan



The following devices are most generally used:

- 1 — Ammeter
- 1 — Voltmeter
- 1 — Ammeter transfer switch
- 1 — Voltmeter transfer switch
- 1 — Watthour meter (2 or 3 element)
- 1 — WHM demand attachment
- 1 — Power factor meter
- 1 — Current test block
- 1 — Voltage Test block
- 1 — Breaker control switch

Standard Instrument Tray Arrangements



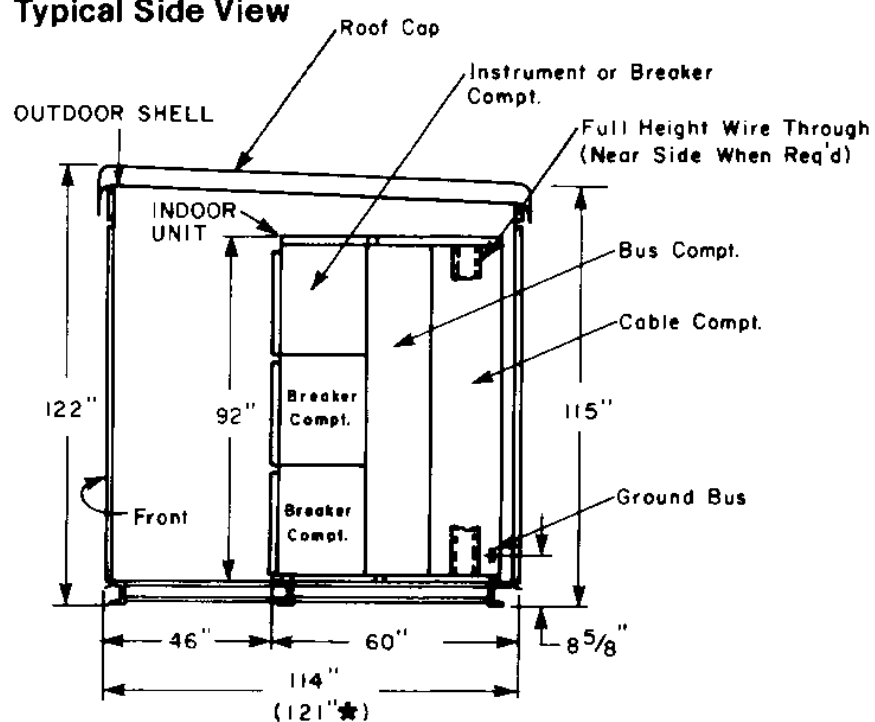
Any instrument tray may be equipped with an ammeter and three-phase transfer switch. Red and green close and trip indication lights are also available. A cardholder is included.

Indoor Sections



Indoor equipment is furnished without channels, and outdoor equipment has a built-in floor frame. Embedded channels should be set level with each other, and should be level over their entire length. Center channel must be supported 1/4 in. thick formed channels are recommended for leveling purposes. Finished floor should have slight pitch away from mounting channels, and in no case should the finished pad be higher than the mounting channels.

Outdoor Sections



* 67" = AKRU

Pioneered by General Electric, Load Center Unit substations are the best equipment available to insure dependable power distribution in industrial plants and commercial buildings, and to supply power station auxiliaries and other applications requiring continuity of service.

General Electric offers a complete line of Load Center Unit Substations for indoor or outdoor installations. They consist of an incoming line section, a transformer section and a low voltage switchgear section and are handled as a single packaged unit simplifying engineering coordination and application.

Standard designs free you from unnecessary purchasing and engineering details. Factory assembly reduces installation time and cost.

Mechanical and electrical coordination results in greater reliability. Expert field engineering is available to further assure proper application, installation and operation.

Your investment in GE Load Center Unit Substations featuring AKD-8 switchgear is an investment in dependable electrical power distribution for growth and profit today and tomorrow.

How to Select Switchgear

The application tables on the following pages list the proper low voltage power circuit breakers for load center applications. The power circuit breakers have been coordinated with transformer and system capacities—electrically, thermally, and mechanically. For additional details on motor starting and dc machine circuit applications, fused breakers, over-current trip details, etc., refer to ANSI C37. 13-1973, and ANSI C37. 16-1973, for short circuit ratings and analysis procedures.

Basis for Application Tables

Application tables are based on the following:

1. A three-phase bolted fault at the low-voltage terminals of the substation;
2. Transformer impedances listed in table;
3. Only source of power to the secondary is the substation transformer;
4. Total connected motor kva does not exceed 50 percent of transformer rating at 208Y/120-volts and 100 percent of transformer rating at 240-, 480-, and 600-volts;
5. The motor contribution is taken as 2.0 times the rated current of the transformer at 208Y/120 volts and 4.0 times the rated current at 240, 480 and 600 volts;
6. Tabulated values of short-circuit current are in terms of rms symmetrical current per NEMA Standard SG-3.

These tables should be used only as guidelines, taking into consideration voltage, temperature, power factor, altitude, and other service conditions that may affect application to a particular power system. For instance, under certain circuit arrangements, the total running motor short-circuit current contribution may be greater than that shown in the motor contribution tables. This condition might exist for unit substations having a high ratio of running motor nameplate horsepower to actual demand, such as may occur in heavy machining or stamping press operations found in industrial plants. This condition also could exist when a secondary selective system operates with one main breaker open, and one main and one tie breaker closed so that the feeder breakers can see "twice" the normal motor contribution to a short circuit.

For these types of systems, the use of higher-rated or AKRU fused circuit breakers may be required to stay within the short-circuit rating of the feeder breaker.

Power circuit breakers are available with various com-

binations of long-time delay, short-time delay, and instantaneous trip elements. Care should be taken to specify the combination of trips which will provide the balance of selectivity and protection required by the power system.

A *selectively coordinated* substation uses main and tie breakers with long-time and short-time trip characteristics (LS) to delay the opening of the main circuit breaker until the faulted feeder has had an opportunity to clear. This provides service continuity for all but the faulted circuit and generally allows coordination of main and tie breakers with the various trip characteristics (LS) (LSI) (LI) available on feeder circuit breakers.

Selectivity may be carried a step further in the substation by specifying selective feeder circuit breakers that incorporate long-time, short-time, and high range instantaneous (LSI) to allow downstream devices to clear faults within their area.

A refinement of the selective feeder incorporates the long-time short-time, and instantaneous characteristics (LSI) to provide selectivity without sacrificing instant-

The Load Center Principle

neous fault protection at high short-circuit currents. This combination of trip characteristics permits application of short-time delay trips to override inrush currents to downstream loads and coordinate with downstream devices for lower fault current values, yet also permits the use of instantaneous trips to provide maximum system protection for high values of fault current. This is called the *Zone-Selective* arrangement and is often desirable when the load-center feeder serves a motor control center or other large load. This system can afford the best feeder protection in many instances.

Long-time and instantaneous trip characteristics (LI) are often used on feeder breakers when short-time delay is not required to coordinate with downstream devices. Depending on the magnitude of fault current and the circuit impedance between breakers, a feeder breaker with LI trips may also be able to coordinate (at least partially) with a similar downstream breaker also having LI trip characteristics. Breakers with LI trips are sometimes referred to as *fully rated* since

Example for Application Table

The application tables make it easy to select the proper General Electric breakers for use with distribution systems using various trip devices.

For example, a 1500-kVA transformer, with 750-MVA maximum primary short-circuit available and a 480-volt secondary, requires, as minimum, an AKRT-50 H main secondary breaker shown in column 7 of the 480-volt application table. Full utilization of a load center transformer with dual temperature rise (such as 55/65° C) capability or forced (fan) cooling capability would require a larger frame size breaker—or an AKR-75 in this example.

The appropriate feeder circuit breaker is found in columns 8, 9, or 10, depending on the combination of long-time, short-time, and instantaneous trips required by the system design. In this example, the same type breakers (AKR-30H) are required regardless of the type of trip device utilized, although a larger frame breaker may be required in order to meet the continuous load requirement of a particular feeder.

these breakers may have higher interrupting capabilities when provided with instantaneous trips (LI or LSI characteristics). The majority of the breakers manufactured today, however, have the same interrupting rating regardless of the trip characteristic.

Long-time and instantaneous trips (LI) could also be used on main breakers when minimum breaker interrupting time is required for the rare occurrence of a fault on the switchgear main bus or when the system design does not require selective coordination.

**Typical Dimensions
Type AKD-8
Switchgear
Sections**

Application Table
480 volts, three phase

						Main	Feeder Circuit Breakers			
						Fully Rated or Selective	Selective	Zone Selective	Fully Rated	
						LI			LI	
						LS	LS	LS	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI	LSI	LSI	LI	
						LSI				

Application Table
240 volts, three phase

						<table><tr><th>Main</th><th colspan="3">Feeder Circuit Breakers</th></tr><tr><th>Fully Rated or Selective</th><th>Selective</th><th>Zone Selective</th><th>Fully Rated</th></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td colspan="4"></td></tr></table>				Main	Feeder Circuit Breakers			Fully Rated or Selective	Selective	Zone Selective	Fully Rated								
Main	Feeder Circuit Breakers																								
Fully Rated or Selective	Selective	Zone Selective	Fully Rated																						
Transformer Rating 3-phase kVA and Impedance Percent	Maximum Short-circuit MVA Available From Primary System	Full load Continuous Current (amperes) 	Short-circuit Rating Symmetrical current (amperes)			Long-time Instantaneous or Long-time Short-time	Long-time Short-time	Long-time Short-time Instantaneous	Long-time Instantaneous																
			Trans- former Alone	100% Motor Load	Combined	Minimum Rating Breaker																			
						Breaker	Breaker	Breaker	Breaker																
1	2	3	4	5	6	7	8	9	10																
300 4 5% ②	50	722	14200	2900	17100	AKR-30	AKR-30	AKR-30	AKR-30																
	100		15200		17900																				
	150		15400		18300																				
	250		15600		18500																				
	500		15800		18700																				
	750		15900		18800																				
500 4 5% ②	Unlimited		16000		18900																				
	50		21900		26700																				
	100		24000		28800																				
	150		24900		29700																				
	250	1203	25600	4800	30400	AKR-50	AKR-30H	AKR-30	AKR-30																
	500		26100		30900																				
750	26300		31100																						
Unlimited	26700		31500																						
50	24900		32100																						
100	27800		35000																						
750 5 75% ②	150		28900		36100																				
	250		29800		37000	AKRT-50	AKR-30H	AKR-30	AKR-30																
	500	30600	37800																						
	750	30800	38000																						
	Unlimited	31400	38600																						
	50	31100	40700																						
100	35700	45300																							
1000 5 75% ②	150		37500		47100	AKR-75	AKR-50	AKR-30H	AKR-30H																
	250		39100		48700																				
	500		40500		50100																				
	750		41000		50600																				
	Unlimited		41900		51500																				
	50		41300		55700																				
1500 5 75% ②	100		49800		64200	AKR-100	AKR-50H	AKR-50	AKR-50																
	150		53500		67900																				
	250		56900		71300																				
	500		59700		74100																				
	750		60600		75000																				
	Unlimited		62800		77200																				

Application Table
208 volts, three phase

						Main	Feeder Circuit Breakers		
						Fully Rated or Selective	Selective	Zone Selective	Fully Rated
 Fully Rated Arrangement									
						 Selectively Coordinated Arrangements			
Transformer Rating 3-phase kVA and Impedance Percent	Maximum Short-circuit Mva Available From Primary System	Full load Continuous Current (amperes) ①	Short-circuit Rating Symmetrical current (amperes)			Long-time Instantaneous or Long-time Short-time	Long-time Short-time	Long-time Short-time Instantaneous	Long-time Instantaneous
			Transformer Alone	50% Motor Load	Combined				
			Minimum Rating Breaker						
1	2	3	4	5	6	Breaker	Breaker	Breaker	Breaker
300 4.5%②	50	833	16300	1700	18000	AKR-50	AKR-30	AKR-30	AKR-30
	100		17300		19000				
	150		17700		19400				
	250		18000		19700				
	500		18300		20000				
500 4.5%②	750	1388	18400	2800	20100	AKR-50	AKR-30H	AKR-30	AKR-30
	Unlimited		18500		20200				
	50		25300		28000				
	100		27800		29600				
	150		28700		31500				
750 5.75%	250	2080	29500	4200	32300	AKR-75	AKR-30H	AKR-30	AKR-30
	500		30200		33000				
	750		30400		33200				
	Unlimited		30800		33600				
	50		35800		41400				
1000 5.75%	100	2780	41100	5600	46700	AKR-75	AKR-30H	AKR-30	AKR-30H
	150		43200		48800				
	250		45100		50700				
	500		46600		52200				
	750		47300		52900				
1500 5.75%	Unlimited	4160	48200	8300	52800	No main breaker available	AKR-50H	AKR-50	AKR-50
	50		47600		55900				
	100		57500		65800				
	150		61700		70000				
	250		65600		73900				
500	68800	77100							
750	69900	78200							
Unlimited	72400	80700							

NOTES

- ① With transformer operating on base temperature rise, without fans. Larger frame size main breaker may be required when dual temperature rise or forced cooled transformers are utilized.
- ② Minimum impedance.

- L = Long-time delay trip (overload tripping).
S = Short-time delay trip (selective fault tripping).
I = Instantaneous trip (high fault current fast tripping).
I_H = High range instantaneous permits a fully selective system, plus a fully rated system.

Application Table
600 volts, three phase

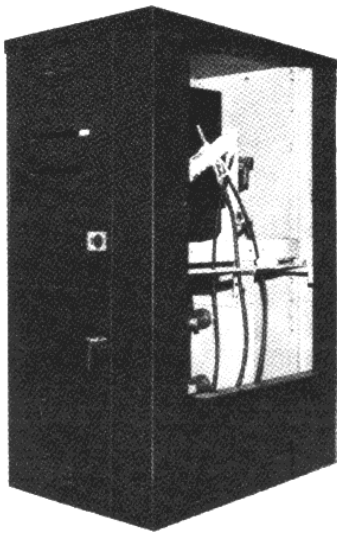
						Main	Feeder Circuit Breakers			
						Fully Rated or Selective	Selective	Zone Selective	Fully Rated	
Transformer Rating 3-phase kVA and Impedance Percent	Maximum Short- circuit Mva Available From Primary System	Full load Continuous Current (amperes) ①	Short-circuit Rating Symmetrical Current (amperes)			Long-time instantaneous or Long-time Short-time	Long-time Short-time	Long-time Short-time Instantaneous	Long-time Instantaneous	
			Trans- former Alone	100% Motor Load	Combined					
										Minimum Rating Breaker
						Breaker	Breaker	Breaker	Breaker	
1	2	3	4	5	6	7	8	9	10	
300 4 5%	50	289	5700	1200	6900	AKR-30	AKR-30	AKR-30	AKR-30	
	100		6000		7200					
	150		6100		7300					
	250		6200		7400					
	500		6300		7500					
750	6400	7600								
Unlimited	6400	7600								
500 4.5% ②	50	481	8700	1900	10600	AKR-30	AKR-30	AKR-30	AKR-30	
	100		9600		11500					
	150		10000		11900					
	250		10200		12100					
	500		10500		12400					
750	10500	12400								
Unlimited	10700	12600								
750 5 75%	50	722	9900	2900	12800	AKR-30	AKR-30	AKR-30	AKR-30	
	100		11100		14000					
	150		11500		14400					
	250		11900		14800					
	500		12200		15100					
750	12300	15200								
Unlimited	12500	15400								
1000 5 75%	50	962	12500	3800	16300	AKR-50	AKR-30	AKR-30	AKR-30	
	100		14300		18100					
	150		15000		18800					
	250		15700		19500					
	500		16200		20000					
750	16400	20200								
Unlimited	16800	20600								
1500 5 75%	50	1444	16500	5800	22300	AKR-50	AKR-30	AKR-30	AKR-30	
	100		19900		25700					
	150		21400		27200					
	250		22700		28500					
	500		23800		29600					
750	24200	30000								
2000 5 75%	Unlimited	1924	25100	7700	30900	AKRT-50	AKR-30H AKR-30	AKR-30H AKR-30	AKR-30H AKR-30	
	50		19700		27400					
	100		24800		32500					
	150		27200		34900					
	250		29400		37100					
500	31200	38900								
750	32000	39700								
Unlimited	33500	41200								
2500 5 75%	50	2406	22400	9600	32000	AKR-75	AKR-30H	AKR-30H	AKR-30H	
	100		29200		38800					
	150		32400		42000					
	250		35700		45300					
	500		38500		48100					
750	39600	49200								
3000 5 75%	Unlimited	2886	41900	11500	51500	AKR-75	AKR-50H AKR-75 AKR-30H	AKR-50H AKR-75 AKR-30H	AKR-50H AKR-75 AKR-30H	
	50		24600		36100					
	100		33000		44500					
	150		37300		48800					
	250		41600		53100					
500	45500	57000								
750	47000	58500								
Unlimited	50200	61700								

**Air-Filled
Terminal
Compartment**

This is a simple metal enclosure to safeguard personnel when the substation is connected directly to the incoming high-voltage line. It can be supplied with either clamp-type terminals or pot-heads to terminate the incoming-line cables. The low cost of this section makes it ideal when over-current protection is provided elsewhere.

The compartment is suitable for single or loop feed and for either top or bottom cable entrance. A bolted-on end panel gives easy access to the cable fittings.

Pothoods can be supplied with special fittings such as wiping sleeves, stuffing boxes, armor clamps, or conduit couplings for any of the common types of cable.

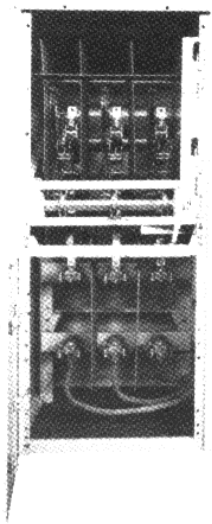
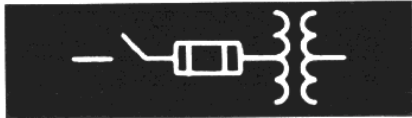


**Air-Interrupter Switches
Two-position Air-
interrupter Switch**

This switch consists of a two-position (OPEN/CLOSED), three-pole mechanism. All three poles are operated simultaneously by a removable handle on the front on the switch compartment. A mechanical position indicator is included.

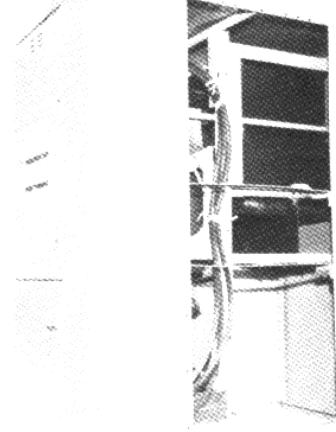
**Air-interrupter
Selector Switch**

Where there are two separate incoming lines, the interrupter selector switch gives



three positions (LINE 1/ OPEN/LINE 2). This gives continuity of service by allowing the operator to switch from one incoming line to the other in case primary feed fails, or to the OPEN position for planned maintenance.

The unit consists of a two-position (OPEN/CLOSED) air-interrupter switch in series with a two-position (LINE 1/ LINE 2) selector switch. The selector switch is a dead-break device and is mechanically interlocked so it cannot be operated unless the interrupter switch is open.



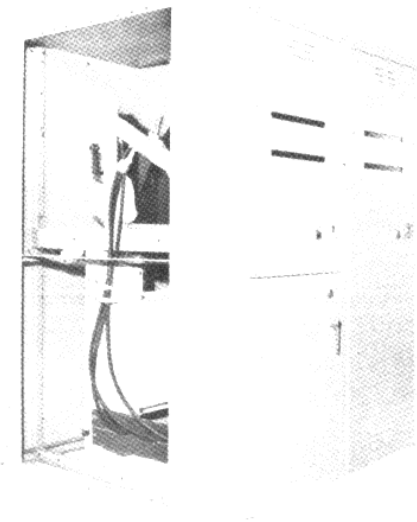
**AKD-8
Low Voltage
Switchgear**

**Load Center
Unit Substations
Incoming Line
Equipment**

**Double Air-
interrupter Switch**

This three-position (LINE 1/OPEN/LINE 2) switch is also used where there are two separate incoming lines, and allows the operator to switch from one line to the other, or to OPEN for planned maintenance.

The double switch has the advantage of isolating the two lines, permitting maintenance of one line while the other line is energized and reducing the probability of fault transfer from one cable to the other. This is accomplished by using two two-position (OPEN/CLOSED) air-interrupter switches, key-interlocked so both incoming line switches cannot be closed at the same time.



VaporTran

The VaporTran transformer is the answer to the need for a truly non-flammable, yet economical transformer.

The VaporTran transformer uses the pool-boiling technique which allows the core and coil to always be totally immersed in dielectric fluid similar to a conventional liquid unit. This compatibility enables the VaporTran transformer to incorporate General Electric's proven core and coil technology.

The insulating fluid is a fully halogenated halocarbon with the chemical name, trichlorotrifluoroethane, familiarly known as R-113. It is currently used industrially in a variety of applications—most notably as a cleaning agent and refrigerant.

R-113 is non-flammable, therefore meeting the fire safety requirements in paragraph 450-23 of the National Electric Code and OSHA Directive 100-54. It is considered superior to the liquids currently offered for non-flammable transformer applications because those liquids all have definite fire and flash points, usually in excess of 300 C.

R-113 is processed to meet General Electric's dielectric specifications after it arrives at the plant in Rome. It has been thoroughly tested and has proven compatibility with standard insulation materials.

Core-and-Coil Construction Features

All General Electric transformers are built with rectangular windings and core. The rectangular core-and-coil construction reduces the size which results in savings in weight and floor space.

First, the low-voltage coils are wound on a rectangular form which simulates the rectangular core leg and serves as the main support for all the windings. These coils are of sheet winding construction using strip conductors. An

adhesive-coated electrical-grade paper is used as the insulation between each low-voltage turn.

The high-voltage coils are wound, under tension, over the low-voltage coils and are of layer-wound construction using film-insulated wire. Film-insulated wire is used because it is less bulky than paper, has higher dielectric strength on a volts-per-mil basis, and does not tend to split or crack when small radius bends are made. To provide insulation between each layer in the high-voltage windings, an electrical-grade adhesive-coated paper is used.

After completing the winding process the high- and low-voltage coils are clamped to the desired dimensions. They are then oven baked at a temperature which causes the adhesive coating on the paper to bond the adjacent conductors and wires together. The result is a winding structure which has short-circuit strength and high electrical stress withstand capability.

Liquid-Filled

Liquid-filled transformers are available with two types of dielectric fluid, 10-C* or 10CA oil, and silicone-liquid. Both types are enclosed in sealed tanks to keep the internal elements free from dirt, moisture, and corrosive atmospheres.

Silicone-Filled

The silicone fluid selected for use in General Electric transformers is a clear, water-white liquid silicone polymer (polydimethylsiloxane) that has been specially processed to meet exacting dielectric specifications. To obtain an optimum combination of heat transfer and fire resistant properties, the transformer silicone fluid has a viscosity of 50 centistokes at 25 C. This fluid has a minimum fire point of 300 C and oxygen index of 21.

The silicone fluid that we

are using meets paragraph 450-23 (High Fire Point — Insulated Transformers) of the 1978 National Electric Code. OSHA by its Program Directive 100-68 permits the use of silicone transformers as equivalent to askarel transformers in its enforcement of the National Electric Code.

Transformer silicone fluid has suitable dielectric characteristics, is compatible with other materials used in construction of transformers, and has shown good thermal stability in accelerated aging tests with transformer materials.

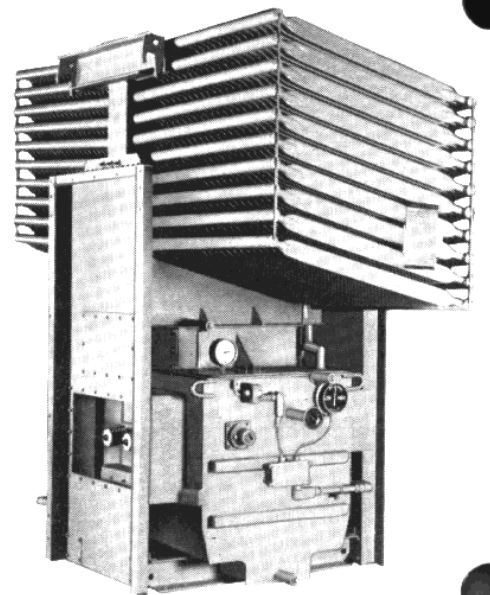
Oil-Filled

The oil-filled unit is the least expensive transformer, and is suitable for mounting outdoors or indoors enclosed in a vault.

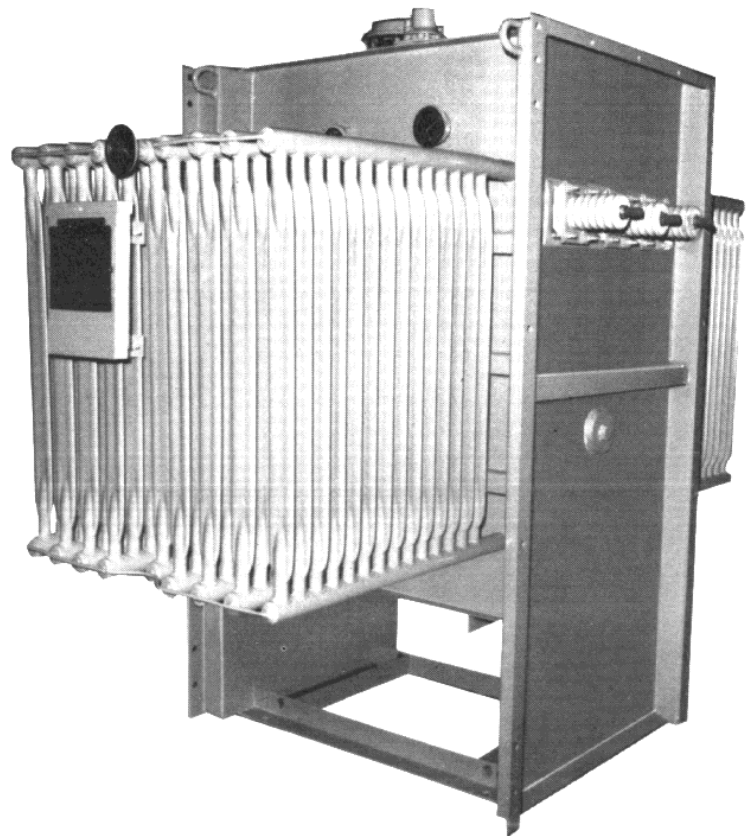
The 10-C oil used in General Electric transformers has high dielectric strength, is free from impurities, is durable and has a high flash point. These features make it an excellent insulating liquid. 10-C oil is described in detail in bulletin GEA-4937F.

AKD-8 Low Voltage Switchgear

Load Center Unit Substations Transformers



Vapor Tran® Transformer



Liquid-Filled Transformer

How to Use

The guide form specifications on these pages may be used to prepare bid specifications for AKD-8 load center unit substations or for free-standing draw out switchgear only. When optional ratings and features are available the choice can be made by crossing out appropriate words in brackets or italics, filling in quantities and ratings, and selecting appropriate paragraphs.

General

Each [load center unit substation] [low voltage switchgear equipment] shall be designed, tested, and assembled in accordance with the applicable standards of ANSI and NEMA and shall be complete from the incoming line termination to the out-going feeder terminals. The control side of the switchgear [and the nameplate side of the transformer] shall be the front of the substation.

General Arrangement

These specifications cover a complete [indoor] [outdoor] [load-center unit substation] [low-voltage switchgear equipment.] The unit shall be arranged as indicated on [drawing] [sketch] number [] and shall consist of

Select as Required

Incoming line section with [] primary circuits
Transforming section with [] transformer sections
Low-voltage section with [] switchgear sections

Incoming Line Section

• Air Terminal Compartment

1—Air-filled terminal compartment mounted integral

with the transformers with (pothead) (set of clamp-type terminals) for a quantity of . . . (single-conductor) (three-conductor) (lead) (rubber covered) cable(s) . . . size (MCM) (AWG) entering from (below) (above).

3—(Station) (Intermediate) (Distribution) class, . . . kV surge arresters mounted inside terminal compartment.

• Air Switch

1—Two-position: open-close, three-pole, gang-operated, air-interrupter switch with stored-energy operating mechanism rated (5) (15) kV, (600 amps continuous, 40,000 amps asymmetrical momentary) (1200 amps continuous, 60,000 amps asymmetrical momentary), 600 amps load interrupting. (Key interlocking with low-voltage main breaker is required.)

3—Power fuses (GE Type EJ) (S&C Type SM4S) (S&C Type SM5S) are to be mounted in separate compartment within the switch unit accessible through a hinged door mechanically interlocked with interrupter switch. Fuses shall be rated . . . amperes and applied on circuit having short-circuit capacity of . . . kVA (symmetrical) at . . . volts. (Pothead) (Set of clamp-type terminals) for a quantity of . . . (single) (three) conductor (lead) (rubber-covered) cable(s) . . . size (MCM) (AWG) entering from (below) (above).

3—(Station) (Intermediate) (Distribution) class, . . . kV surge arresters are to be mounted inside the incoming-line compartment.

• Air-interrupter Switch

1—Air-interrupter, three-pole, gang-operated, selector switch rated (5) (15) kV, 600 amps continuous and load interrupting rating 40,000 amps

asymmetrical momentary. It will consist of a two-position: open-close air switch with stored-energy mechanism in series with a two-position, line 1—line 2, dead-break switch. The two switches are to be mechanically interlocked so that the open-close interrupter switch must be in the open position before the line 1—line 2, dead-break switch can be operated. (Key interlocking of the interrupter switch with low breakers is required.)

3—Power fuses (GE Type EJ) (S&C Type SM4S) (S&C Type SM5S) are to be mounted in separate compartment within the switch unit accessible through a hinged door mechanically interlocked with interrupter switch. Fuses shall be rated . . . amperes and applied on a circuit having short-circuit capacity of . . . kVA (symmetrical) at . . . volts. (Pothead) (Set of clamp-type terminals) for a quantity of . . . (single-) (three-) conductor (lead) (Rubber covered) cable(s) . . . size (MCM) (AWG) entering from (below) (above).

3—(Station) (Intermediate) (Distribution) class . . . kV surge arresters are to be mounted inside the compartment and are to be connected to the bus between the two switches.

• Double Air-interrupter Switch

1—Double air-interrupter switch rated (5) (15) kV, (600 amps continuous, 40,000 amps asymmetrical momentary) (1200 amps continuous, 60,000 amps asymmetrical momentary), 600 amperes loading interrupting. The equipment will consist of 2—two-position: open-close, three-pole, gang-operated, air interrupter switches, equipped with stored-energy mechanisms, which are connected to a common load-side

Guide Form Specifications

bus. The switches will be keyed interlocked so that only one switch can be in the closed position.

3—Power fuses (GE Type EJ) (S&C Type SM4S) (S&C Type SM5S) will be mounted in a separate compartment within the switch unit accessible through a hinged door that is key interlocked so that both switches must be in the open position before the door can be opened. Fuses shall be rated . . . amperes and are to be connected to the load-side switch bus. The incoming circuit has a short-circuit capacity of . . . kVA symmetrical at . . . volts. (Pothead) (set of clamp-type terminals) for a quantity of . . . (single-) (three-) conductor (lead) (rubber-covered) cable(s) . . . size (MCM) (AWG) entering from (below) (above) each switch.

3—(Station) (Intermediate) (Distribution) class . . . kV surge arresters are to be mounted inside the compartment and are to be connected to the common bus between the switches and power fuses.

VaporTran

The transformer will be insulated with a nonflammable halogenated halocarbon and will be vaporization cooled. Ratings: . . . kVA, three-phase, 60 Hertz, . . . volt delta primary, . . . volt (wye) (delta) secondary.

The high-voltage winding BIL will be (95) (75) (60) (45) kV; the low-voltage winding BIL will be 30 kV. Transformer impedance will be 5.75% (8% is an optional standard at 1000 kVA).

The transformer shall have four approximately 2½% rated kVA taps, two above and two below rated primary voltage. Taps shall be brought to an externally operated manual tap changer for operation only when the transformer is de-energized.

The sound level will be same as those listed in the NEMA Standards for oil-insulated transformers.

(Fans) (provision for the future addition of cooling fans) shall be supplied to provide an additional rating of 150% of the self-cooled rating when operating in a 30 C ambient.

Standard Accessories

Liquid-level gage with alarm contacts
Pressure-vacuum gage
Dial-type thermometer
Pressure relief device
Pressure switch with contacts
Tap changer for de-energized operation
Filling valve
Drain valve
Grounding pads
Lifting lugs for lifting complete unit
Provision for skidding, rolling, or jacking
Diagrammatic nameplate

Liquid-Filled Transformers

The transformer section shall be designed and built in accordance with the latest applicable NEMA Standards. It shall be (oil-filled) (silicone-filled), self-cooled (with fans) and rated: OA(/FA)-60- Hertz- . . . kVA (65C) (55/65C)- . . . volts delta primary- . . . volts (wye) (delta) secondary. Impedance, sound level and voltage connections will be in accordance with NEMA Standards.

The transformer shall have four approximately 2½-per-cent rated kVA taps, two above and two below rated primary voltage. These taps shall be available by means of an externally operated manual tap changer for operation only when transformer is de-energized. Provision for padlocking the tap changer is required.

Standard Accessories

Diagrammatic nameplate
Liquid level guage with alarm contacts
Dial-type thermometer (with alarm contacts)
Pressure-vacuum gage
Provision for lifting and jacking
Base suitable for skidding and rolling in any direction
Hand hole on cover
Drain valve and sampling device
Top filling connection
Ground pad on low end of tank

Optional Accessories

Fans for auxiliary cooling mounted on tubes
Pressure-relief device*
Fault-pressure relay
Winding temperature indicator

*Standard on silicone transformer.

Dry Type

The transformer section shall be designed and built in accordance with the latest applicable NEMA Standards. It shall be ventilated dry type self-cooled (with fans) and rated:

AA (/FA), 60 Hertz, . . . kVA 150C (115C) (80C), . . . volts delta primary, . . . volts (wye) (delta) secondary. Impedance, sound level and voltage connections will be in accordance with NEMA Standards. The transformer shall have four approximately 2½ per-cent rated kVA taps, two above and two below rated primary voltage. These taps shall be available by means of an internal terminal board located behind a removable plate on the side of the transformer case and are to be changed only when the transformer is de-energized.

Standard Accessories

Diagrammatic nameplate
Ventilating louvers
Removable side sheets
Vibration-isolating pads
Provision for lifting
Provision for jacking
Base suitable for rolling or skidding
Ground pad on LV end of enclosure

Optional Accessories

Fans for auxiliary cooling mounted inside enclosure
Overload indicator (with alarm contacts)

Guide Form Specifications

Transforming Section

Select one for each primary circuit

Test Requirements

The transformer core and coils shall be designed and built to meet the requirements of "Distribution and Power Transformer Short-circuit Test Code" ANSI C57.12.90a—IEEE 262A-1974. Each bidder shall submit to the engineer for his review and approval a complete listing of all full-size transformers of his manufacture within the rating category covered by these specifications.

Each transformer will receive all standard commercial tests in accordance with ANSI C57.12.90. [In addition, the following special tests will be performed on each transformer in accordance with applicable ANSI Standards—(impulse test on high-voltage winding) (sound level test) (temperature test at the self-cooled rating).]

General

The switchgear shall be rated [] volts, 3-phase, [3-wire] [4-wire with 50 percent neutral], [50] [60] Hertz with [aluminum] [copper] main bus rating of [] amperes, and braced for [] amperes RMS symmetrical.

The low-voltage equipment shall be designed, built, and tested in accordance with ANSI C37.20 and NEMA SG-5 standards and the low-voltage power circuit breaker to ANSI C37.17 and NEMA SG-3. (In addition, the switchgear shall be UL listed and labelled.)

The switchgear shall be arranged for [close coupling to the transformer secondary through a transition compartment] [connection to the supply source by cable] [connection to the supply source by busway].

Switchgear Sections

Individual vertical sections shall be constructed of bolted steel frames. Each breaker compartment shall be isolated completely from other breaker compartments by grounded steel barriers. For operator safety, breaker compartment doors shall be furnished without ventilation slots and the door shall remain closed when racking the breaker to any of its three positions: disconnected—test—connected.

Bus bar System

The switchgear bus shall extend to each breaker compartment. The bus system shall be [all-welded aluminum] [bolted copper] with copper to copper connections at the breaker terminals. The bus shall be braced for [] amperes RMS symmetrical.

(In addition, the entire bus system shall be phase isolated/insulated to preclude accidental contact with live busbars while working in the outgoing power cable compartment.)

Low Voltage Power Circuit Breakers

All circuit breakers shall have stored-energy closing mechanisms, three position closed-door draw out racking mechanism, and a solid-state tripping device, as specified for each breaker.

The breakers shall have self-aligning fingers to engage the line and load primary disconnects. The draw out mechanism shall firmly support the breaker from the fully connected to the fully disconnected positions. Interlocks shall prevent racking the breaker in or out when the breaker contacts are closed. A rejection system shall be

provided in each breaker compartment to prevent the insertion of a breaker with inadequate short-circuit rating.

Provisions shall be furnished to padlock the breaker when in the open position to prevent unauthorized closing or racking of the breaker.

Breaker for ac applications will be provided with MicroVersaTrip solid-state trip units. Standard functions will include adjustable current setting, adjustable long-time pick up, adjustable long-time delay, long-time timing light, and adjustable instantaneous.

[For fused breakers add following paragraph:

All fused low-voltage power circuit breakers shall include integrally or separately mounted current limiting fuse units coordinated with overcurrent trip devices so as to avoid unnecessary blowing of the fuses. Fused breakers shall include blown fuse indicator which locks out the circuit breaker until the fuse is replaced and the device reset.]

[For Electrically operated breakers, add the following:

Electrically operated breakers shall have (remote closing) (a close push button on the escutcheon of the breaker).]

Main Breaker(s)

The quantity, type, and arrangement of the power circuit breakers shall be as follows:

[] Main secondary breaker (s) type [AKR-], [] ampere frame size, (manually) (electrically) operated, (fused) (unfused) with MicroVersaTrip solid-state tripping device having (short-

Guide Form Specifications

Low-voltage Switchgear Equipment

time delay) (instantaneous) (high-range instantaneous) elements in the overcurrent trip devices (and integral ground fault protection¹).

Tie Breaker (when required)

Tie breaker, type [AKR-], [] ampere frame size, (manually) (electrically) operated, (fused) (unfused) with type MicroVersaTrip solid-state tripping device having (short-time delay) (instantaneous) (high-range instantaneous) elements in the overcurrent trip devices (and integral ground fault protection¹).

Tie Breaker Control

Automatic throw-over control equipment with [single-phase] [three-phase] under-voltage indication for automatic transfer to the emergency source tie breaker and [manual] [automatic] return to the normal power source.

Control power automatic throw-over equipment to transfer the control bus from one control power source to another when one is de-energized.

**Main Breaker Metering
and Control**

- [] Ammeter, indicating type
- [] Ammeter selector switch
- [] Voltmeter, indicating type
- [] Voltmeter selection switch
- [] Watthour [demand] meter, [2]
[2½] [3] element
- [] Wattmeter, indicating type
- [] Power factor meter, indicating
type
- [] Current transformers, []
ampere
- [] Potential transformers
- [] Control power transformer,
[] kVA
- [] Current test blocks
- [] Potential test blocks
- [] Ground detection lamps with
potential transformers
- [] Solid State Ground Fault
Protection
- [] Monitor Panel

Feeder Breaker Metering

- [] Ammeter, indicating type
- [] Ammeter transfer switch
- [] Current transformers, []
amperes
- [] Current transformers, []
ampere
- [] Current transformers, []
ampere

**Feeder Breakers:
(Repeat for each frame size)**

- [] Feeder breaker(s), type
[AKR-], [] ampere
frame size, (manually) (elec-
trically) operated, (fused)
(unfused) with MicroVersaTrip
solid-state tripping device
having (short-time delay) (instan-
taneous) elements in the
overcurrent trip devices (and
integral ground fault protection.)

**Breaker Optional Accessories
(specify breakers)**

- [] Shunt trip (standard on electri-
cally operated breaker)
- [] Instantaneous under voltage device
- [] Time-delay undervoltage device
- [] Bell alarm lockout device
- [] Auxiliary Switch (standard on
electrically operated breakers)
- [] Integral ground fault protection
Specify 3W or 4W (includes targets for trip
indication).
- [] Targets for long-time and
instantaneous trip indication
- [] Close-open indicating lights
- [] Lighted annunciator panel for
breaker indication (including
close-open)
- [] Attachment to padlock breaker
in test/disconnect positions
- [] Short-time l²t switch — in/out.

Equipment Optional Accessories

- [] Shutters to cover line/load
primary disconnects (standard on
tie breakers)
- [] Complete Isolated phase/isolated
bus bar system
- [] Compression lugs
- [] Breaker lifting device (standard
on outdoor equipment)
- [] Space heaters (standard on outdoor
equipment)
- [] Breaker compartment door interlock
for connect/test positions
- [] Breaker compartment door handle
lock
- [] Kirk-key lock (specify breakers and
arrangement)
- [] Barriers between sections in cable
compartment.

**Guide Form
Specifications**

Metering

**Additional
Information**

Busway

Types LVD, LVDP 600-5000A.
Type DNSP Service Entrance
Types FVK-FVA 225-1000A
Armor Clad® 225-5000A.
Type CL Current Limiting

GEA-6736
GEA-10257
GEA-6470
GEA-7946
GEA-10257

Panelboards

Types NLQ/NLAB
Types NAB/NHB
Type CCB
Type QMR

GEA-6737
GEA-6738
GEA-6739
GEA-6740

Switchboards

AV-LINE®
Automatic Throwover Equipment
AV-Line® Installation Instructions
Power Break®
Power Break Installation Instructions
Power Break Draw out Assembly 3000-4000A.

GEA-7931
GEA-10261
GEH-2621
GEA-10258
GEH-2638
GEH-2639

Transformers

Vapor Tran
Liquid-Filled
Ventilated Dry

GEA-10495
GEA-9878
GEA-10423

Molded-Case Circuit Breakers

Application and Selection

GET-2779

Power Break® Circuit Breakers

Application and Selection

GET-9732

AKR Power Circuit Breakers

Application and Selection

GEA-10265

High Pressure Contact Switches

Application and Selection

GET-6205

Ground Break®

Application and Selection

GET-2964

Time Current Curves

MicroVersaTrip LSI
MicroVersaTrip LSI
MicroVersaTrip G

GES-6193
GES-6194
GES-6195

For further information, contact your local General Electric Sales Office,
or write Marketing Communications,
Distribution Equipment Division, 41 Woodford Ave., Plainville, CT 06062

