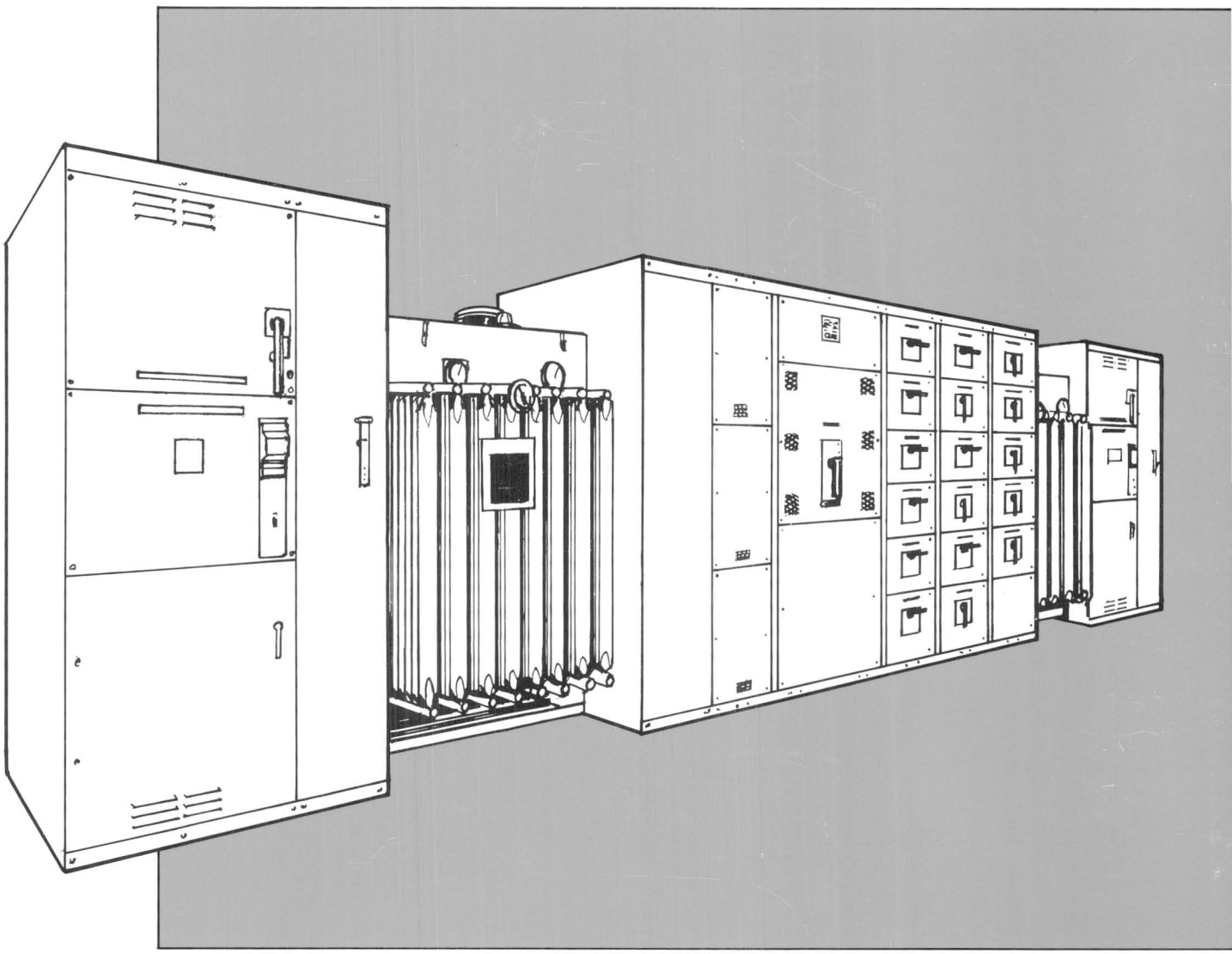
GEA-9878H

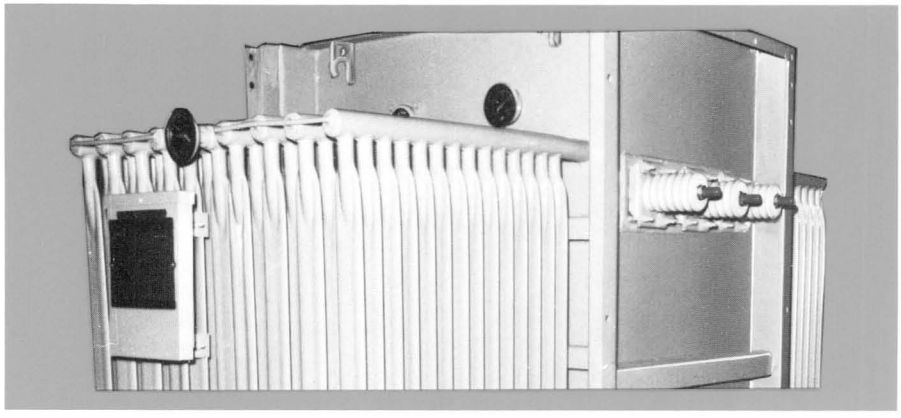
GE Power Delivery and Control



Liquid-filled Secondary Substation Transformers

And Termination Equipment For Integral Substations

GE Transformers Meet Latest Applicable Standards of ANSI and NEMA



The available incoming power supply determines the primary voltage and the frequency of the transformer. The voltage that is required by the load determines the secondary voltage. Present load, plus allowance for growth, determines the kVA rating of the transformer. Transformers with specific combinations of voltages and kVA ratings are available as standard units.

All standard secondary substation transformers are three-phase, 60 Hz, with high-voltage windings delta-connected. Transformers are also available in 50 Hz designs.

112.5 kVA	500 kVA	1500 kVA
150 kVA	750 kVA	2000 kVA
225 kVA	1000 kVA	2500 kVA
300 kVA		3000 kVA

The standard kVA ratings are based on a 65C average winding temperature rise by resistance above a 30C average ambient.

All Delta:

2400 Volts*	12000 Volts
4160 Volts	12470 Volts
4800 Volts	13200 Volts
6900 Volts	13800 Volts
7200 Volts	

Primary voltage ratings are supplemented with four approximately 2½-percent full-capacity taps, two above and two below normal. This combination allows compensating for either a higher or a lower than normal sustained primary voltage.

*Not standard above 1500 kVA.

208Y/120†	480	480Y/277

†Not standard above 1000 kVA.

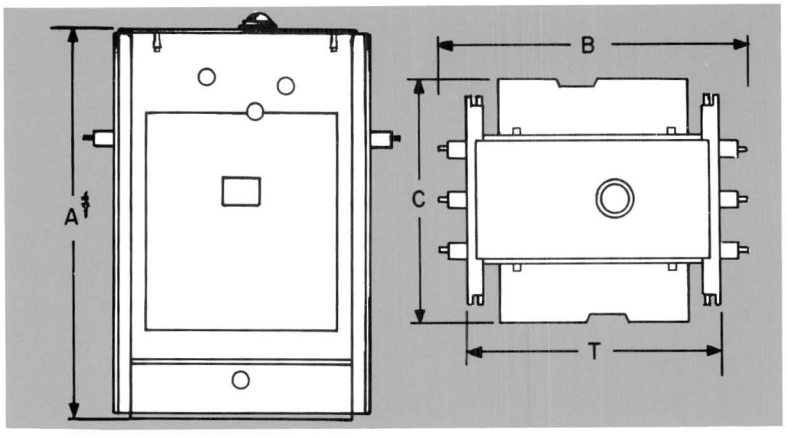
Secondary voltage ratings are approximately 4.2 percent above the standard motor voltages (460 and 230 volts), allowing for voltage drop in the line between the substation and the motor terminals without operating the motor at subnormal voltage. Motors and control operate satisfactorily on voltages 10 percent above or below rating.

Secondary lighting voltages are standardized at the voltage rating of the lamps (120 volt). Operating voltage is fairly critical to lamp performance. Overvoltage causes overheating and subsequent short life of lighting equipment, while under-voltage reduces illumination output and may have adverse effects on the operation of fluorescent lamps. The 120-volt rating for lighting transformers normally gives the best results. If the regulation is then too great, it is the usual practice to correct it with a small voltage regulator installed on each feeder.

kVA	Primary Line-to-line Volts									Secondary Line-to-line Volts			
	2400	4160	4800	6900	7200	12,000	12,470	13,200	13,800	208	240	480	600
112.5	27.1	15.6	13.5	9.4	9.0	5.4	5.2	4.9	4.7	312	271	135	108
150	36.1	20.8	18.0	12.6	12.0	7.2	7.0	6.6	6.3	416	361	180	144
225	54.1	31.2	27.1	18.8	18.0	10.8	10.4	9.8	9.4	625	541	271	217
300	72.2	41.6	36.1	25.1	24.1	14.4	13.9	13.1	12.6	833	722	361	289
500	120	69.4	60.1	41.8	40.1	24.1	23.1	21.9	20.9	1388	1203	601	481
750	180	104	90.2	62.8	60.1	36.1	34.7	32.8	31.4	2082	1804	902	722
1000	241	139	120	83.7	80.2	48.1	46.3	43.7	41.8	2776	2406	1203	962
1500	361	208	180	126	120	72.2	69.6	65.6	62.8	....	....	1804	1443
2000	....	278	241	167	160	96.2	92.5	87.5	83.7	....	....	2406	1925
2500	....	347	301	209	200	120	115.5	109	105	....	....	3007	2405
3000	....	406	361	251	240	144	139	131	126	....	....	3608	2886

Dimensions and Weights

OIL-FILLED AND SILICONE LIQUID-FILLED TRANSFORMERS



All dimensions are subject to change without notice and should not be used for construction purposes unless endorsed.

OIL-FILLED TRANSFORMER
WEIGHTS & DIMENSIONS BASED ON 55 C RISE

Dimensions in Inches					Volume (Gallons)	Total Wgt. (Lbs.)	Low-voltage Rating
kVA	A‡	B	C	T			
112.5	77.5	47	46	39	99	2495	All Standard†
150	77.5	47	46	39	99	2495	All Standard†
225	77.5	48	56	41	107	2695	All Standard†
300	77.5	48	66	40	111	2995	All Standard†
500	77.5	47	90	40	142	3975	All Standard†
750	77.5	52	100	45	151	4960	208Y
750	77.5	54	84	47	155	4800	480
1000	77.5	52	108	44	201	6130	208Y
1000	77.5	53	108	46	170	5560	480
1000	77.5	57	106	50	177	5660	480*
1500	77.5	58	111	50	237	7415	480#
1500	77.5	60	108	55	276	7855	480**
2000	77.5	60	119	53	268	8880	480+
2000	77.5	60	113	55	323	9390	480@
2500	90	64	115	56	339	10655	480+
2500	77.5	61	117	56	344	10600	480@
3000	90	63	118	55	413	12280	480

SILICONE-FILLED TRANSFORMER
WEIGHTS & DIMENSIONS BASED ON 55 C RISE

Dimensions in Inches					Volume (Gallons)	Total Wgt. (Lbs.)	Low-voltage Rating
kVA	A‡	B	C	T			
112.5	77.5	47	46	39	96	2525	All Standard†
150	77.5	47	46	39	96	2525	All Standard†
225	77.5	48	60	41	107	2820	All Standard†
300	77.5	48	74	41	113	3190	All Standard†
500	77.5	48	106	40	153	4245	All Standard†
750	77.5	54	96	47	155	5180	208Y
750	77.5	58	84	50	164	4980	480
1000	77.5	56	116	49	188	6295	208Y
1000	77.5	55	112	47	179	6000	480
1000	77.5	61	95	54	186	6055	480*
1500	77.5	60	108	53	211	7505	480#
1500	77.5	60	102	55	259	7945	480**
2000	77.5	63	121	55	242	9115	480+
2000	77.5	61	121	55	276	9390	480@
2500	77.5	65	122	58	281	10625	480+
2500	77.5	63	122	58	308	10840	480@
3000	90	78	123	70	340	15000	480

WEIGHTS & DIMENSIONS BASED ON 65 C RISE

Dimensions in Inches					Volume (Gallons)	Total Wgt. (Lbs.)	Low-voltage Rating
kVA	A‡	B	C	T			
112.5	77.5	47	46	39	99	2495	All Standard†
150	77.5	47	46	39	99	2495	All Standard†
225	77.5	48	48	41	103	2565	All Standard†
300	77.5	48	54	40	105	2800	All Standard†
500	77.5	47	74	40	134	3665	All Standard†
750	77.5	52	80	45	138	4515	208Y
750	77.5	54	68	47	145	4365	480
1000	77.5	52	96	44	165	5515	208Y
1000	77.5	53	88	46	157	5165	480
1000	77.5	57	86	50	162	5155	480*
1500	77.5	58	97	50	192	6635	480#
1500	77.5	60	88	55	256	7210	480**
2000	77.5	60	105	53	217	8005	480+
2000	77.5	60	101	55	269	8485	480@
2500	77.5	64	111	56	252	9365	480+
2500	77.5	61	103	56	285	9560	480@
3000	77.5	63	110	55	317	10770	480

WEIGHTS & DIMENSIONS BASED ON 65 C RISE

Dimensions in Inches					Volume (Gallons)	Total Wgt. (Lbs.)	Low-voltage Rating
kVA	A‡	B	C	T			
112.5	77.5	47	46	39	96	2525	All Standard†
150	77.5	47	46	39	96	2525	All Standard†
225	77.5	48	50	41	102	2680	All Standard†
300	77.5	48	60	41	106	2935	All Standard†
500	77.5	47	84	40	140	3845	All Standard†
750	77.5	54	78	47	142	4775	208Y
750	77.5	58	68	50	153	4545	480
1000	77.5	56	92	49	171	5705	208Y
1000	77.5	55	88	47	162	5410	480
1000	77.5	61	77	54	172	5545	480*
1500	77.5	60	108	53	211	7505	480#
1500	77.5	60	84	55	280	7860	480**
2000	77.5	63	121	55	242	9115	480+
2000	77.5	61	101	55	298	9265	480@
2500	77.5	65	122	58	281	10625	480+
2500	77.5	63	124	58	310	10555	480@
3000	97	68	120	60	325	14000	480

* 8% impedance (Instead of 5.75%)
† All standard low-voltage ratings: 208Y/120; 240; 480Y/277; 480 volts
‡ Add 5 inches for standard accessories mounted on cover

** If HV is less than 4160 volts
# If HV is equal to or greater than 4160 volts
\+ High voltage above 4800 volts
@ High voltage equal to 4160-4800 volts

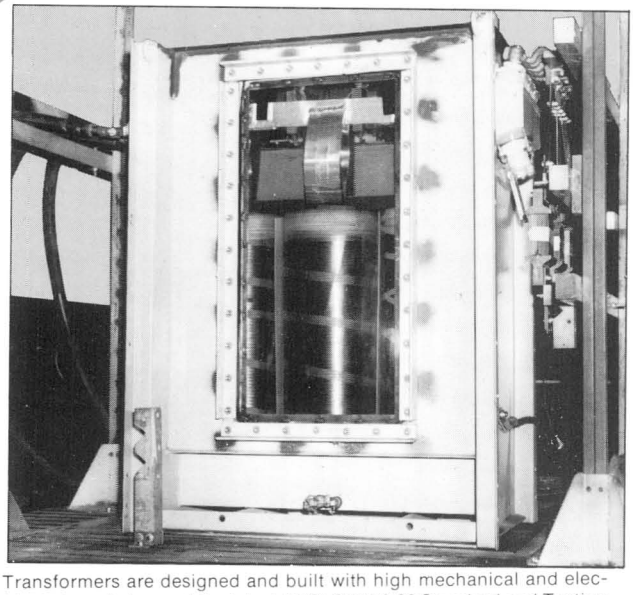
Electrical and Mechanical Characteristics

STANDARD IMPEDANCES

kVA	Percentage Impedance
112.5	2.0*
150	2.0*
225	2.0*
300-500	4.5*
750-3000	5.75§

* Minimum impedance.

§ 1000-kVA units with 480-volt (delta or wye) low voltage are available with optional 8-percent impedance.



Transformers are designed and built with high mechanical and electrical strength to meet the latest ANSI C57.12.90 Standard and Testing requirements for short-circuit withstand.

AUDIO SOUND LEVELS

All transformers have an inherent sound caused by the alternating magnetic flux in the core. The sound level is proportional to the kVA size of the transformer. When, due to special application requirements, standard sound levels are objectionable, take the following steps:

1. Install the transformer where sound will be least objectionable.

2. Use flexible conduit connections to prevent sound from being transmitted to other locations where it may be objectionable. Use auxiliary vibration dampers if needed.

3. Design transformer rooms of such a size and shape that they will minimize sound.

4. Install the transformer away from smooth surfaces, hallways, stairways, and enclosures which may reflect, resonate, or echo the sound.

STANDARD SOUND LEVELS

Self-cooled Rating kVA	Sound Levels, Decibels	
	Without Fans	With Fans Running
300 and below	55	. .
500	56	. .
750	58	67
1000	58	67
1500	58	67
2000	61	67
2500	62	67
3000	63	67

PROVISION FOR FAN COOLING

Cooling fans will increase the transformers capacity by 15 percent (750-2000 kVA) and 25 percent (2500-3000 kVA). Provision for adding fans is inherent in all units rated 750 kVA and above.

It includes:

1. Capacity in all current-carrying parts for fan-cooled rating.

2. Provision for thermometer relay to control fan from liquid temperature.

DIELECTRIC TESTS OF WINDING INSULATION

Nominal System Voltage	BIL	Insulation Class	Low-frequency Test	Impulse Tests		
				Chopped Wave		Full Wave
kV	kV	kV	kV	kV Crest	Min. Time to Flashover, Micro-seconds	kV Crest
1.2	30	1.2	10	36	1.0	30
2.4	45	2.5	15	54	1.25	45
4.8	60	5	19	69	1.5	60
8.32	75	8.7	26	88	1.6	75
14.4	95	15	34	110	1.8	95

Standard Transformer Connections

Voltage	Delta-wye connections
2400 volt three wire 4160 volt three wire 4800 volt three wire 6900 volt three wire 7200 volt three wire 12000 volt three wire 12470 volt three wire 13200 volt three wire 13800 volt three wire	 208Y/120 three- or four-wire 480Y/277 three- or four-wire

Voltage	Delta-Delta connections
2400 volt three wire 4160 volt three wire 4800 volt three wire 6900 volt three wire 7200 volt three wire 12000 volt three wire 12470 volt three wire 13200 volt three wire 13800 volt three wire	 240 three wire 480 three wire

Industrial distribution systems with secondary voltages 600 volts and below should be wye-connected, grounded-neutral. In the past, such systems have been characteristically delta-connected and ungrounded. Grounded-neutral operation at these voltages will give the same advantages as has been demonstrated at the higher distribution voltages. Some of these advantages are:

1. A single line-to-ground fault will cause sufficient ground-fault current to flow to trip the feeder breaker and thereby isolate the faulted circuit. In contrast to this, single line-to-ground fault on an ungrounded system will cause essentially no current to flow, and no tripping can be effected until a second fault occurs on a different phase. This situation constitutes a line-to-line fault with high fault current and the possibility of considerable damage at the point of fault.

2. A ground fault on a grounded-neutral system causes immediate tripping and therefore immediate identification of the ground circuit. In contrast, a ground on an ungrounded system can only be located by successive opening of circuit breakers until the faulted circuit is found. It requires a complete outage of the system to locate grounds when two occur on the same phase.

3. Grounding of the system neutral will avoid excessive transient overvoltages during normal switching of a grounded circuit. Transient overvoltages of considerable magnitude are created during normal switching of a grounded circuit on an ungrounded system. This can be avoided by proper grounding of the system neutral.

4. The maximum voltage to ground imposed on any phase is limited to line-to-ground value when a ground occurs on one phase. An ungrounded system imposes line-to-line voltage between two phases and ground, when a ground occurs on one phase.

5. The development of 277-volt fluorescent lighting with its economy in cost and conductor is an additional advantage of using the 480Y/277-volt transformer secondary voltage.

Delta-connected primary windings are provided in standard secondary substation transformers. This is the simplest and most satisfactory connection. If the primary system is a grounded neutral, three-phase, four-wire system it is neither necessary nor desirable to connect the system neutral wire. The system fourth or neutral wire may be tied to the station ground system.

Wye-connected secondary windings gain the advantages of neutral grounding in the most practical and economical manner.

For these reasons, the connections listed have been selected as standards.

Liquid-filled Transformers Feature Rectangular Coils

Thorough analysis by GE designers incorporate many new features utilizing up-to-date technology. The result: high mechanical and electrical strength necessary to meet the latest ANSI C57.12.90 Standard and Testing requirements for transformer short-circuit withstand.

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

OIL-FILLED

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

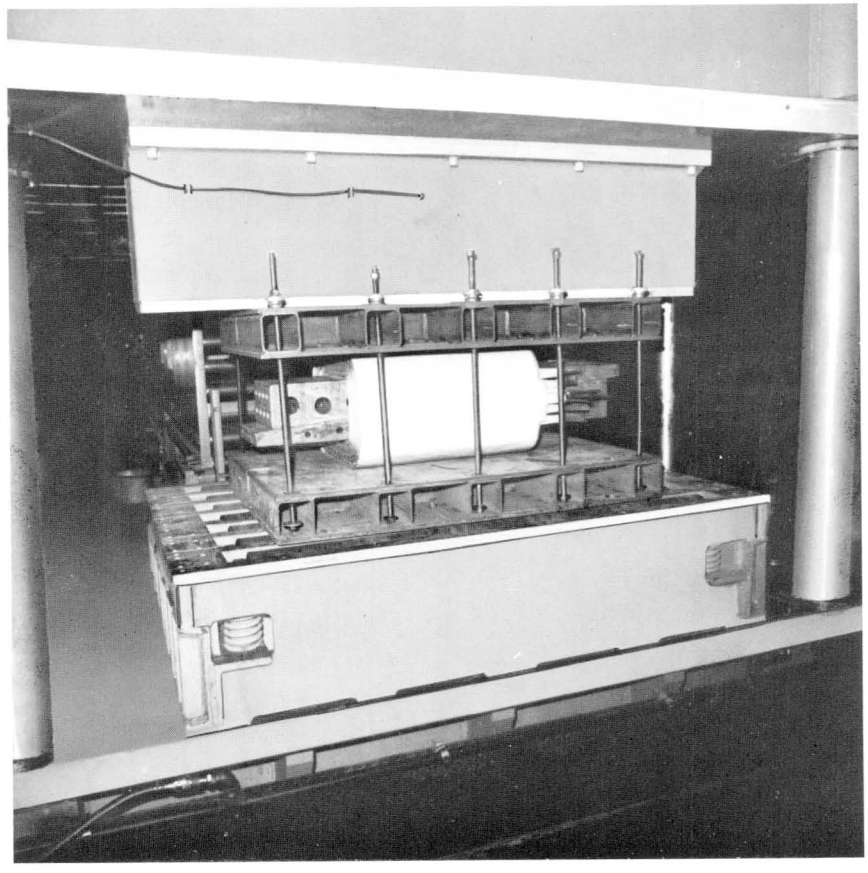
The oil used in GE transformers meets all the requirements of ANSI C57.106 and ASTM D-3487, has high dielectric strength, is free from impurities, is durable and has a high flash point. These features make it an excellent insulating liquid.

SILICONE-FILLED

The silicone fluid selected for use in GE 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 Liquid-Insulated Transformers) of the National Electrical 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 Electrical 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.



A coil being compressed by hydraulic press.

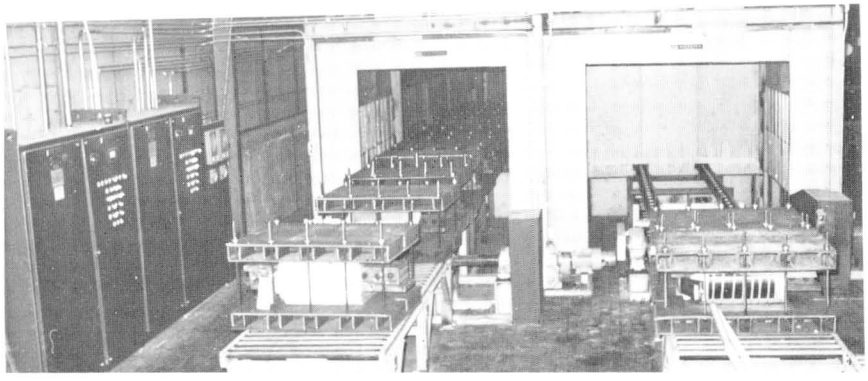
CORE-AND-COIL CONSTRUCTION FEATURES

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

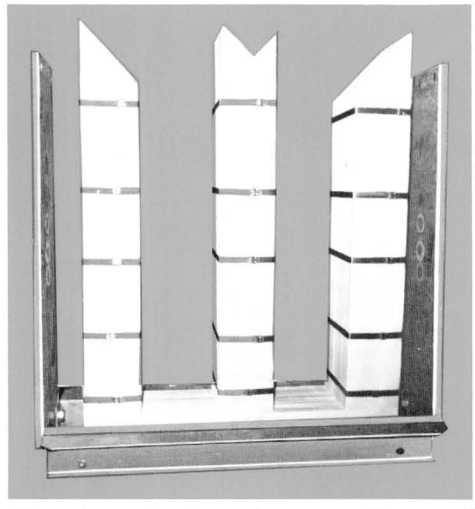
First, the low-voltage coils are wound on a rectangular form which simulates the rectangular core leg and serves as the main support for all the windings. These coils are of sheet winding construction using strip conductors. An extra strong electrical-grade paper is used as the insulation between each 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 high short-circuit strength and high electrical stress withstand capability.



Ovens where coils are baked to enable epoxy base coated paper to bond together.

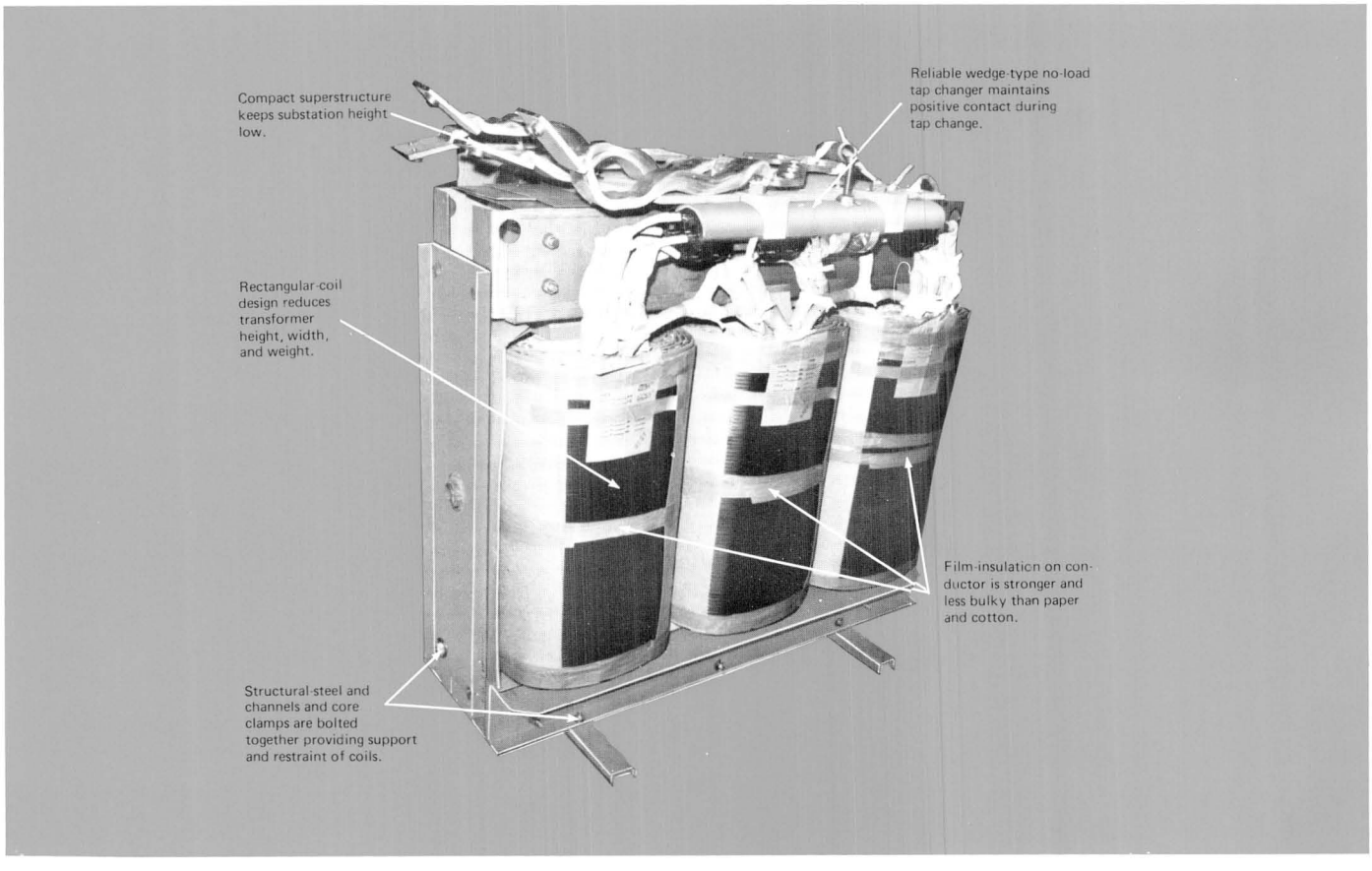


Three legs of a three-phase core. The metal bands are removed when coils are assembled on the core.

The core has a rectangular cross section in both leg and yoke. It is constructed of grain-oriented silicone steel laminations and utilizes mitered joints between legs and yokes to reduce size, sound and losses in the finished core.

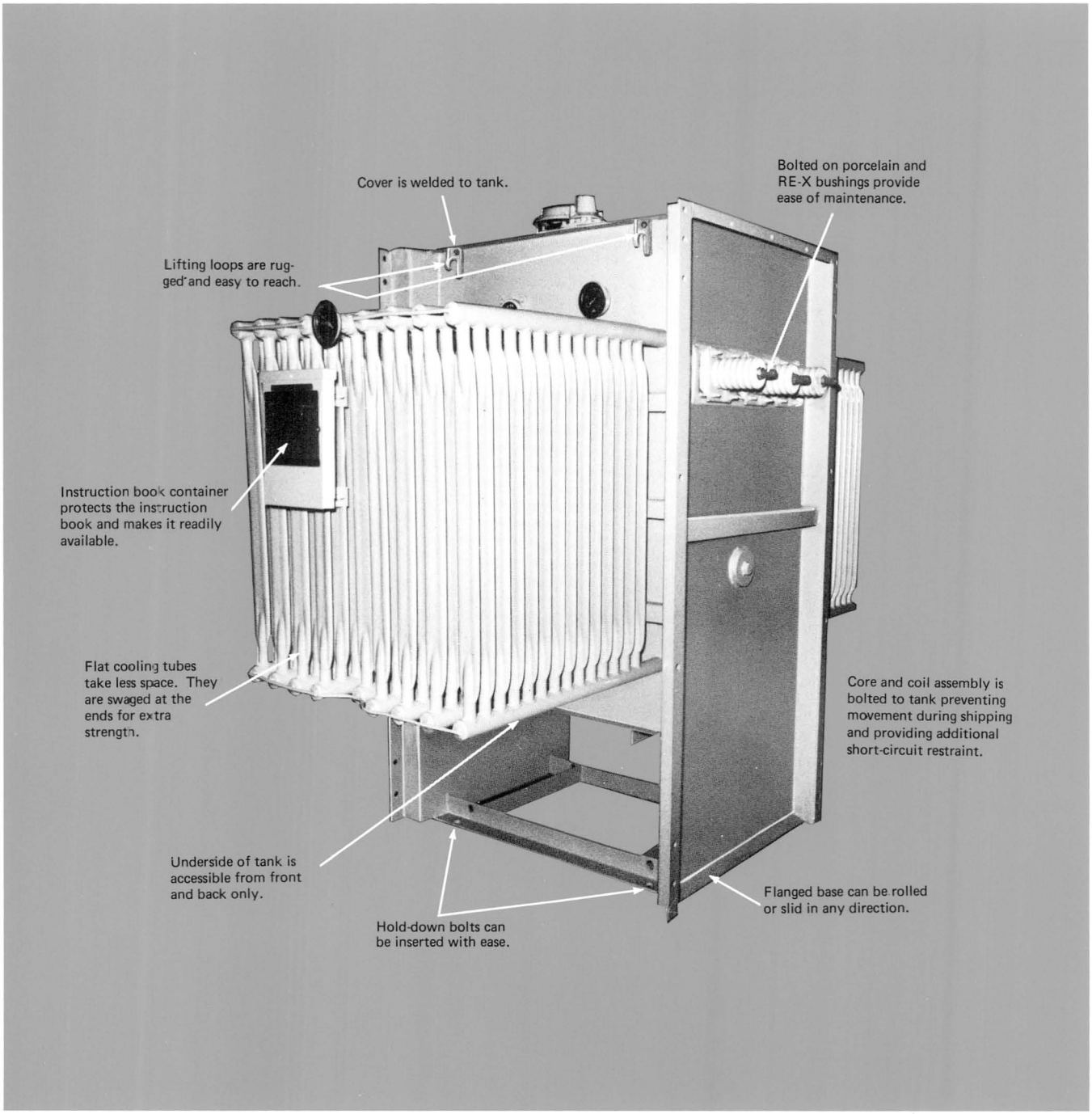
The rectangular core legs serve as the main support for the coils and are clamped with structural members at the top and bottom yokes. The top and bottom structural members are bolted together with end channels after assembly of the coils on the legs. This forms a compact structure of core and coil which restrains both axial and radial movement, essential to superior short-circuit strength.

In addition to the structure required to restrain the movement of the coils on the core, a compact super-structure supports the leads and wedge-type, no-load tap changer which is designed to withstand the full short-circuit current of the transformer.

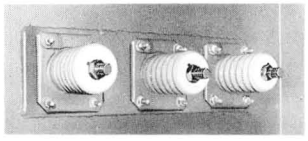


Core- and coil-assembly and superstructure.

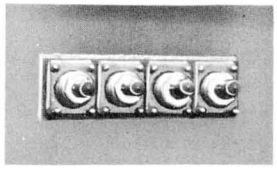
Leak-resistant Welded Transformer Tanks



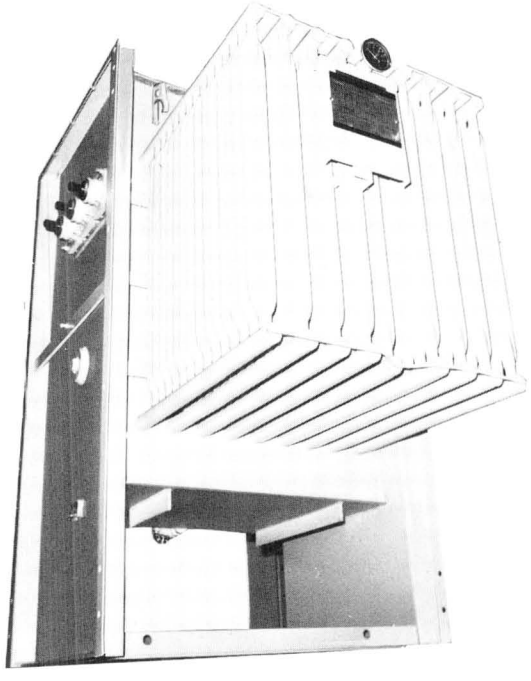
Flanged base can be rolled or slid in any direction.



High-voltage bushings



Low-voltage bushings



Underside of tank fully accessible and visible from front and back.

LEAK-RESISTANT WELDED TRANSFORMER TANK CONSTRUCTION

The tank design incorporates many desirable features which assure flexibility of location, ease of maintenance and installation, and rodent protection.

The design, in effect, wraps the tank around the core-and-coil assembly. In so doing, the overall weight is reduced by reducing the tank material weight as well as the weight of the dielectric fluid.

The underside of the tank is accessible from the front and back, and allows the free movement of air, which helps to keep the underside of the tank dry and deter the formation of rust.

The high- and low-voltage welded flanges have no openings, which eliminates the possibility of rodent access to adjacent high- and low-voltage terminal equipments.

High- and low-voltage bushings feature ease of maintenance and connection.

The tank cover is welded-on to eliminate contamination in the atmosphere from entering the tank. Cooling-tube ends are swaged and submerged-arc welded and are leak tested during the production cycle.

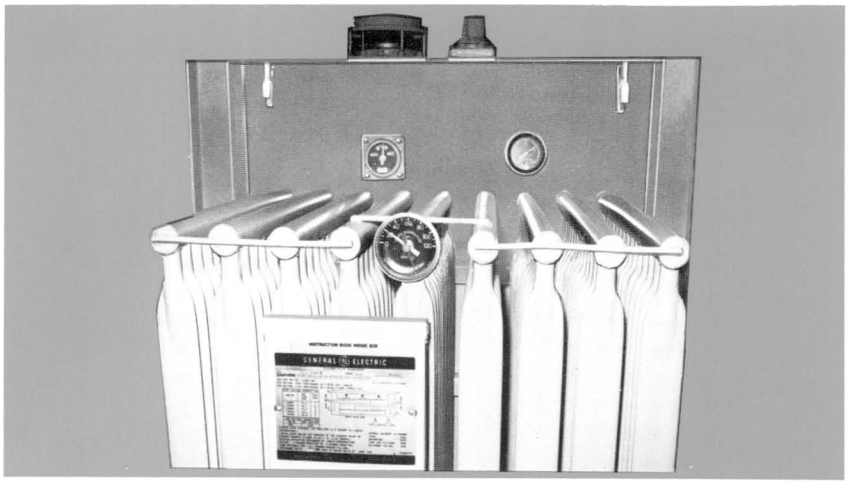
BUSHING DESIGN

The bushing design utilizes bolted construction using time-tested gasketing techniques and materials which are compatible with the liquid dielectric. These techniques assure leak-free performance for the full life of the transformer.

Both high- and low-voltage bushings are externally removable without the necessity of removing the tank cover. This enables easy replacement of the bushings, should such a replacement be required.

The bolted-on porcelain bushings are ideally suited for their application.

Standard External Features and Accessories



- Cover vent-plug
- Tank lifing lugs
- Gang-operated tap-changer control accessible on cover
- Handhole
- Top filter-press connection
- Liquid-level gage
- Dial-type thermometer
- Pressure-vacuum gage
- Stainless-steel diagrammatic nameplate
- Sampling device
- Pressure test valve
- Grounding pad
- Full-drain valve and bottom filter-press connection
- Metal instruction book container

The instrumentation is grouped and is reversible. The liquid-level gage, dial-type thermometer, and pressure-vacuum gage are grouped with the nameplate so that all are easily readable from one floor-level position. The operating mechanism for the no-load tap changer is located on top of the tank, and is equipped with a cover which also serves as a tap position indicator. The cover design, and its location, tend to discourage tampering with the tap-changer mechanism.

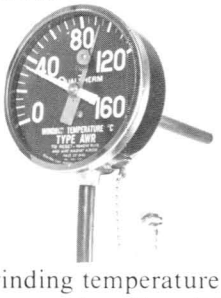
The instruments and nameplate can be placed on either side of the transformer, whichever is most convenient for the installation.

For ease of handling and installation sturdy lifting lugs are welded in place on each corner for lifting by crane.

The base is designed with bolt holes for easy tie down. It is constructed for rolling, skidding or sliding in any direction.

OPTIONAL ACCESSORIES

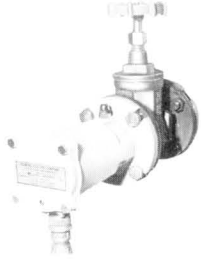
WINDING TEMPERATURE INDICATOR



The winding temperature indicator provides a visual reading of the equivalent transformer winding hot-spot temperature. Similar to the top liquid thermometer, the winding temperature indicator is located in a top tube header well on one of the tube rows. The indicator reads the combination temperature of the top liquid and a heater. This heater, when supplied with current proportional to the winding current, is designed to closely approximate the winding hot-spot rise over the top liquid; and thus, the indicator reading indicates winding hot-spot.

The indicator comes equipped with two sets of contacts which can be used for actuating auxiliary devices.

FAULT-PRESSURE RELAY



The GE fault-pressure relay, Model 900-1, provides a positive and reliable means of detecting an excessive rate of pressure rise within the tank resulting from an internal arc. The relay is normally mounted on a shut-off valve which is located on the tank wall just below the top of the radiators. The relay is equipped with one normally open and one normally closed momentary contacts; therefore, the user must provide for a seal-in circuit to operate other devices.

PRESSURE-RELIEF DEVICE

The pressure-relief device is self-reclosing and self-resealing. The mechanism is set at the factory to operate within an accuracy of plus or minus 10 percent.

A pressure-relief device will be furnished as a standard accessory on all silicone-insulated transformers.

Finishing and Testing

PAINT FINISH

Prior to painting, the tanks, and cooling tube units are shot blasted to white metal. They are flow coated with one coat of primer and baked.

An intermediate flow coat of enamel is then applied and baked. If the unit is for outdoor application a third flow coat is applied and baked to give a minimum film thickness of two mils.

Final finishes use an air dry enamel which is applied by either the hot air spray or conventional cold spray methods.

The standard paint finish color is ANSI-Number 61, Light Gray, Munsell Notation 8.3G 6.10/0.54.

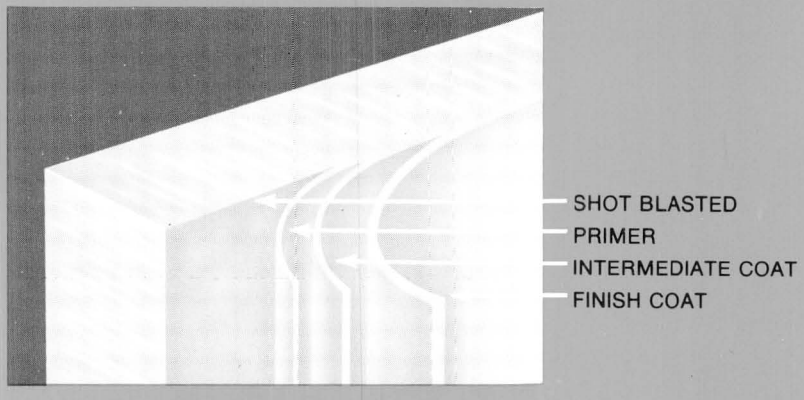
Optional colors available are:

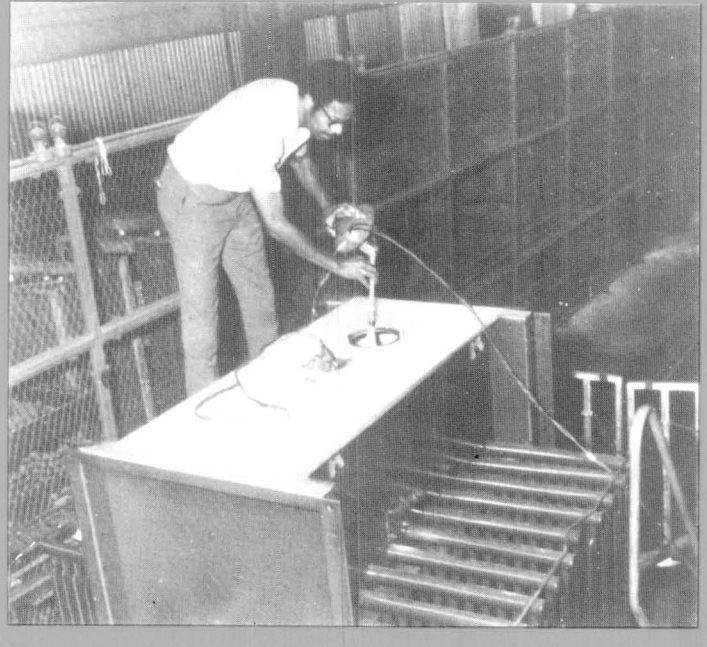
Color	ANSI #	Munsell Notation
Light Gray	70	5.0 BG 7.0/4.0
Dark Gray	24	10 B 2.4/1.18

STANDARD TESTS

The following tests will be made on all transformers but not necessarily in the sequence listed. All tests are performed in accordance with the latest revision of ANSI Standard Test Code for Transformers C57.12.90 — 1980.

1. Resistance measurements of all windings.
2. Ratio tests on the rated voltage connection and on all tap connections.
3. Polarity and phase-relation tests on the rated voltage connection.
4. No-load loss at rated voltage on the rated voltage connection.
5. Exciting current at rated voltage on the rated voltage connection.
6. Impedance and load loss.
7. Applied potential tests.
8. Induced potential tests





Production-line sound test verifies conformance to sound level standards.

* Trademark of GE Company.

Incoming Termination Equipments

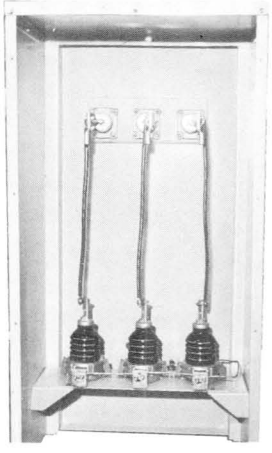
FOR LIQUID-FILLED SECONDARY SUBSTATION TRANSFORMERS

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 potheads 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.

Potheads 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.



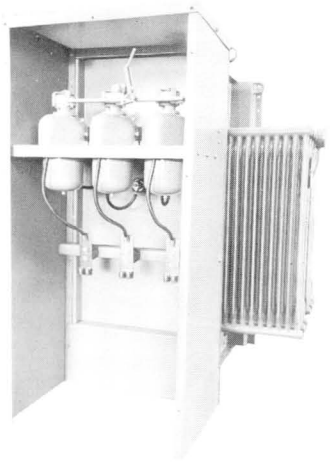
Air-filled compartment with surge arresters and clamp-type terminals mounted for bottom cable entrance.

OIL CUTOUTS

If fuses are required, oil cutouts are the most economical interrupter switches available. The three-pole, two position, (OPEN/CLOSED) cutouts are operated simultaneously by a handle accessible through a hinged door on the end of the compartment for 5 kV and on the side for 15 kV. Cables and other live parts are completely metal enclosed. They are not accessible through the operating door, so operators are protected.

Either clamp-type terminals or potheads can be used to terminate cables. The compartment can be specified by the customer for single or loop feed, top or bottom cable entrance, indoor or outdoor installation.

Switch contacts of the cutouts are completely metal enclosed. The contacts operate under oil, completely submerging the arc flame during circuit interruption. The cutout can be supplied with fuses which will clear fault currents up to 11,000 amperes at 4160 volts and 7000 amperes at 13,800 volts.

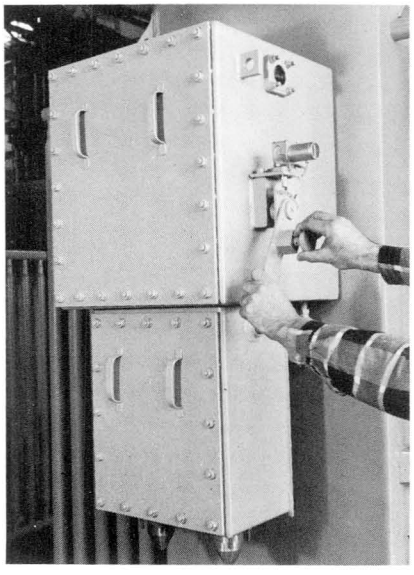


Oil cutouts are operated by a handle accessible through a hinged door.

OIL-FILLED SWITCH

The oil-filled interrupter switch is a compact, economical package for manually disconnecting the substation from the incoming line.

The switch is a three-pole device. It is available for two-position operation (OPEN/CLOSED) or three-position operation (LINE 1/OPEN/LINE 2 or OPEN/CLOSED/CABLE GROUND).



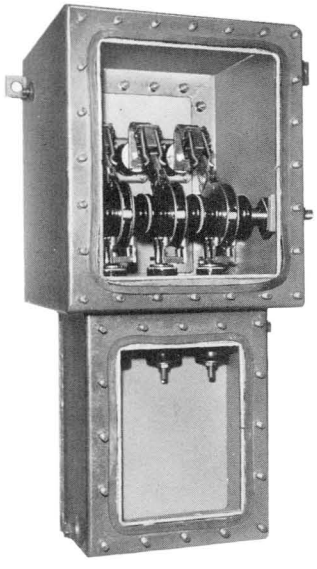
Device on the operating handle prevents operator from jogging switch.

The switch is suitable for limited load-break application (400 amperes at 5 kV, or 200 amperes at 15 kV). Oil-filled switches can be key interlocked or key locked to prevent operation by unauthorized personnel.

A device on the operating handle prevents the operator from jogging the switch and from opening the switch immediately after closing.

A compound-filled terminal chamber (similar to a pothead) is an integral part of the switch construction. Oil switches are available for cable entrance from either above or below. A double-size terminal chamber is available for loop feed.

Fittings for most types of cables can be furnished. Fuses and surge arrester are not available for use with the oil-filled switch.



Oil-filled switch designed for bottom cable entrance.

MINIMUM SUGGESTED PRIMARY FUSES*

(Based on 65 C rise)

3ø Self-cooled Transformer kVA	Rated Primary Voltage (Volts)	Rated Primary Current (Amperes)	GEType EJ-01 9F62 Series†	S & C Type (Slow Char.)‡ SM-4S	GE Oil Cutout Fuse Link
112.5	2400	27.1	40E	30E	9F57CAA030
	4160	15.6	30E	20E	025
	4800	13.5	25E	15E	020
	6900	9.4	20E	15E	015
	7200	9.0	20E	10E	010
	12000	5.4	20E	7E	006
	12470	5.2	20E	7E	006
	13200	4.9	15E	7E	006
	13800	4.7	15E	7E	006
150	2400	36.1	50E	40E	9F57CAA040
	4160	20.8	40E	25E	025
	4800	18.0	30E	20E	025
	6900	12.6	20E	15E	020
	7200	12.0	20E	15E	015
	12000	7.2	20E	10E	010
	12470	7.0	20E	10E	010
	13200	6.6	20E	10E	010
	13800	6.3	20E	10E	010
225	2400	54.1	65E	65E	9F57CAA065
	4160	31.2	50E	40E	040
	4800	27.1	40E	30E	030
	6900	18.8	25E	20E	025
	7200	18.0	25E	20E	025
	12000	10.8	20E	15E	015
	12470	10.4	20E	15E	015
	13200	9.8	20E	15E	015
	13800	9.4	20E	15E	015
300	2400	72.2	100E	80E	9F57CAA075
	4160	41.6	50E	50E	050
	4800	36.1	50E	40E	040
	6900	25.1	40E	30E	030
	7200	24.1	40E	30E	030
	12000	14.4	20E	20E	020
	12470	13.9	20E	20E	020
	13200	13.1	20E	15E	020
	13800	12.6	20E	15E	020
500	2400	120	150E	125E	9F57CAA125
	4160	69.4	80E	80E	075
	4800	60.1	80E	65E	065
	6900	41.8	50E	50E	050
	7200	40.1	50E	50E	050
	12000	24.1	25E	30E	030
	12470	23.1	25E	30E	030
	13200	21.9	25E	25E	025
	13800	20.9	25E	25E	025
750	2400	180	200E	200E	9F57CAA200
	4160	104	125E	200E	125
	4800	90.2	100E	100E	100
	6900	62.8	65E	65E	065

3ø Self-cooled Transformer kVA	Rated Primary Voltage (Volts)	Rated Primary Current (Amperes)	GEType EJ-01 9F62 Series†	S & C Type (Slow Char.)‡ SM-4S	GE Oil Cutout Fuse Link
750	7200	60.1	65E	65E	9F57CAA065
	12000	36.1	50E	40E	040
	12470	34.7	50E	40E	040
	13200	32.8	50E	40E	040
	13800	31.4	50E	40E	040
1000	2400	241	250E	—	.....
	4160	139	150E	150E	9F57CAA140
	4800	120	125E	125E	125
	6900	83.7	100E	100E	100
	7200	80.2	100E	100E	100
	12000	48.1	50E	50E	050
	12470	46.3	50E	50E	050
	13200	43.7	50E	50E	050
	13800	41.8	50E	50E	050
1500	2400	361	400E	—	.....
	4160	208	250E	—	.....
	4800	180	200E	200E	9F57CAA200
	6900	126	125E	150E	140
	7200	120	125E	125E	125
	12000	72.2	80E	80E	075
	12470	69.6	80E	80E	075
	13200	65.6	80E	80E	075
	13800	62.8	65E	65E	065
2000	4160	278	300E	—	.....
	4800	241	250E	—	.....
	6900	167	175E	175E	9F57CAA200
	7200	160	175E	175E	200
	12000	96.2	100E	100E	100
	12470	92.5	100E	100E	100
	13200	87.5	100E	100E	100
	13800	83.7	100E	100E	100
2500	4160	347	400E	—	.....
	4800	301	350E	—	.....
	6900	209	250E	—	.....
	7200	200	250E	200E	.....
	12000	120	125E	125E	9F57CAA125
	12470	115.5	125E	125E	125
	13200	109	125E	125E	125
	13800	105	125E	125E	125
3000	4160	416	450E	—	.....
	4800	361	400E	—	.....
	6900	251	250E	—	.....
	7200	240	250E	—	.....
	12000	144	150E	175E	9F57CAA150
	12470	139	150E	150E	150
	13200	131	150E	150E	140
	13800	126	150E	150E	140

* A larger fuse should be selected in some ratings, based on fan cooling and overload capability of the transformer.

† The minimum fuse rating is the smallest fuse which will withstand transformer inrush.

‡ Fuses rated below 15E are standard characteristic.

Outgoing Termination Equipments

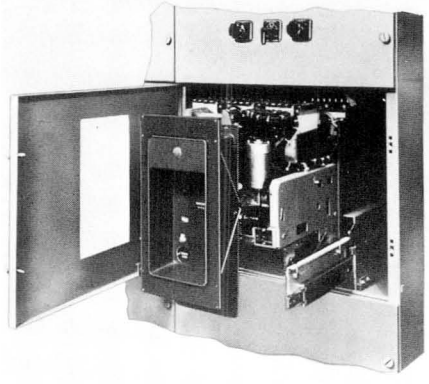
FOR INTEGRAL SUBSTATION APPLICATION

The power-distribution requirements of different loads vary widely. That's why GE's building-block approach to building Integral Distribution Centers has particular meaning in the outgoing section. There are five basic building blocks, and some of these have modular construction within themselves, to give even more flexibility.

AIR-FILLED TERMINAL COMPARTMENT

This is a simple metal enclosure with clamp-type terminals identical to the incoming-line compartment described on page 12.

Type AKR Air Circuit Breaker



Your Integral Distribution Center can be supplied with a single Type AKR low-voltage power circuit breaker, as shown in TABLE 1. Breakers are available for drawout mounting and for either manual or electrical operation.

A stored energy closing mechanism is standard with either manual or electrical operation. Pre-charged springs in this mechanism provide a powerful, uniform closing force which is independent of the operation force. This quick, positive closing prevents unnecessary arcing between contacts resulting in longer contact and breaker life.

Solid-state trip devices are available with AKR breakers. The Micro VersaTrip® trip device is shown in Table 1.

For more detailed information, refer to GEA-10265.

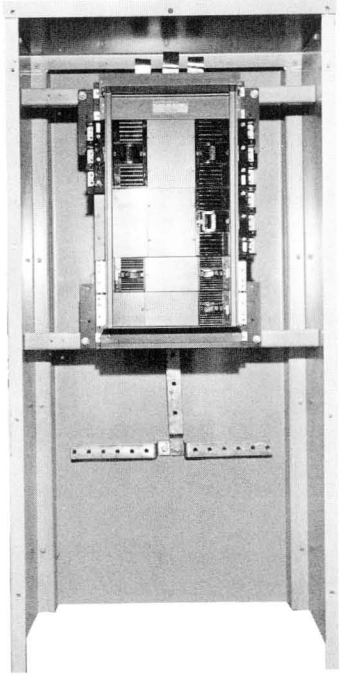
MOLDED-CASE CIRCUIT BREAKERS

Molded-case circuit breakers can be arranged to provide a main breaker, a main breaker with feeder breakers, or feeder breakers only. Any combination of the breakers shown in TABLE 2 can be used, as long as the height does not exceed 48 "X" units and the width does not exceed the panel space available.

A typical arrangement for determining the number of "X" units, interrupting rating, trip rating and cable lug sizes is given in TABLE A. For more details refer to "Buy Log"-GEP-1100.

Main circuit breakers in the compartment panel may be furnished with continuous current ratings up to 1200 amperes and interrupting capacity up to 65,000 amperes symmetrical at 240 volts. Micro VersaTrip® breakers are available in J or K frame construction.

Additional separately mounted main circuit breakers can be furnished with continuous current ratings up to 4000 amps and interrupting capacity up to 200,000 amperes symmetrical at 240 volts. Additional compartment width may be required. Refer to TABLE 3 on page 17 for application guide.



See TABLE A for typical panel arrangement.

TABLE A. TYPICAL PANEL ARRANGEMENT (MAXIMUM SPACE AVAILABLE IS 48X)*

1200 Amp TKM FRAME 2- or 3-pole		8X
800 Amp TKM FRAME 2- or 3-pole		6X
600 Amp TJK Frame 2- or 3-pole	600 Amp TJK Frame 2- or 3-pole	6X
225 Amp TFK Frame 2- or 3-pole	225 Amp TFK Frame 2- or 3-pole	3X
100 Amp TED Frame 3-pole	100 Amp TED Frame 3-pole	3X
Filler		1X
	TOTAL	27X

* For units without metering.

METERING AND CONTROL POWER EQUIPMENT

Simple secondary metering and control equipment can be mounted in the out-going section of your Integral Distribution Center. Often, though, the compartment must be larger to add this equipment and still provide adequate tolerances and working space. Standard equipments available include:

Metering

Ammeters	Power-factor meters
Voltmeters	Frequency meters
Wattmeters	Watthour meters
Varmeters	KVA meters

Instrument transformers

Current transformers
Potential transformers

Control-power transformers

TABLE 1. APPLICATION GUIDE—TYPE AKR LOW-VOLTAGE POWER CIRCUIT BREAKER

Breaker Type	Max Amp	Interrupting Rating* (Sym KA RMS) 240V	480V	600V	Sensor Current Rating (Amperes) Fixed Sensors	Tapped Sensors	Current Setting (Mult. of Sensor Current Rating)
AKR-30†	800	42	30	30	100 150 225 300 400 600 800	100, 150 225, 300 or 300, 400, 600, 800	0.5, 0.6, 0.7, 0.8, 0.85, 0.9, 0.95, 1.0 (x)
AKR-30H	800	50	42	42			
AKR-50†	1600	65	50	42	300 400 600 800 1200 1600	300, 400 600, 800 or 600, 800, 1200, 1600	Same as above
AKR-50H	1600	65	65	65			
AKRT-50H	2000	65	65	65	800 1200 1600 2000	(800, 1200, 1600, 2000)	Same as above
AKR-75	3200	85	65	65	1200 1600 2000 3200	(1200, 1600, 2000, 3200)	Same as above
AKR-100	4000	130	85	85	1600 2000 3000 4000	(1600, 2000, 3000, 4000)	Same as above

*With instantaneous trip
†Breakers with extended short-circuit ratings also available.
(x) = Sensor current rating

TABLE 3. APPLICATION GUIDE POWER BREAK® CIRCUIT BREAKER‡

Max Amp	Interrupting Rating Amperes Symmetrical 240V	480V	600V	Sensor Ampere Ratings	Space Used
800A	65,000	50,000	42,000	200, 400, 600, 800	18X
B	100,000	100,000	65,000		
1600A	85,000	65,000	50,000	800, 1000, 1200, 1600	18X
B	125,000	100,000	65,000		
2000A	85,000	65,000	50,000	1000, 1200, 1600, 2000	18X
B	125,000	100,000	65,000		
3000A	100,000	100,000	85,000	400, 600, 800, 1000, 1200, 1600, 2000, 2500, 3000	18X
B	200,000	150,000	100,000		
4000A	100,000	100,000	85,000	4000	(a)
B	200,000	150,000	100,000		

‡ Available with Micro Versa Trip®
A: Standard Break
B: Hi-Break
(a) Refer to factory for space requirements

TABLE 2. APPLICATION GUIDE—MOLDED-CASE CIRCUIT BREAKERS

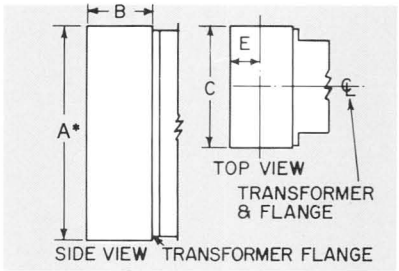
Type Frame	Max. Amperes	Interrupting Capacity (Amperes)¶ 240V	480V	600V	Trip Rating (Amperes)	Breaker Space (Max. 48X) △ 2-pole	3-pole
TED-6§	100	18,000	14,000	14,000	15, 20, 30, 40, 50, 60, 70, 90, 100, 110, 125, 150	2 Xθ 2 Xθ	3 Xθ 3 Xθ
THED§	100	65,000	25,000	18,000	15, 20, 30, 40, 50, 60, 70, 90, 100, 110, 125, 150	3 Xθ 3 Xθ	3 Xθ 3 Xθ
TFJ§	225	25,000	22,000	18,000	70, 90, 100, 125, 150, 175, 200, 225	3 Xθ	3 Xθ
TFK	225	25,000	22,000	18,000	70, 90, 100, 125, 150, 175, 200, 225	3 Xθ	3 Xθ
THFK	225	65,000	25,000	18,000	70, 90, 100, 125 150, 175, 200, 225	3 Xθ	3 Xθ
TJJ§	400	42,000	30,000	22,000	125, 150, 175, 200, 225, 250, 300, 350, 400	6 Xθ	6 Xθ
TJK-4	400	42,000	30,000	22,000	125, 150, 175, 200, 225, 250, 300, 350, 400	6 Xθ	6 Xθ
THJK-4	400	65,000	35,000	25,000	125, 150, 175, 200, 225, 250, 300, 350, 400	6 Xθ	6 Xθ
TJK-6 TJ4V	600	42,000	30,000	22,000	250, 300, 350, 400 500, 600	6 Xθ	6 Xθ
TKM-8	800	42,000	30,000	22,000	125, 150, 175, 200, 225 300, 350, 400, 500, 600 700, 800	6 X	6 X
THKM-8	800	65,000	35,000	25,000	125, 150, 175, 200, 225 300, 350, 400, 500, 600	6 X	6 X
					700, 800	6 X	6 X
TKM-12 TK4V	1200	42,000	30,000	22,000	700, 800	8 X	8 X
					1000	8 X	8 X
					1200	8 X	8 X
THKM-12	1200	65,000	35,000	25,000	700, 800	8 X	8 X
					1000	8 X	8 X
					1200	8 X	8 X

§ Breaker has fixed trip unit.
¶ U/L listed interrupting ratings—symmetrical.
θ Two breakers of size shown can be mounted side by side in this space.
△ For units without metering. When metering is required, consult factory for maximum breaker space available.

Dimensions and Weights

INCOMING TERMINATION EQUIPMENTS

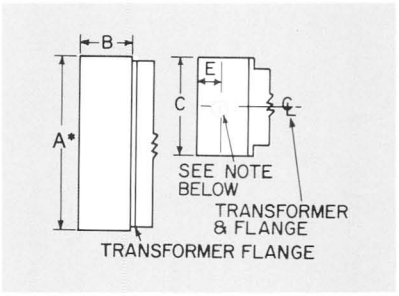
AIR-FILLED TERMINAL COMPARTMENT AND OIL CUTOUT—FUSED OR UNFUSED WITH CLAMP TYPE TERMINALS WITH 500 MCM MAXIMUM CONDUCTOR.



kV	Dimensions in Inches			Weight in Pounds
	B	C	E	
5	14.8 26.3	38.4 38.4	† 14.3	200 500
15	21.3 51.5	38.4 41.25	† 8.0	250 1200

* A = Same height as transforming section.
† Entire plan area available for cable entrance.
Black = Air-filled terminal compartment. Orange = Oil cutout.

AIR-FILLED TERMINAL COMPARTMENT AND OIL CUTOUT—FUSED OR UNFUSED WITH ONE POTHEAD 3 C WITH 500 MCM MAXIMUM CONDUCTOR.

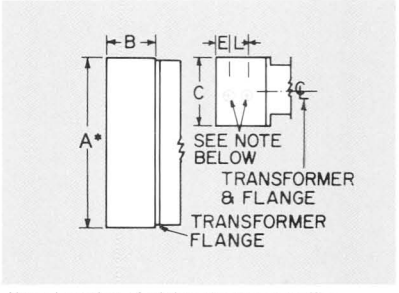


Note: Location of wiping sleeves or stuffing boxes for cable entrance‡

kV	Entrance	Dimensions in Inches			Weight in Pounds
		B	C	E	
5	Top	14.8 26.3	38.4 38.4	9.8 15.95	350 600
	Bottom	14.8 26.3	38.4 38.4	7.45 15.95	350 600
15	Top	14.8 51.5	38.4 41.25	9.8 8.32	350 1300
	Bottom	21.3 51.5	38.4 41.25	10.95 7.3	350 1300

* A = Same height as transforming section.
‡ For top entrance additional clearance required, 17.3" max.
Black = Air-filled terminal compartment. Orange = Oil cutout.

AIR-FILLED TERMINAL COMPARTMENT AND OIL CUTOUT—FUSED OR UNFUSED WITH TWO POTHEADS 3/C WITH 500 MCM MAXIMUM CONDUCTOR.

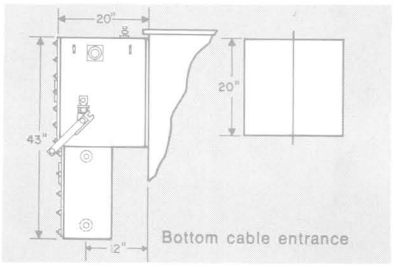


Note: Location of wiping sleeves or stuffing boxes for cable entrance‡

kV	Entrance	Dimensions in Inches				Weight in Pounds
		B	C	E	L	
5	Top	21.3 26.3	38.4 38.4	8.3 8.07	8.0 7.88	500 700
	Bottom	21.3 26.3	38.4 38.4	6.07 8.07	7.88 7.88	500 700
15	Top	21.3 59.5	38.4 41.25	8.3 8.12	8.0 8.0	500 1400
	Bottom	26.3 59.5	38.4 41.25	8.07 7.12	7.88 7.88	500 1400

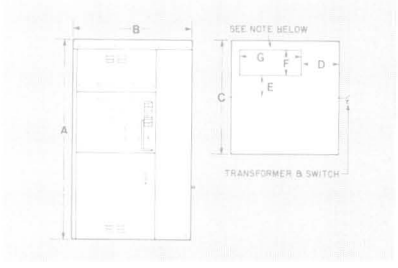
* A = Same height as transforming section.
‡ For top entrance additional clearance required, 17.3" max.
Black = Air-filled terminal compartment. Orange = Oil cutout.

OIL-FILLED SWITCH



Transformer Type	Number of Potheads	Weight in Pounds
Oil	1	600
Oil	2	700

AIR-INTERRUPTER SWITCHES

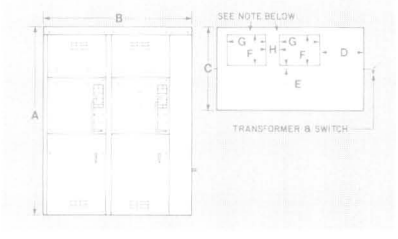


NOTE: Available space for primary leads at top and bottom.

kV Type	Dimensions in Inches						Weight in Pounds
	A*	B	C	D	E	F x G	
5 Two Position	*	34.5	50	9.3	9.25	12.5 x 23	800†
15 Two Position	*	46	53	16 8	10.31	13 x 25	1100†
5 Selector	90	34.5	69.5	9.3	7.25	20 x 23	1200‡
15 Selector	90	46	81	19.4	5.88	31.75 x 19.75	1500‡

* Same height as transforming section.
† (1) For potheads add 100 pounds per 3/C or 3-1C sets.
(2) For fuses add 200 pounds.
(3) For lightning arresters add 100 pounds.
‡ (1) For potheads add 200 pounds per 2-3/C or 3-1C sets.
(2) For fuses add 200 pounds.
(3) For lightning arresters add 100 pounds.

DOUBLE AIR-INTERRUPTER SWITCH



NOTE: Available space for primary leads at top and bottom.

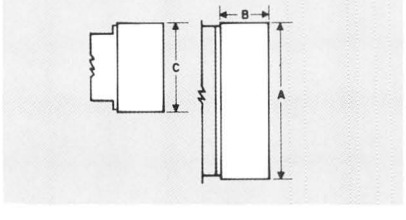
kV	Dimensions in Inches							Weight in Pounds
	A*	B	C	D	E	F x G	H	
5	*	61.84	50	9.3	7.75	16 x 23	4.36	1500‡
15	*	79.3	53	15.80	9.0	12.5 x 27	6.3	2100‡

* Same height as transforming section.
† (1) For potheads add 200 pounds per 2-3/C or 3-1C sets.
(2) For fuses add 200 pounds.
(3) For lightning arresters add 100 pounds.

All dimensions are subject to change without notice and should not be used for construction pruposes unless endorsed.

OUTGOING TERMINATION EQUIPMENTS

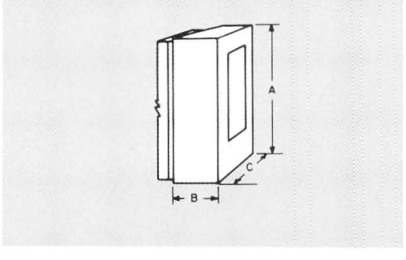
AIR-FILLED TERMINAL COMPARTMENT



No. of Cables per phase	Dimensions in Inches			Approx. Weight in Pounds
	A	B	C	
1 to 4	*	15	39	250
5 to 8	*	22	39	400

* Same height as transforming section.

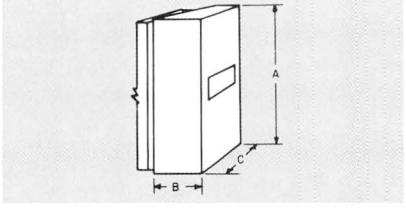
TYPE AK BREAKER COMPARTMENT ¶



Type Breaker	Dimensions in Inches				Approximate Weight in Pounds
	A	B		C	
		Indoor	Outdoor		
AKR-30	*	32.5	38.5	39	700
AKR-50	*	32.5	38.5	39	800

* Same height as transforming section.
¶ In some cases the addition of metering will change the dimensions of the compartment. When metering or dimensions for AKR-75 and AKR-100 breaker compartments are required, contact your GE Sales Office for additional information.

MOLDED-CASE BREAKER OR QMR FUSIBLE SWITCH COMPARTMENT ¶



Type Panelboard	Dimensions in Inches				Approximate Weight in Pounds
	A	B	C	Doorswing S⌀	
Molded-case Breakers	*	22‡	39	15	500

* Same height as transforming section.
⌀ Outdoor Units: doors are not normally furnished for indoor units.
‡ For main circuit breaker larger than 1200 amps dimensions will be increased.
¶ In some cases the addition of metering will change the dimension of the compartment. When metering is required, contat your GE Sales Office for additional information.

Guide Form Specifications

INTEGRAL DISTRIBUTION CENTERS

Fill in number

Fill in quantity and rating, cross out one

Item No. ..... Integral Distribution Center
Unit Substation Specifications
..... kVA *(indoor) (outdoor)* Secondary
Unit Substation(s)

General Arrangement

Cross out one

Cross out two

These specifications cover a complete *(outdoor) (indoor)* distribution center unit substation from the incoming line terminals to the outgoing feeder terminals. The unit shall be arranged so that facing the front of the unit, the incoming line section shall be on the *(left) (right)* and the low-voltage outgoing section on the (right (left).

Ratings

Fill in rating

The substation shall have the following self-cooled ratings.

Capacity ..... kVA
Frequency ..... 60 Hertz
Phases ..... three
Fill in rating
Cross out one
and fill in rating
Incoming 3-wire circuit ..... volts
Outgoing (3) (4)-wire circuits ..... volts

THE UNIT SUBSTATION WILL CONSIST OF THE FOLLOWING COORDINATED COMPONENTS:

1. Incoming Line Section

Air-filled Terminal Compartment

1—Air-filled low-voltage terminal compartment shall be mounted integrally with the transformer with *(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—TRANQUELL® (distribution type) ..... kV surge arresters mounted inside terminal compartment.

Old Cutouts

1—Set of three, gang-operated, oil cutouts rated *(5 kV) (15 kV)* mounted in an air-filled terminal chamber integral with the transformer. *(Key interlocking with the low-voltage secondary circuit breakers is required).*

1—Set of three fuse links mounted in above cutouts. These fuses shall be rated . . . . amperes and will be applied on a circuit having 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).*

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

Select one

Air-interrupter 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, 600 amps load interrupting, 40,000 amps asymmetrical momentary) (1200 amps continuous, 1200 amps load interrupting, 60,000 amps asymmetrical momentary). (Key interlocking with low-voltage* ***main breaker may be 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 Selector 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, 600 amps load interrupting, 40,000 amps asymmetrical momentary) (1200 amps continuous, 1200 amps load interrupting, 60,000 amps asymmetrical momentary).* 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 bus. The switches will be key 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.
(Potheads) (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 common bus between the switches and power fuses.

2. Transforming Section

Cross out one
Fill in ratings and cross out one

The transformer section of the unit substation 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 (65 C) (55/65 C). . . . 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 percent 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
Pressure-vacuum gage
Hand hole on cover
Drain valve and sampling device
Top filling connection
Pressure relief device*
Fault pressure relay
*Standard on silicone transformer—
Liquid-level gage (with alarm contacts)
Dial-type thermometer (with alarm contacts)
Provision for lifting and jacking
Base suitable for skidding and rolling in any direction
Ground pad on low end of tank
Fans for auxiliary cooling mounted on tubes
Winding temperature indicator

Optional Accessories

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 C57.12.90. 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 rate).]

3. Outgoing Line Section

Select one

Molded-case Circuit-breaker Panelboard

Consisting of a dead-front panelboard of the convertible circuit-breaker type containing individual molded-case circuit breakers, manually operated, with thermal-magnetic overcurrent protection assembled into a single unit. The panelboard shall be mounted in a metal-enclosed compartment mounted integral with the transformer. The following breakers are included.

Fill in ratings

1—Main air circuit breaker, molded-case, manually operated, stationary-type 3-pole, ... frame, rated . . . . amp . . . . amps . . . . interrupting capacity at . . . . volts, set to trip at . . . . amps.

Fill in quantity and ratings

. . . . feeder breakers, molded case, manually operated, stationary-type interrupting rating at . . . . volts as follows:

Fill in quantity and ratings

Qty	Frame	Pole	Max Amp	Interrupting Rating (Amp)	Set to Trip at (Amp)
.....	.....	.....	.....	.....	.....
.....	.....	.....	.....	.....	.....
.....	.....	.....	.....	.....	.....

AKR Air Circuit Breaker

Consisting of a single Type AKR air circuit breaker of the drawout construction mounted in a metal-enclosed compartment mounted integral with the transformer. The breaker shall be of the stored-energy type and shall be *(manually) (electrically)* operated. The breaker shall be . . . . amps frame size with . . . . amps trip rating. Each pole of the breaker shall be equipped with dual magnetic long-time and instantaneous-overcurrent tripping devices.

Air-filled Terminal Compartment

Air-filled, low-voltage terminal compartment shall be mounted integrally with the transformer with *(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).*

Notes

VERSATILE AND RELIABLE AIR-INTERRUPTER SWITCHES

Switches are rated for use with liquid-filled transformers rated 112.5 through 3000 kVa, 2400 through 13,800 volts.

The basic switch, incorporating a stored-energy operating mechanism, has an interrupting rating of 600 amperes at all voltages. The stored-energy mechanism provides a positive, controlled closing and opening stroke independent of the operator.

All air switches meet NEMA Standard SG-5 for power switching equipment, and ANSI Standard C37.30.

Incoming-line cables can enter the top or bottom of the compartment and can be connected for either single or loop feed. Cables can be terminated with clamp-type terminals or potheads. The terminals are easily accessible to apply test voltage or check the phasing of the unit.

Two observation windows of shatter-proof safety glass are provided in the sheet-steel door. The windows are sized and located to give an adequate view of the switch contacts, but are small enough to provide maximum personnel protection during inspection.

Current-limiting fuses can be included in the compartment under the interrupter switch. They can provide interrupting capacity sufficient to clear a fault at the low-voltage terminals. When fuses are furnished, the fuse compartment door is mechanically interlocked with the switch so the fuse door cannot be opened unless the interupter switch is in the OPEN position. Likewise, the interrupter switch cannot be closed unless the fuse door is also closed. Key interlocking with low-voltage circuit-interrupting devices can also be furnished.

Surge arresters can be supplied in the switch compartment for added protection against voltage surges.

AIR SWITCH CONTINUOUS AND SHORT-CIRCUIT CURRENT RATINGS

kV	BIL	Continuous Current Rating and Load Break	Momentary and Close and Latch Assembly (KA without fuses)
5	60	600	40
5	60	1200	61
15	95	600	40
15	95	1200	61
15	95	1200	80

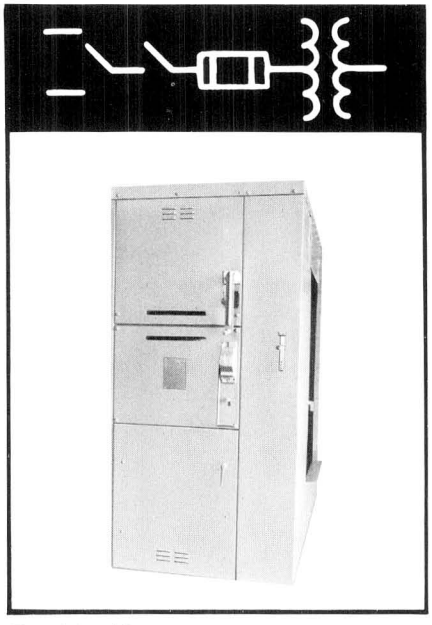
Two-position Air-interrupter Switch

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

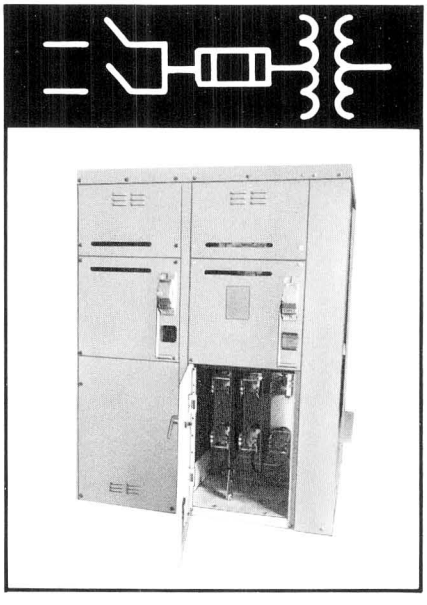
The unit consists of a two-position (OPEN/CLOSED) air-interrupter switch in series with a two-position (LINE 1/LINE 2) selector switch. The selector switch is a dead-break device and is mechanically interlocked so it cannot be operated unless the interrupter switch is open.



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.



Selection and Application Information

SURGE PROTECTION

It is recommended that proper surge arresters be installed at the primary terminals of the substation, in order to protect the incoming line equipment and transformer from voltage surges.

If it is not possible to locate the surge protection at the transformer incoming line equipment, further investigation should be undertaken to determine if safe surge voltages can still be maintained.

SURGE ARRESTERS

To determine the type and rating of the arrester best suited to a particular system it will be necessary to (1) determine the characteristics of the incoming circuit supplying the substation primary terminals with respect to grounding, as defined in the IEEE Standard for surge arresters, (2) shielding as defined in one of the ANSI guides for arrester application — C62.2 or C62.22, and (3) location of other equipment in relation to the transformer.

APPLICATION OF UNFUSED INTERRUPTER SWITCHES

High voltage	2400-4800V		6900-7200V		12000-13800V
Transformer kVA	112.5-750	1000-2500	112.5-1500	2000-3000	112.5-3000
Air Switch	X	X	X	X	X
Oil-filled Switch	X	X‡	X	X	X
Oil Cutouts	X	—	X	—	X

‡ At 2400 volts, the oil-filled switch can be applied on transformers up to 1000 kVA.

INTERLOCKING

To safeguard personnel and reduce switch contact maintenance, the high-voltage switch should be operated while de-energized or while carrying only the magnetizing current of the transformer.

Key interlocking the high-voltage switch with the low-voltage main circuit breaker makes it necessary to remove the low-voltage load before opening the high-voltage switch. When specified, this feature is included on GE Substations.

FUSING

Fuses, while available for air switches and cutouts, are not generally required on Integral Distribution Centers. A plain interrupter switch does not involve the expense and coordination problems of fuses and it is adequate for all units that can be protected by remote over-current relays.

Sometimes, though, other loads on the circuit are great enough that the National Electrical Code requires fuses on the incoming side of the substation. For example, if the kVA size of the substation is less than about 1/4 to 1/6 of the total load on the feeder, an interrupter switch and fuse combination should be used to protect the unit against short circuits.

Minimum suggested primary fuses are listed in the table on page 15 for the self-cooled rating.

It is essential that the coordination of fuses with other primary and secondary devices be checked before selecting the fuse rating.

For further information on GE current-limiting fuses and oil cutouts with fuse link, refer to GET-6779.

FUSE INTERRUPTING RATING, RMS AMPERES

Operating Voltage	Oil Cutouts With Fuse Link (Asymmetrical)	Air Switch With EJ Fuse (Symmetrical)	Air Switch with Type SM-4S S & C Fuses (Asymmetrical)
2400	11000	50,000	27,500
4160	11000	50,000	27,500
4800	10000	50,000	25,000
6900	5000	50,000	25,000
7200	5000	50,000	20,000
12470	7000	50,000	20,000
13200	7000	50,000	20,000
13800	7000	50,000	20,000

GE Power Delivery and Control

Transformer Business Department
General Electric Company
P.O. Box 2188
Hickory, North Carolina 28603

GEA-9878H

Printed in USA 11/89/10M04