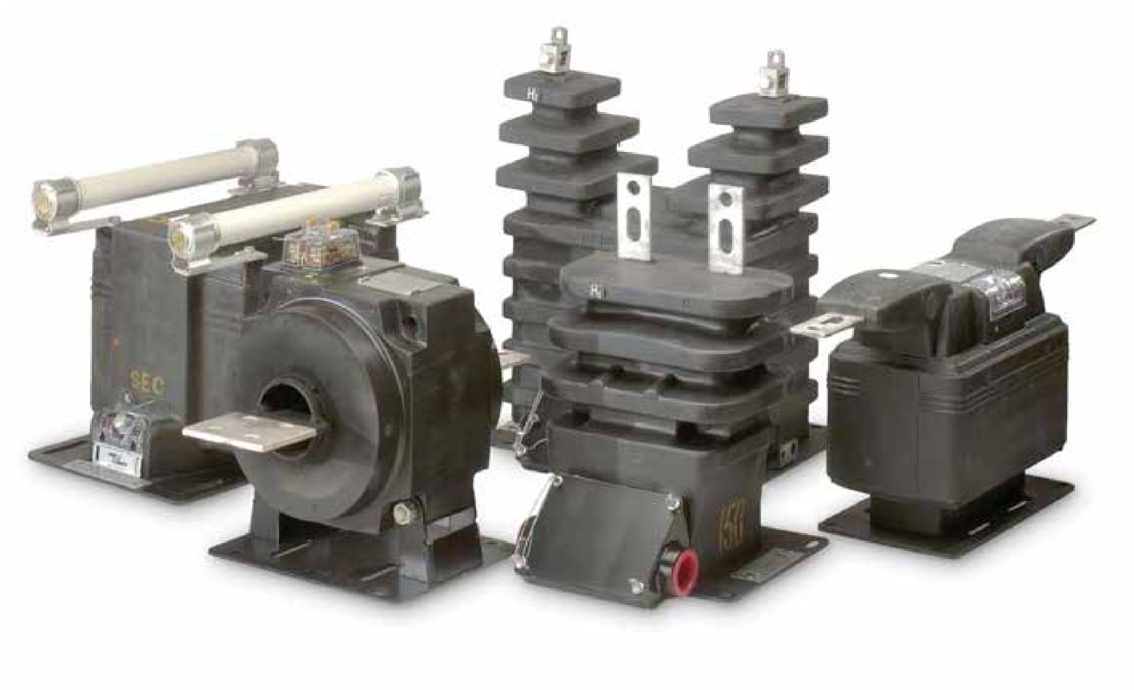
GE
Digital Energy

INSTRUCTIONS
SUPERBUTE™



Dry-type, Butyl-molded Instrument Transformers
GEH-230AG Issue 12/2014

Contents

SUPERBUTE Model Type & Catalog Number

The figure at right illustrates the breakdown of a SUPERBUTE Instrument Transformer model name, and the information contained therein. Assigned type numbers are described below.

Low Voltage (600V – 1200V)

JAD - Current, Indoor/Outdoor, window

JAF - Current, Indoor, window, for switchgear

JAR - Current, Indoor, auxiliary

JCD - Current, Indoor/Outdoor, window

JCP - Current, Indoor/Outdoor, window

JCS - Current, Indoor, molded, for switchgear

JNP - Voltage, Indoor/Outdoor, US Navy

Medium Voltage (2400V – 69000V)

JCB - Current, Indoor, window

JCD - Current, Indoor/Outdoor, window type

JCM - Current, Indoor, bar type

JCW - Current, Indoor/Outdoor, bar type

JKC - Current, Indoor, wound primary, for switchgear

JKS - Current, Indoor, wound primary, for switchgear

JCK - Current, Outdoor, wound primary

JKM - Current, Indoor, wound primary

JKW - Current, Outdoor, wound primary

JVM - Voltage, Indoor, molded

JVW - Voltage, Outdoor, molded

JVS - Voltage, Outdoor, station-class, single bushing

JVT - Voltage, Outdoor, station-class, two bushing

The figure at right illustrates the breakdown of a SUPERUBTE Instrument Transformer catalog number, and the information contained therein.

J V W - 5 A

Special Feature (select models only)
A = High Accuracy
ER = High Accuracy, Extended Range

Correspond to IEEE Insulation Classes as follows:

Voltage Class, in kV

0 = 0.6	95 = BIL, in kV
1 = 1. 2	110 = BIL, in kV
2 = 2.5	150 = BIL, in kV
3 = 5	200 = BIL, in kV
4 = 8.7	250 = BIL, in kV
5 = 15	350 = BIL, in kV
6 = 25	
7 = 34.5	
8 = 46	
9 = 69	

Dominant Features;
(Dependent on second character)
M = Indoor
W = Outdoor
S = Single-bushing Voltage Transformer
T = Two-bushing Voltage Transformer

Current Transformer:
A = Window or Bar Type CT
C = Window or Bar Type CT
K = Wound Type CT

Voltage Transformer:
N = US Navy VT
V = Wound Type VT

Instrument Transformer:
= J

7 6 5 X 0 X X X X X

Group Number

Model

Voltage Class, in kV

0 = 0.6	4 = 8.7	8 = 46
1 = 1. 2	5 = 15	9 = 69
2 = 2.5	6 = 25	
3 = 5	7 = 34.5	

5 = Current Transformer
6 = Voltage Transformer

7 = Instrument Transformer

Voltage Transformer Model Types

GE Model	Catalog # Series	Design	Volts	BIL (kV)	0.3 Acc. Burden	Thermal (VA)	Avg. Lbs.	Other/ Options
Indoor								
JVM-2	762X022XXX	---	2,400	45	Y	750	30	Fuse Option
JVM-3	763X021XXX	---	4,800	60	Y	750	30	Fuse Option
JVM-4	764X020XXX	---	7,200	75	Z	1,500	85	Fuse Option
JVM-5	765X021XXX	---	14,400	95/110	Z	1,500	85	Fuse Option
JVM-6	766X021XXX	---	24,000	125	Y	750	90	---
Outdoor								
JVW-3	763X030XXX	Distribution-Class	4,800	60	Y	750	44	2 Bushing
JVW-4	764X030XXX	Station-Class	7,200	75	Z	1,500	105	1-2 Bushing
JVW-5	765X030XXX	Station-Class	14,400	110	Z	1,500	105	1-2 Bushing
JVW-110	765X031XXX	Distribution-Class	14,400	110	Y	1,000	105	1-2 Bushing
JVW-6	766X031XXX	Distribution-Class	24,000	125	Y	750	95	1-2 Bushing
JVW-6	766X035XXX	Distribution-Class	24,000	150	Y	750	95	1 Bushing
JVW-7	767X031XXX	Distribution-Class	34,500	150	Y	750	140	1-2 Bushing
JVS-150	766X030XXX	Station-Class	14,400	150	ZZ	3,000	230	1 Bushing
JVT-150	766X030XXX	Station-Class	24,000	150	ZZ	3,000	225	2 Bushing
JVS-200	767X030XXX	Station-Class	20,125	200	ZZ	3,000	240	1 Bushing
JVT-200	767X030XXX	Station-Class	34,500	200	ZZ	3,000	235	2 Bushing
JVS-250	768X030XXX	Station-Class	27,600	250	ZZ	5,000	420	1 Bushing
JVT-250	768X030XXX	Station-Class	46,000	250	ZZ	4,500	520	2 Bushing
JVS-350	769X030XXX	Station-Class	40,250	350	ZZ	5,000	430	1 Bushing
JVT-350	769X030XXX	Station-Class	69,000	350	ZZ	4,500	560	2 Bushing

Notes:

1. Typical values shown. Actual values can vary with ratio. Contact factory or refer to data sheets.
2. High Accuracy versions are available in most models, designed with an "A" after the model name (e.g. JVW-5A). Contact factory or refer to data sheets for performance values.

Current Transformer Model Types

GE Model	Catalog # Series	Design	Volts	BIL (kV)	0.3 Acc. @ Meter Burden	Relay Class	Primary Amps		Typical 30°C R. F.	Ave. Lbs.	Other/ Options
							Min.	Max.			
Indoor – Window and Bar Types											
JCM-2	752X020XXX	Bar	2,500	45	B1.8	C200	600	4,000	1.3	37	---
JCM-3	753X020XXX	Bar	5,000	60	B1.8	C200	600	4,000	1.3	62	Tap Sec.
JCB-3	753X021XXX	Window	5,000	60	B1.8	C100 - C400	600	4,000	1.3	85	Tap Sec.
JCM-4	754X020XXX	Bar	8,700	75	B1.8	C200	600	4,000	1.3	62	Tap Sec.
JCB-4	754X021XXX	Window	8,700	75	B1.8	C100 - C400	600	4,000	1.3	85	Tap Sec.
JCM-5	755X020XXX	Bar	15,000	110	B1.8	C200	600	4,000	1.3	95	Tap Sec.
JCB-5	755X021XXX	Window	15,000	110	B1.8	C100 - C400	600	4,000	1.3	110	Tap Sec.
Indoor – Wound Types											
JKM-2	752X040XXX	Wound	2,500	45	B0.5	T50	10	1,200	1.5	16	---
JKC-3	753X002XXX	Wound	5,000	60	B0.5	T50	10	1,200	1.5	16	---
JKS-3	753X001XXX	Wound	5,000	60	B0.1 – B1.8	T10 - T100	15	800	1.5	30	Tap, Dual Sec.
JKM-3	753X040XXX	Wound	5,000	60	B1.8	T100	5	800	1.5	30	Tap, Dual Sec.
JKM-4	754X040XXX	Wound	8,700	75	B1.8	T100	10	800	1.5	30	---
JKS-5	755X001XXX	Wound	15,000	95	B0.1 – B1.8	T10 - T100	15	800	1.5	50	Tap, Dual Sec.
JKM-5	755X042XXX	Wound	15,000	110	B1.8	T200	5	800	1.5	50	Tap, Dual Sec.
Outdoor - Window and Bar Types											
JCW-3	753X030XXX	Bar	5,000	60	B1.8	C200	600	4,000	1.3	95	Tap Sec.
JCD-3	753X031XXX	Window	5,000	60	B1.8	C100 - C400	600	4,000	1.3	110	Tap Sec.
JCW-4	754X030XXX	Bar	8,700	75	B1.8	C200	600	4,000	1.3	95	Tap Sec.
JCD-4	754X031XXX	Window	8,700	75	B1.8	C100 - C400	600	4,000	1.3	110	Tap Sec.
JCW-5	755X030XXX	Bar	15,000	110	B1.8	C200	600	4,000	1.3	115	Tap Sec.
JCD-5	755X031XXX	Window	15,000	110	B1.8	C100 - C400	600	4,000	1.3	135	Tap Sec.
Outdoor – Wound Types											
JCK-3	753X051XXX	Distribution-Class	5,000	60	B0.5	---	5	800	3.0	35	
JKW-3	753X050XXX	Station-Class	5,000	60	B1.8	T100	5	800	1.5	40	Tap Sec.
JCK-4	754X051XXX	Distribution-Class	8,700	75	B0.5	---	5	800	3.0	35	
JKW-4	754X050XXX	Station-Class	8,700	75	B1.8	T100	10	800	1.5	40	Tap Sec.
JCK-5	755X052XXX	Distribution-Class	15,000	110	B0.5	---	5	800	3.0	35	
JKW-5	755X053XXX	Station-Class	15,000	110	B1.8	T200	5	1,200	1.5	60	Tap Sec.
JKW-6	756X050XXX	Distribution-Class	25,000	150	B1.8 or B0.9	T200 or T100	5	1,200	1.5 or 3.0	80	Tap Sec.
JKW-7	757X050XXX	Distribution-Class	34,500	200	B0.5	---	10	800	3.0	72	Tap Sec.
JKW-150	756X030XXX	Station-Class	25,000	150	B1.8	T200/400	25	3,000	1.5/3	320	Tap, Dual Sec.
JKW-200	757X030XXX	Station-Class	34,500	200	B1.8	T200/400	25	3,000	2.0/	345	Tap, Dual Sec.
JKW-250	758X030XXX	Station-Class	46,000	250	B1.8	T200/400	25	3,000	2	540	Tap, Dual Sec.
JKW-350	759X030XXX	Station-Class	69,000	350	B1.8	T200/400	25	3,000	2	590	Tap, Dual Sec.

Notes:

1. Multiply primary amps by rating factor to get maximum amp rating at 30°C.
2. Typical values shown. Accuracy, Relay Class and Rating factor can vary with ratio.
3. High Accuracy and/or Extended Range versions are available in most models, designed with an "A" or "ER" after the model name (e.g. JKW-5A). Contact factory or refer to data sheets for performance values.

Instructions

These instructions apply to SUPERBUTE current and voltage transformers with standard ratings and applied under usual conditions (refer to IEEE C57.13). For information on unusual ratings for frequency, voltage, current, or on installations where unusual conditions exist, please consult with a General Electric sales representative.

Before Installation

Inspection

Immediately upon receiving the transformer, inspect it for physical damage that may have occurred during shipment or handling. If damage is evident, file a claim with the transportation company immediately and promptly notify General Electric sales representative.

For current transformers, make sure that the short-circuit jumper is securely in place on at least two terminals of each secondary provided. Do not remove or cut away a jumper until the secondary circuit in question is closed through a suitable burden.

Storage & Handling

The butyl-molded transformers are less fragile than porcelain, HCEP, and other epoxy insulated transformers, but nevertheless should be handled with care.

These butyl-modeled current transformers are practically impervious to moisture. If, due to unusual circumstances, insulations tests indicate a possibility of entrance moisture, please consult with a General Electric sales representative for detailed information on the proper procedure.

Testing

Insulation tests should be made in accordance with the latest revision of IEEE C57.13 Standard Requirements for Instrument Transformers and/or ANSI/NETA ATS Standard for Acceptance Testing Specifications for Electrical Power Equipment and Systems. Initial users tests of insulation should not be in excess of 75% of factory test voltage.

Insulated-Neutral and Grounded-Neutral Terminal-Type Voltage Transformers

Certain voltage transformers are designed with one fully insulated primary terminal, with the neutral end of the primary winding insulated for a lower level or connected to the case, frame, or base. In some designs, this connection to the case, etc., can be removed for primary-applied potential testing. In such designs, the customer should consider the required factory primary-applied potential test level to be 19 kV on outdoor types and 10 kV on indoor types. These levels correspond to IEEE C57.13 requirements for insulated-neutral terminal types.

Demagnetizing Current Transformers

Current transformer cores may become magnetized as a result of the application of direct current to a winding (for example, while measuring winding resistance or checking continuity) or in other ways. If a current transformer becomes magnetized, it should be demagnetized before being used for precision work. Current transformers should always be demagnetized before accuracy test. IEEE C57.13 lists methods for demagnetizing current transformers.

One method is to connect the transformer in the test circuit as shown in Fig. 1, below. Pass rated current through the low-turn winding (usually the primary). Increase the resistance (R) in the high-turn winding (usually the secondary) circuit unit the transformer core is saturated; then, slowly reduce resistance to zero and disconnect the current source. Saturation of the core is indicated by a reduction of current in the high-turn winding circuit.

On tapped-secondary current transformers, demagnetizing should be done using the X2-X3 section of the winding to reduce the voltage required for saturation. On dual-secondary current transformers, the two secondaries should be paralleled during demagnetization.

WARNING: A CONTINUOUSLY VARIABLE RESISTANCE MUST BE USED TO AVOID OPENING THE HIGH-TURN WINDING CIRCUIT WHEN RESISTANCE VALUES ARE CHANGED. AS THE RESISTANCE IS INCREASED, THE VOLTAGE ACROSS THE RESISTANCE WILL APPROACH OPEN-CIRCUIT VALUE.

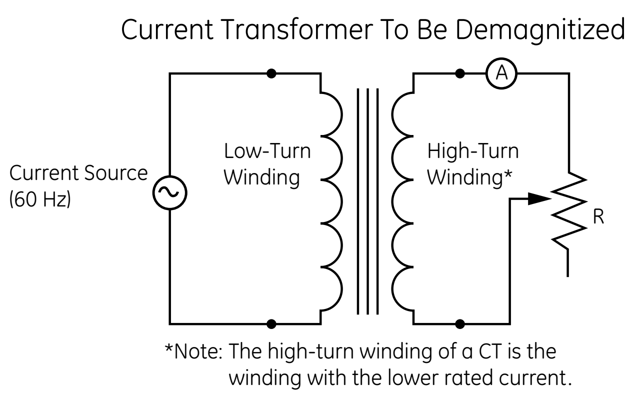


Figure 1 - Circuit for demagnetizing current transformers

Installation

Safety Precautions

1. Always consider an instrument transformer as a part of the circuit to which it is connected, and do not touch the leads and terminals or other parts of the transformer unless they are adequately grounded.

2. The insulation surface of molded transformers should be considered the same as the surface of a porcelain bushing, since a voltage stress exists across the entire insulation surface from terminals to grounded metal parts.

3. Always ground the metallic cases, frames, bases, etc., of instrument transformers. The secondaries should be grounded close to the transformers. However, when secondaries of transformers are interconnected, there should only be one grounded point in this circuit to prevent accidental paralleling with system grounding wires.

4. Do not open the secondary circuit of a current transformer while the transformer is energized, and do not energize while the secondary circuit is open. Current transformers may develop open-circuit secondary voltages which may be hazardous to personnel or damaging to the transformer or equipment connected in the secondary circuit.

5. The applications of power fuses in the primary circuits of voltage transformers is recognized and recommended operating practice on power systems. To provide the maximum protection practical against damage to other equipment or injury to personnel in the event of a voltage transformer failure, it is usually necessary to use the smallest fuse ampere rating which will not result in nuisance blowing. Increasing the fuse ampere rating to reduce nuisance blowing is usually accompanied by slower clearing and increased possibility of damage to other equipment or injury to personnel.
6. Never short-circuit the secondary terminals of a voltage transformer. A secondary short circuit will cause the unit to overheat and fail in a very short period of time.

Mounting

Versatile mounting is a feature of these transformers. All SUPERBUTE transformers can be mounted in any position: upright, horizontal, or even inverted. Instrument transformers should be mounted so that connections can be made to the power or distribution lines in such a manner as to avoid placing appreciable strains upon the terminals of the transformers.

For high-current transformer ratings, 2000 amperes and above, there may be some interference from the electric field of the return bus unless the bus centers are kept at a minimum distance of 15 inches apart; for ratings above 5000 amperes, this distance should be not less than 24 inches. If this type transformer is used with more than one primary turn, the loop should be at least 24 inches in diameter. Make sure that the secondary leads are twisted closely together and carried out without passing through the field of the primary conductors. It is not necessary that the bus exactly fill the window, but the bus or buses should be centralized. For ratings of 1000 amperes or less, these precautions are generally unnecessary.

Refer to model specific data sheets for more detail, as some models have maximum loading recommendations and/or alignment recommendations that should be followed. Several models have accessories available which allow for multiple mounting options such as bolting directly to a crossarm attached by “U” bolts or suspension hooks, or mounted on double crossarms, using channel brackets.

Secondary Connections

When connecting instrument transformers with meters or instruments, refer to the instructions furnished with the meters or instruments involved.

The resistance of all primary and secondary connections should be kept as low as possible to prevent overheating at the terminals, and to prevent an increase in the secondary burden.

The resistance of the secondary leads should be included in calculating the secondary burden carried by current transformers. The total burden should be kept within limits suited to the transformers used. The voltage drop in the primary and secondary leads of voltage transformers will reduce the voltage at the measuring device.

Short-Circuiting of Current Transformers

Many current transformers are provided with a device for short-circuiting the secondary terminals, and are normally shipped from the factory with this device in the short-circuiting position. Check the position of the shorting device. The secondary terminals should be short-circuited by the shorting device, or equivalent, until a suitable burden (such as an ammeter, wattmeter, watthour meter, relay, etc.) has been connected to the secondary terminals.

Tapped-secondary current transformers, including multi-ratio current transformers with more than one secondary tap, are adequately short-circuited when the short is across at least 50 percent of the secondary turns. When a suitable secondary burden has been connected to two terminals of a tapped-secondary current transformer, and normal operation is desired, all unused terminals must be left open to avoid short- circuiting a portion of the secondary winding and producing large errors. Only one ratio can be used at a time.

On double-secondary or multiple-secondary current transformers, that is, transformers with two or more separate secondary windings (each having an independent core), all secondary windings not connected to a suitable burden must be shorted.

Before a burden is disconnected from a current transformer, the secondary terminals should be short- circuited.

Polarity

When wiring instrument transformer circuits, it is necessary to maintain the correct polarity relationship between the line and the devices connected to the secondaries. For this reason, the relative instantaneous polarity of each winding of a transformer is indicated by a marker H1 (or a white spot) on or near one primary terminal, and a marker X1 (or a white spot) near one secondary terminal. Refer to Figure 2.

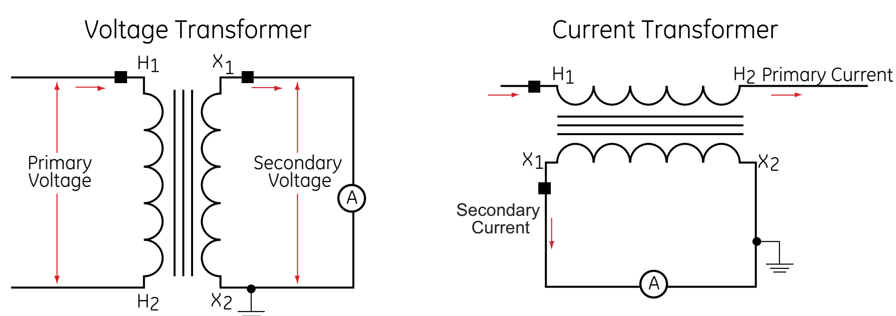


Figure 2 - Elementary Connections of Instrument Transformers

Where taps are present, all terminals are marked in order. The primary terminals are H1, H2, H3, etc.; the secondary terminals X1, X2, X3, etc. (and Y1, Y2, Y3, etc., if another secondary is used). The marker H1 always indicates the same instantaneous polarity as X1 and Y1.

When connection is made to secondary terminal having a polarity marking similar to a given primary terminal, the polarity will be the same as if the primary service conductor itself were detached from the transformer and connected directly to the secondary conductor. In other words, at the instant when the current is flowing toward the transformer in a primary lead of a certain polarity, current will flow away from the transformer in the secondary lead of similar polarity during most of each half cycle.

When the secondary of an instrument transformer is connected to an instrument (such as a voltmeter or ammeter) which measures only the magnitude of the primary voltage or current, polarity is not significant.

High Altitude Operation

These transformers are designed to operate over the ambient temperature range as indicated at the standard ratings (see nameplate), provided the altitude does not exceed 3300 feet. If the transformers are to be used above 3300 feet, consult IEEE Standard C57.13 for the effect of altitude on temperature rise.

Current Transformer Primary By-Pass Protection

Primary by-pass protectors are recommended for the proper protection of current transformers which are so located as to be exposed to the effect of surge currents. They are especially recommended for low primary-current ratings, as these ratings have a relatively high winding impedance. Thyrite primary by-pass protectors consist of one or more Thyrite disks which are connected in parallel with the primary winding of the transformer. When high frequency current surges occur, an appreciable part of the surge current is by-passed through the protector, reducing the voltage built up across the winding. Under normal operating conditions, the current bypassed has a negligible effect on accuracy.

On station-class current transformers (Types JKW-150 through JKW-350), internal gaps are provided on low current ratings. If high voltages occur across the primary coil, these gaps fire and bypass the current around most of the primary impedance. The gaps fire at voltages well below the internal turn-to-turn dielectric strength of the primary winding.

Primary Fuses for Voltage Transformers

The application of fuses in the primary circuits of voltage transformers is recognized and recommended operation practice of power systems. Their correct application is as important as the proper selection of power circuit breakers for such systems.

The function of voltage transformer primary fuses is to protect the power system by de-energizing failed voltage transformers. Although the function of the fuses is not to protect the voltage transformer, the fuses selected will often protect the voltage transformer promptly in the event of a short in the external secondary circuitry, if the short is electrically close to the secondary terminals.

To provide the maximum protection practical against damage to other equipment or injury to personnel in event of a voltage transformer failure, it is usually necessary to use the smallest fuse current rating which will not result in nuisance blowing. Fuses are rarely available which will fully protect voltage transformer from overloads, or immediately clear the system of a failed voltage transformer. Increasing the fuse ampere rating to reduce nuisance blowing is usually accompanied by slower clearing and increased possibility of other damage.

Voltage transformers require fuses which combine low continuous current rating with high interrupting capacity. In this regard, it will be noted that available interrupting ratings of current limiting power fuses in each voltage class are typically comparable to the available ratings of the related power circuit breakers.

In applying current-limiting fuses, it is necessary to adhere to certain established principles with respect to voltage, frequency, and interrupting ratings, as well as location and mounting.

The factors involved have been taken into consideration in listing the voltage transformers "with fuses" as listed in applicable Product Data Sheets.

The methods of connection fall into two classes, arbitrarily called Class I and Class II. Figure 3 shows various methods of connecting voltage transformers and primary fused to a power system.

Class I includes those connections in which each fuse carries the exciting current of only one transformer. This is the case in single-phase connection, (Figure 3, a) delta connections in which the transformer primaries are each fused separately (Figure 3, b and c), and wye connections (Figure 3, d).

Class III includes delta and open delta connections (Figure 3, e and f) in which a fuse must pass the exciting current of more than one transformer.

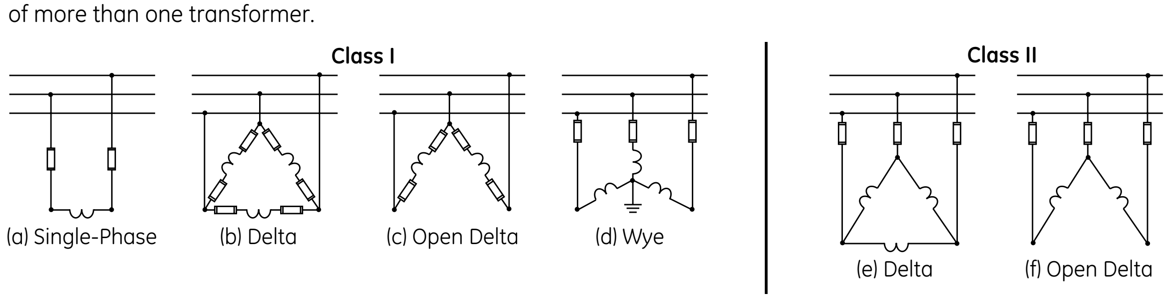


Figure 3. Primary Fuse and Voltage Transformer Connections

For indoor voltage transformers "with fuses", listed on Product Data Sheets, the connections are necessarily Class I, hence the fuses have been selected on the basis of Class I connections. On non-handbook items "with fuses", the fuses are provided on the basis of Class I connections.

For outdoor voltage transformers where fuses are always mounted separately, Table 2 recommends fuse units for Class I connections and for Class II connections.

The use of a fuse in the connection of a voltage transformer terminal to ground is not recommended. For grounded wye connections, it is preferred practice to connect one primary lead from each voltage transformer directly to the grounded neutral, using a fuse only in the line side of the primary. With this connection, a transformer can never be "alive" from the line side with a blown fuse on the grounded side.

For separately mounted fuses where over-insulation is required or specified, the fuse must be selected on the basis of actual service voltage. The mounting for the fuse can be provided with insulators of a higher voltage rating so as to provide additional insulation to ground.

Selection Of Fuses – Voltage Ratings

Maximum operating line-to-line voltage should be in the range 70 to 100 percent of the rated voltage of the fuse. This range of application voltage is recommended because the current-limiting action of the fuse is characterized by the generation of transient recovery voltages above normal circuit voltages values. The magnitude of these over-voltages increases nonlinearly as available short-circuit current increases. The maximum voltage permitted at rated interrupting current is specified in ANSI C37.46.

Therefore, it is important that the voltage rating of high-voltage fuses be coordinated with the voltage levels of the associated system equipment to avoid inducing destructive voltages during fuse operation.

Note: Fuse ratings apply to GE VT's only.

System Voltage Nominal Line-to-line	DATA TABLE		Current Limiting Fuse Unit Type[1]			
	Primary Voltage	Fuse Voltage Rating	Fuse Voltage Rating	Fuse Size[2]	Fuse Ampere Rating for Connection	
					Class I	Class II
2,400	2,400	JVM-2	2,400	A, B or C	1E	2E
4,160Y	2,400	JVM-2	2,400	A, B or C	1E	...
2,400	2,400	JVM-3	2,400	B or C	1E	2E
4,160Y	2,400	JVM-3	4,800	B or C	1E	...
4,200	4,200	JVM-3	4,800	B or C	0.5E	1E
4,800	4,800	JVM-3	4,800	B or C	0.5E	1E
4,200	4,200	JVM-4	4,800	B or C	1E	2E
7,280Y	4,200	JVM-4	7,200	B or C	2E	...
4,800	4,800	JVM-4	4,800	B or C	1E	2E
7,200	7,200	JVM-4	7,200	B or C	1E	2E
7,200	7,200	JVM-5	7,200	B or C	1E	2E
12,470Y	7,200	JVM-5	14,400	B or C	1E	...
14,560Y	8,400	JVM-5	14,400	B or C	0.5E	...
12,000	12,000	JVM-5	14,400	B or C	0.5E	1E
14,400	14,400	JVM-5	14,400	B or C	0.5E	0.5E
24,000	24,000	JVM-6	23,000	C	0.5E	0.5E
20,780Y	12,000	JVM-6	23,000	C	0.5E	—
24,940Y	14,400	JVM-6	23,000	C	0.5E	—

[1] Fuses selected must always have voltage rating equal to or nearest rating above the line-to-line voltage of the system. Exception: Fuse units rated 600 volts may be applied on circuits rated 220 to 600 volts.

[2] A- and B-size fuses can be mounted directly on the transformer. C-size fuses must be mounted separately.

Table 1. Recommended Fuses for Class I and II Indoor Connections

DATA TABLE						
System Voltage Nominal Line-to-line	DATA TABLE		Current Limiting Fuse Unit Type[1]			
	Primary Voltage	Fuse Voltage Rating	Fuse Voltage Rating	Fuse Size	Fuse Ampere Rating for Connection	
					Class I	Class II
2,400	2,400	JVW-3	2,400	C	1E	2E
4160Y	2,400	JVW-3	4,800	C	1E	...
4,200	4,200	JVW-3	4,800	C	0.5E	1E
4,800	4,800	JVW-3	4,800	C	0.5E	1E
2,400	2,400	JVW-4	2,400	C	2E	3E
4160Y	2,400	JVW-4	4,800	C	2E	...
4,200	4,200	JVW-4	4,800	C	1E	2E
7,280Y	4,200	JVW-4	7,200	C	2E	...
4,800	4,800	JVW-4	4,800	C	1E	2E
7,200	7,200	JVW-4	7,200	C	1E	2E
7,200	7,200	JVW-5	7,200	C	1E	2E
12,470Y	7,200	JVW-5	14,400	C	1E	...
14,560Y	8,400	JVW-5	14,400	C	0.5E	...
12,000	12,000	JVW-5	14,400	C	0.5E	1E
14,400	14,400	JVW-5	14,400	C	0.5E	0.5E
12,470Y	7,200	JVW-110	14,400	C	1E	...
14,560Y	8,400	JVW-110	14,400	C	0.5E	...
12,000	12,000	JVW-110	14,400	C	0.5E	1E
14,400	14,400	JVW-110	14,400	C	0.5E	0.5E
24,000	24,000	JVW-6	23,000	C	0.5E	0.5E
20,780Y	12,000	JVW-6	23,000	C	0.5E	...
24,940Y	14,400	JVW-6	23,000	C	0.5E	...
34,500	34,500	JVW-7	34,500	D	1E	1E
34,500Y	20,125	JVW-7	34,500	D	1E	...
23,000	24,000	JVT-150	23,000	C	0.5E	0.5E
34,500	34,500	JVT-200	34,500	D	1E	1E
24,940Y	14,400	JVT-150	23,000	C	2E	...
34,500Y	20,125	JVT-200	34,500	D	1E	...

[1] Fuses selected must always have voltage rating equal to or nearest rating above the line-to-line voltage of the system. Exception: Fuse units rated 600 volts may be applied on circuits rated 220 to 600 volts.

Table 2 - Recommended Fuses for Class I and II Outdoor Connections

Selection of Fuses – Ampere Ratings

In selecting primary-fuse ampere ratings for use with voltage transformers, the objective is to use the smallest ampere rating that will not result in nuisance blowing during normal energization of the voltage transformer. When delayed clearing of a failed voltage transformer may result in damage to other equipment or injury to personnel, "Class II" connection (where a fuse must pass the magnetizing inrush current of two transformers) should be avoided if this connection requires a higher fuse ampere rating than the "Class I" connection (where a fuse passes the inrush current of one transformer).

In selecting primary fuses for voltage transformers the chief objectives are:

1. System short-circuit protection
2. Clearing the system of failed voltage transformers
3. Freedom from unnecessary fuse operation

To attain the first objective, it is necessary to use a fuse with interrupting rating at least equal to the maximum current obtainable in the system at the point of fuse installation.

To attain the second objective with the maximum protection practical against damage to other equipment or injury to personnel, it is necessary to use the smallest fuse ampere rating which will not result in nuisance blowing. Fuses are rarely available which will fully protect the voltage transformer from overloads, or immediately clear the system of a failed voltage transformer. Increasing the fuse ampere rating to reduce nuisance blowing is always accompanied by slower clearing and the increased possibility of other damage.

To attain the third objective of freedom from unnecessary fuse blowing, it is necessary to choose fuses having sufficient inrush current capacity to safely pass the transformer magnetizing inrush.

The heat generated in the fuse line is proportional to the square of the current and the time during which it flows. It is logical, therefore, to evaluate the inrush capacity of the fuse in terms of the ampere-squared-seconds required to melt its current-responsive element. This may be written i^2t, where “i” is the current flowing for “t” seconds.

The i^2t inrush capacity of any fuse is readily obtained from the time-current curves of the fuses under consideration.

These curves are plotted on “log-log” paper, and it may be seen that, for fast melting at high currents, the melting-time-current curve becomes practically a straight line with a negative slope of 2 to 1 (-63.43°). It is necessary only to project the straight-line portion of the curve back to the one-second line and square this current. Of course, the current from the straight-line portion of the curve, at any time, squared and multiplied by time will give the same result.

The maximum inrush current to the transformer can be recorded with an oscillograph, but the most practical way to get it is from the transformer manufacturer, in amperes-square-seconds. This may be written I^2T, to distinguish it from the fuse i^2t. For satisfactory fuse application, the fuse i^2t should exceed the transformer I^2T by a reasonable factor of safety. The recommended factor of safety is 1.5. Therefore, for Class I applications:

$i^2t \geq 1.5\ I^2T$

For Class II applications, the fuse must pass the magnetizing current of two transformers and the heating effect of inrush in one line could be approximately three times that occurring for one transformer. Therefore, for Class II applications:

$i^2t \geq 4.5\ I^2T$

The I^2T of the transformers is typically calculated at 110% of rated primary voltage.

Possible damage to other equipment or injury to personnel, due to delayed clearing of a failed voltage transformer, is an important consideration, Class II connection should be avoided if this connection requires a higher fuse ampere rating than the Class I connection. It should be noted that in Class II (Figure 3, f), two of the fuses carry the excitation current of only one transformer. These two can be selected on the basis of Class I connections, provided approximately the same protection as provided in Class I (Figure 3, c).

The inrush I^2T increases very rapidly with increases in applied voltages, and, in requesting the I^2T value from the manufacturer, the voltage specified should be the maximum expected in service.

In some applications, particularly cable circuits, there is a possibility that the inherent capacitance of the circuit will give rise to a discharge current through the primaries of connected voltage transformers when the circuit is disconnected from the bus. The magnitude and duration of this discharge current may be calculated from the circuit constants, and in some instances may result in blowing of primary fuses. Such cases have been found to be rare, however, and for most installations, unnecessary operation of primary fuses can be prevented by selecting the fuse ampere rating on the basis of the magnetizing inrush current of the voltage transformers.

In-Service Maintenance

Whether mounted indoors or outdoors, SUPERBUTE transformers require no special care or regular maintenance other than keeping the insulation surfaces free from accumulation of dirt.

Butyl Rubber Aging

The only indication the HY-BUTE 60 butyl rubber material used in SUPERBUTE transformers gives of aging is a visual one, where the surface color turns from black to gray. The gray coloration that occurs on the surface of HY-BUTE 60 over a period of time is caused by ultra-violet radiations from sunlight. Most plastic materials, of which butyl is a part, start to decompose when subjected to ultra-violet radiation. With HY-BUTE 60, surface decomposition occurs slowly over a period of two to three years. In time, these decomposition products form a protective surface coating that prevents further penetration into the material. In HY-BUTE 60 the penetration is minute, being less than 1/64 of an inch.

The impact from this process is cosmetic only, as the decomposed surface product fully retains the non arc-tracking, hydrophobic, ozone resistance, and other environmental and electric characteristics of HY-BUTE 60 are while the transformer is in service.

Cleaning

If the surface of the transformer should become contaminated with a foreign material or the customer desires to clean the surface of the transformer, the following procedure is recommended;

1. Scrub the surface of the transformer using a stiff brush and a mild detergent and water solution.
2. Rinse loose material from the surface with clean water.
3. If further cleaning is desired the mild detergent and water solution can be used in conjunction with grit cloth such as Norton Abrasive Durite 421 – 320 GRIT.
4. It is not necessary to remove the gray coloration and restore the original black color. Removal of any "foreign" material should be sufficient in most instances.
5. Following the rinse process dry the transformer completely before testing

Note: it is no long recommended to apply silicone oil or any other surface restoration product to the transformer, as this may negatively impact the transformer insulation.

WARNING: CLEANING SHOULD ONLY BE PERFORMED WHILE UNIT IS DE-ENERGIZED.

Testing

These instrument transformers require no in service testing, and no test to date has proven to offer predictive value of internal insulation breakdown or remaining service life on SUPERBUTE designs. Testing on aged units can be performed at user's discretion to validate units pass rated insulation and accuracy levels. Insulation tests should be made in accordance with the latest revision of IEEE C57.13 Standard Requirements for Instrument Transformers and/or ANSI/NETA ATS Standard for Acceptance Testing Specifications for Electrical Power Equipment and Systems. Periodic insulation tests by user should not be in excess of 65% of factory test voltage. These recommendations relate to dielectric tests applied between windings and ground and to induced voltage tests. For ratio and phase-angle tests, refer to IEEE C57.13.

Interpretation Of Power-Factor And Megger Test Measurements

The value of power-factor measurements in liquid-insulated transformers for monitoring development of certain failure mechanisms is well established. A common use of this test is to detect change in the level of contaminants in the liquid, allowing sufficient warning to have the unit serviced before failure. The insulation system of dry type SUPERUBTE instrument transformers is made with butyl and epoxy and is a chemically stable, sealed system, not subject to internal contamination.

In-service dry type transformers with high power factor readings are usually the result of surface contamination and or moisture (including inside the conduit box). This is a valid use of a power-factor test to schedule preventive maintenance. When clean and free of moisture, dry-type instrument transformer power factor readings are invariably restored to original levels. The important distinction is that power-factor testing offers no predictive value of internal insulation breakdown.

A meggar test, while no more predictive, should be considered when trying to indentify weakened insulation. Neither power factor testing or megger testing are specified as a routine or type test in IEEE C57.13 Standard Requirements for Instrument Transformers.

Disclaimer

These instructions do not purport to cover all details or variations in equipment nor to provide for every possible contingency to be met in connection with the installation, operation or maintenance. The equipment covered by these operating instructions should be operated and serviced only by competent technicians familiar with good safety practices, and these instructions are written for such personnel and are not intended as a substitute for adequate training and experience in safe procedures for this type of equipment. Should further information be desired or should particular problems arise which are not covered sufficiently for the purchaser's purposes, the matter should be referred to the General Electric Company.

For more information about GE's Power Sensing products visit

GEDigitalEnergy.com/ITI

GE Digital Energy

Toll Free: +1 877-605-6777
Direct: +1 678-844-6777

GEDigitalEnergy.com

GEH-230AG (12/2014)