

JIS

JAPANESE INDUSTRIAL STANDARD

**Instrument Transformers
for Metering Service**

JIS C 1736—1988

Translated and Published

by

Japanese Standards Association

Printed in Japan

In the event of any doubt arising,
the original Standard in Japanese is to be final authority.

JAPANESE INDUSTRIAL STANDARD

J I S

Instrument Transformers for
Metering Service

C 1736-1988

1. Scope

This Japanese Industrial Standard specifies instrument transformers for metering service for use in combination with watt-hour meters, var-hour meters or maximum demand meters.

2. Defintitions

For the purpose of this Standards, the following principal definitions shall apply:

(1) General Terms

- (a) instrument transformer A transforming apparatus for current or voltage to be used with watt-hour meters, var-hour meters or maximum demand meters; it is the generic name of current transformer, voltage transformer and combined transformer.
- (b) primary winding The winding to which the current or voltage to be transformed is applied.
- (c) secondary winding The winding which supplies the current or voltage to watt-hour meters, var-hour meters or maximum demand meters.
- (d) secondary circuit The external circuit which receives the current or voltage supplied by the secondary winding of an instrument transformer.
- (e) highest system voltage The highest circuit voltage which will occur normally, and at which the performances specified in this Standard are ensured under the specified conditions.
- (f) actual transformation ratio The ratio of the current or voltage actually applied to the primary winding to the current or voltage supplied from the secondary winding. It is the value obtained by the measurement.

Applicable Standard and Corresponding International Standards:

JIS C 1731-Instrument Transformers for Testing Purpose and Used with General Instrument

IEC 185-Current transformers

IEC 186-Voltage transformers

IEC 44-3-Instrument transformers Part 3 Combined transformers

IEC 44-4-Instrument transformers Part 4 Measurement of partial discharge

- (g) rated transformation ratio The ratio of the rated primary current of the rated primary voltage to the rated secondary current or the rated secondary voltage.
- (h) current error or voltage error (ratio error) The ratio in percent of the difference between rated transformation ratio K_n and actual transformation ratio K to actual transformation ratio K . It is the value expressed by the following equation:

$$\text{Current error or voltage error} = \frac{K_n - K}{K} \times 100\%$$

- (i) phase displacement The difference in phase between the primary current or primary voltage vector and the secondary current or secondary voltage vector. The direction of the vectors shall be so chosen that the angle is zero for a perfect instrument transformer. The phase displacement is said to be positive when the secondary current or secondary voltage vector leads the primary vector and expressed in minutes.
- (j) rated power transformation ratio (power transformation ratio) The product of the rated transformation ratio of a current transformer and the rated transformation ratio of a voltage transformer.
- (k) power error The error in the indication of a watt-hour meter, var-hour meter or maximum demand meter affected by instrument transformers. The combination of the ratio error and the error due to the phase displacement of one or one set of instrument transformer(s).
- (l) totalized error The algebraic sum of the power error of instrument transformer and the measuring error or indicating error of the watt-hour meter, var-hour meter or maximum demand meter.
- (m) burden A load connected across secondary terminals of an instrument transformer, expressed by the apparent power (VA) consumed in the load under the rated secondary current or secondary voltage and by its power factor.
- (n) rated burden The burden per winding at which the performances specified in this Standard are ensured under the specified conditions.
- (o) service burden The burden which is connected with an instrument transformer in service.
- (p) range of service burden The range of burden within which use of an instrument transformer is allowed by the Measurement Law.
- (q) rated frequency The frequency at which the performances specified in this Standard are ensured under the specified conditions.
- (r) accuracy class The class assigned to an instrument transformer to indicate the limits of error. As a rule, it is expressed in the limit value of the power error when the rated current or rated voltage at the rated frequency is applied under the rated burden.

- (s) insulation level The level to indicate the dielectric strength of an instrument transformer. It is expressed by a number denoting the combination of two values of test voltages i.e. the power-frequency and lightning impulse withstand voltages for a transformer with a nominal voltage 275 kV or under, and by a number denoting the combination of four values of the test voltages i.e. the power-frequency, lightning impulse, switching impulse and long-time power-frequency withstand voltages for a transformer with nominal voltage of 500 kV.
- (t) partial discharge The discharge which appears partially in the dielectric media without bridging the electrodes when a voltage is applied across the electrodes.

(2) Terms concerning Current Transformer

- (a) current transformer An instrument transformer which transforms a current value to another current value in proportion to the former (including the part as a current transformer in a combined transformer).
- (b) window type current transformer A current transformer which is used in such a manner that the primary conductor such as a bus bar, single core bushing and cable is inserted into the window of current transformer core equipped with the secondary winding.
- (c) rated current of current transformer The primary current and secondary current at which the performances specified in this Standard are ensured under the specified conditions.
- (d) rated withstanding current The limit of overcurrent within which the performances specified in this Standard are ensured under the specified conditions. It is expressed by the rated overcurrent strength (the ensured overcurrent divided by the rated current) or by the rated overcurrent (the ensured current).
- (e) initial temperature The initial temperature of primary winding to be established in the calculation of short-time thermal current of a current transformer.

(3) Terms concerning Voltage Transformer and Combined Transformer

- (a) voltage transformer An instrument transformer which transforms a voltage value to another voltage value in proportion to the former (including capacitor voltage transformer and the part as a voltage transformer in a combined transformer).
- (b) combined instrument transformer (combined transformer) An instrument transformer consisting of a current transformer and a voltage transformer which mutually connected and accommodated in an enclosure.
- (c) unearthed voltage transformer A voltage transformer in which the both primary terminals are connected across the lines during its service.
- (d) earthed voltage transformer A voltage transformer in which one primary terminal is connected to the line and the other terminal(s) is earthed during its service (including capacitor voltage transformers).

- (e) capacitor voltage transformer A voltage transformer which utilizes the divided voltage by capacitors.
- (f) capacitor voltage transformer for protected region A capacitor voltage transformer to be used in a region always protected by a lightning arrester.
- (g) capacitor voltage transformer for non-protected region A capacitor voltage transformer to be used in a region not always protected by a lightning arrester.
- (h) rated voltage of voltage transformer The primary voltage and secondary voltage at which the performances specified in this Standard are ensured under the specified conditions.
- (i) high-voltage capacitor of capacitor voltage transformer A capacitor existing between the primary line-side terminal and the intermediate voltage point of a capacitor transformer.
- (j) intermediate-voltage capacitor of capacitor voltage transformer A capacitor existing between the intermediate voltage point and the earth terminal capacitor voltage transformer.
- (k) electromagnetic unit of capacitor voltage transformer A transformer connected to the intermediate-voltage capacitor in parallel, directly or through a resonance reactor.
- (l) intermediate voltage of capacitor voltage transformer The voltage which appears across terminals of intermediate-voltage capacitor when a primary voltage is applied to a capacitor voltage transformer.
- (m) thermal limiting output of voltage transformer The limit of load within which a voltage transformer can be used continuously at the rated frequency and the rated primary voltage without exceeding the prescribed temperature rise. It is expressed by the apparent power (VA) at the rated secondary voltage.

3. Service Conditions

3.1 Standard Service Conditions The standard service conditions of instrument transformers are the conditions meeting all of the following requirements:

- (1) The ambient temperature is within the range from 40°C to -20°C and the average ambient temperature over 24 h does not exceed 35°C.
- (2) The altitude of installation site does not exceed 1000 m.
- (3) None of items in 3.2 is applicable.

3.2 Special Service Conditions When instrument transformers are intended for use under any one of the conditions given below, the service conditions are regarded as special and these special service conditions shall be specified especially. Transformers are used in a place.

- (1) where the altitude or ambient temperature is outside the range specified in 3.1;
- (2) where atmosphere is remarkably affected by salty air;
- (3) where air is humid;
- (4) where excessive water or oil vapour exists;
- (5) where explosive, inflammable or other harmful gas exists or may come;
- (6) where excessive dust exists;
- (7) where abnormal vibration or shock is anticipated;
- (8) where much ice and snow exist; or
- (9) where special conditions other than stated above exist.

4. Classification and Ratings

4.1 Classification

4.1.1 Classification Instrument transformers are classified into current transformers, voltage transformers and combined transformers according to the purpose of transformation.

4.1.2 Accuracy Classes The accuracy classes of instrument transformers shall be the three classes as shown in Table 1.

Table 1. Accuracy Class of Instrument Transformer

Accuracy class	Principal application
Class 0.3 W	For high precision watt-hour meter, var-hour meter and maximum demand meter
Class 0.5 W	For precision watt-hour meter, var-hour meter and maximum demand meter
Class 1.0 W	For normal watt-hour meter

4.2 Ratings

4.2.1 Rated Current The rated primary current and rated secondary current of current transformers shall have the relevant values given in Table 2, as the standard.

Table 2. Rated Current of Current Transformer

Rated primary current				Rated secondary current
10	100	1000	10000	5
—	—	1200	12000	
15	150	1500	15000	
20	200	2000	20000	
30	300	3000	30000	
40	400	4000	—	
50	500	5000	—	
60	600	6000	—	
75	750	—	—	
80	800	8000	—	

Remark: The rated primary current of a double ratio current transformer shall be chosen from Table 2, and twofold ratio shall be employed as a rule.

4.2.2 Rated Voltage The rated primary voltage and rated secondary voltage of voltage transformers shall have the relevant values given in Tables 3 and 4 as the standard.

Table 3. Rated Voltage of Unearthed Voltage Transformer and Earthed Three-phase Voltage Transformer

Rated primary voltage kV			Rated secondary voltage V
—	11	110	110
—	13.2 ⁽¹⁾	154	
—	16.5 ⁽¹⁾	—	
—	22	—	
3.3	33	—	
6.6	66	—	
—	77	—	

Note (1) Voltage transformer with primary rated voltage of 13.2 kV and that of 16.5 kV are for use in a generator circuit only.

Table 4. Rated Voltage of Earthed Single-phase Voltage Transformer
(including capacitor voltage transformer)

Rated primary voltage kV		Rated secondary voltage V
$11/\sqrt{3}$	$110/\sqrt{3}$	$110/\sqrt{3}$
$13.2/\sqrt{3}^{(2)}$	$154/\sqrt{3}$	
$16.5/\sqrt{3}^{(2)}$		
—	$187/\sqrt{3}$	
$22/\sqrt{3}$	$220/\sqrt{3}$	
—	$275/\sqrt{3}$	
$33/\sqrt{3}$	$500/\sqrt{3}$	
$66/\sqrt{3}$	$550/\sqrt{3}$	
$77/\sqrt{3}$	—	

Note (2) Voltage transformer with primary rated voltage of $13.2/\sqrt{3}$ and that of $16.5/\sqrt{3}$ are for use in a generator circuit only.

4.2.3 Highest System Voltage The standard values of highest system voltages of instrument transformers shall be as given in Table 5. However, window type current transformers (for cable and for bushing) are excluded.

Table 5. Highest System Voltage of Instrument Transformer

Unit: kV

Nominal voltage	Highest system voltage
0.2	0.23
0.415	0.46
3.3	3.45
6.6	6.9
11	11.5
13.2 ⁽³⁾	13.8 ⁽³⁾
16.5 ⁽³⁾	17.25 ⁽³⁾
22	23
33	34.5
66	69
77	80.5
110	115
154	161
187	195.5
220	230
275	287.5
500	550

Note ⁽³⁾ Instrument transformer with highest system voltage of 13.8 kV and that of 17.25 kV are for use in a generator circuit only.

Remark: The voltages indicated in the lower column are applicable to the instrument transformers used for effectively earthed transmission line system.

4.2.4 Rated Withstanding Current The standard values for rated withstanding current of current transformers shall be as given in Table 6, when expressed in the rated overcurrent strength, and in Table 7 when expressed in the rated overcurrent.

Table 6. Rated Overcurrent Strength of Current Transformer

Rated overcurrent strength ⁽⁴⁾	Guaranteed overcurrent
40	40 times rated primary current
75	75 times rated primary current
150	150 times rated primary current
300	300 times rated primary current

Note (4) Current transformers with overcurrent strength exceeding 300 shall be considered as special products.

Table 7. Rated Overcurrent of Current Transformer

Highest system voltage kV	Rated overcurrent ⁽⁵⁾ kA						
3.45	1.6	4	8	16	25	40	
6.9	2	4	8	12.5	20	31.5	40
11.5	25	40	50	80			
23	12.5	20	25	40	50	63	
34.5	12.5	16	25	31.5	40		
69	12.5	20	25	31.5	40		
80.5	12.5	20	25	31.5			
115	12.5	20	25	31.5	40		
161	12.5	20	25	31.5	40		
195.5	12.5	16	25	31.5	40	50	
230	20	25	31.5	40	50	63	
287.5	16	20	31.5	40	50		
550	40	50					

Note (5) When the rated overcurrent converted to rated overcurrent strength exceeds 300, the current transformers shall be considered as special products.

Remark: The values indicated in the lower column are applicable to the current transformers used for effectively earthed transmission line system.

4.2.5 Rated Burden

- (1) Current Transformer The standard values of rated burden of current transformer are given in Table 8.

Table 8. Rated Burden of Current Transformer

Unit: VA

Accuracy class	Rated burden				
Class 0.3 W					
Class 0.5 W	5	10	15	25	40
Class 1.0 W					

- (2) Voltage Transformer The standard values of rated burden of voltage transformer are given in Table 9.

Table 9. Rated Burden of Voltage Transformer

Unit: VA

Accuracy class	Rated burden				
Class 0.3 W					
Class 0.5 W	10	15	25	50	100
Class 1.0 W					

4.2.6 Rated Frequency The rated frequency of instrument transformers shall be 50 Hz, 60 Hz or 50 Hz/60 Hz.

5. Performances

5.1 Limit of Power Error

- (1) Current Transformer The power error of current transformers (power error of each phase for three-phase current transformers) in the measurement of electric power shall not exceed the limit specified in Table 10, when tested in accordance with 7.1. The limit of power error at an intermediate primary current shall be determined by interpolation method.

Table 10. Limit of Power Error of Current Transformer

Accuracy class	Primary side load power factor 1		Primary side load power factor 0.5 lagging current	
	Primary current	Limit %	Primary current	Limit %
Class 0.3 W	0.05 to 1.2 I_n	± 0.3	0.1 to 1.2 I_n	± 0.6
	0.025 I_n (°)	± 0.45 (°)	0.05 I_n (°)	± 0.9 (°)
Class 0.5 W	0.05 to 1.2 I_n	± 0.5	0.1 to 1.2 I_n	± 1.0
	0.025 I_n (°)	± 0.75 (°)	0.05 I_n (°)	± 1.5 (°)
Class 1.0 W	0.1 to 1.2 I_n	± 1.0	0.2 to 1.2 I_n	± 2.0
	0.05 I_n	± 1.3	0.1 I_n	± 2.5

Note (6) The limits for transformers of Classes 0.3 W and 0.5 W at primary side load power factor 1, $0.025 I_n$; and at primary side load power factor 0.5 lagging current, $0.05 I_n$; are the values for informative reference.

Remark: The I_n means the rated primary current at rated frequency.

- (2) Voltage Transformer The power error of voltage transformers (power error of each phase or each line-to-line for three-phase voltage transformers) in the measurement of electric power shall not exceed the limit specified in Table 11 when tested in accordance with 7.1.

Table 11. Limit of Power Error of Voltage Transformer

Accuracy class	Primary current	Limit %	
		Primary side load power factor 1	Primary side load power factor 0.5 lagging current
Class 0.3 W	$0.9 V_n$ to $1.1 V_n$	± 0.3	± 0.6
Class 0.5 W	$0.9 V_n$ to $1.1 V_n$	± 0.5	± 1.0
Class 1.0 W	$0.9 V_n$ to $1.1 V_n$	± 1.0	± 2.0

Remark: The V_n means the rated primary voltage at rated frequency.

- (3) Combined Transformer The power error of combined transformer (total power error for three-phase combined transformers) in the measurement of electric power shall not exceed the limit specified in Table 12, when tested in accordance with 7.1. The limit of power error at an intermediate primary current shall be determined by interpolation method. The power errors of the current transformer and the voltage transformer composing a combined transformer shall not exceed twice the limits of Table 10 and Table 11, respectively.

Table 12. Limit of Power Error of Combined Transformer

Accuracy class	Primary side load power factor 1			Primary side load power 0.5 lagging current(°)		
	Primary current	Primary voltage	Limit	Primary current	Primary voltage	Limit
Class 0.3 W	0.05 to $1.2 I_n$	0.9 to $1.1 V_n$	± 0.3	0.1 to $1.2 I_n$	0.9 to $1.1 V_n$	± 0.45
	$0.025 I_n$ (°)		± 0.45 (°)	$0.05 I_n$ (°)		± 0.7 (°)
Class 0.5 W	0.05 to $1.2 I_n$		± 0.5	0.1 to $1.2 I_n$		± 0.75
	$0.025 I_n$ (°)		± 0.75 (°)	$0.05 I_n$ (°)		± 1.15 (°)
Class 1.0 W	0.05 to $1.2 I_n$		± 1.0	0.1 to $1.2 I_n$		± 1.5

Notes (7) For three-phase combined transformers, the primary side power factor 0.5 lagging current applies to positive-phase-sequence and negative-phase-sequence.

- (⁸) The limits for transformers of classes 0.3 W and 0.5 W at primary side load power factor 1, $0.025 I_n$; and at primary side load factor 0.5 lagging current, $0.05 I_n$ are the values for informative reference.

Remark: The I_n and V_n mean the rated primary current and rated primary voltage at rated frequency, respectively.

5.2 Current Characteristic The current characteristic of current transformers shall be such that the variation in the power error (power error of each phase for three-phase current transformers, and total power error for three-phase combined transformers) due to the current change does not exceed the limit specified in Table 13, when tested in accordance with 7.2.

Table 13. Current Characteristic of Current Transformer

Accuracy class	Primary side load power factor 1		Primary side load power factor 0.5 lagging current(⁹)	
	Current range	Limit of variation %	Current range	Limit of variation %
Class 0.3 W	$(0.05 \text{ to } 1.2) I_n$	0.3	$(0.1 \text{ to } 1.2) I_n$	0.45
Class 0.5 W	$(0.05 \text{ to } 1.2) I_n$	0.5	$(0.1 \text{ to } 1.2) I_n$	0.75
Class 1.0 W	$(0.05 \text{ to } 1.2) I_n$	1.3	$(0.1 \text{ to } 1.2) I_n$	2.0

Note (⁹) For three-phase combined transformers, this primary side load power factor 0.5 lagging current applies to positive-phase-sequence or negative-phase-sequence.

Remark: The I_n means the rated primary current at rated frequency.

5.3 Voltage Characteristic The voltage characteristic of voltage transformers shall be such that the variation in the power error (power error of each phase or each line-to-line for three-phase voltage transformers, and total power error for three-phase combined transformers) due to the voltage change does not exceed the limit specified in Table 14, in each voltage range, when tested in accordance with 7.3.

Table 14. Voltage Characteristic of Voltage Transformer

Accuracy class	Voltage range	Limit of variation %	
		Primary side load power factor 1	Primary side load power factor 0.5 lagging current ⁽¹⁰⁾
Class 0.3 W	0.9 V_n to 1.0 V_n	0.15	0.25
	1.0 V_n to 1.1 V_n		
Class 0.5 W	0.9 V_n to 1.0 V_n	0.25	0.4
	1.0 V_n to 1.1 V_n		
Class 1.0 W	0.9 V_n to 1.0 V_n	0.5	0.8
	1.0 V_n to 1.1 V_n		

Note ⁽¹⁰⁾ For three-phase voltage transformers, this primary side load power factor 0.5 lagging current applies to positive-phase-sequence and negative-phase-sequence.

Remark: The V_n means the rated primary voltage at rated frequency

5.4 Frequency Characteristic The frequency characteristic of capacitor voltage transformers shall be such that the variation in the power error due to change in frequency does not exceed the limit, in each frequency range, specified in Table 15, when tested in accordance with 7.4

Table 15. Frequency Characteristic of Capacitor Voltage Transformer

Accuracy class	Voltage range	Limit of variation %	
		Primary side load power factor 1	Primary side load power factor 0.5 lagging current
Class 0.3 W	0.95 f_n to 1.0 f_n	0.6	0.9
	1.0 f_n to 1.05 f_n		
Class 0.5 W	0.95 f_n to 1.0 f_n	0.8	1.2
	1.0 f_n to 1.05 f_n		
Class 1.0 W	0.95 f_n to 1.0 f_n	1.5	2.4
	1.0 f_n to 1.05 f_n		

Remark: The f_n means the rated frequency.

5.5 Mutual Interference The variation in error of combined transformers due to the mutual interference shall not exceed the limit given in Table 16 when tested in accordance with 7.5.

Table 16. Limit of Variation in Error of Combined Transformer Due to Mutual Interference

Accuracy class	Limit of variation %
Class 0.3 W	0.15
Class 0.5 W	0.25
Class 1.0 W	0.5

5.6 Dielectric Withstand Voltage The dielectric withstand voltage of instrument transformers shall be as follows:

- (1) Power-Frequency Withstand Voltage When the power-frequency withstand voltage of an instrument transformer is tested in accordance with 7.6 (2), the specimen shall withstand the appropriate test voltage to the insulation level (the highest system voltage if the insulation level is not specified) given in Table 17.

Table 17. Test Voltage for Power-frequency Withstand Voltage of Instrument Transformer

Highest system voltage (kV)	Insulation level (No.)	Test voltage kV			
		Between primary windings connected together, and secondary windings and enclosure connected together of current transformer and unearthed voltage transformer	Between earth side primary terminal and enclosure of earthed voltage transformer	Between terminals of intermediate voltage capacitor	Between secondary windings and enclosure
		Between line-side terminal and earth-side terminal of capacitor voltage transformer			If primary winding ⁽¹³⁾ or secondary winding consists of more than one separately insulated winding, between such windings
0.23	—	2	2 ⁽¹⁵⁾	—	2
0.46	—	3			
1.15	—	4			
3.45	3 A	16			
	3 B	10			
6.9	6 A	22			
	6 B	16			
11.5	10 A	28			
	10 B				
13.8 ⁽¹⁴⁾	15 A ⁽¹⁴⁾	39 ⁽¹⁴⁾			
	15 B ⁽¹⁴⁾				
17.25 ⁽¹⁴⁾	15 A ⁽¹⁴⁾	39 ⁽¹⁴⁾			
	15 B ⁽¹⁴⁾				
23	20 A	50			
	20 B				
34.5	30 A	70			
	30 B				
69	60	140			
	60 S				
30.5	70	160			
	70 S				
115	100	230			
	100 S				
161	140	325			
	140 S				
195.5	140	325			
	140 S				
230	170	395			
	170 S				
287.5	200	460			
	200 S				
550	500 L	750			
	500 H				

Note ⁽¹¹⁾ For current transformers only.⁽¹²⁾ Instrument transformers of insulation levels Nos. 5 A and B are those to be used in a generator circuit only.⁽¹³⁾ If increase of insulating property of earth-side terminals is specified especially, such a case is considered as special ones, and the voltage is altered to 4 kV for transformers of insulation levels No. 10 and No. 15 or to 10 kV for transformers of No. 20 or above.

Remark: In this table, "A" applies to standard level transformers, "B" applies to lower level transformers, "S" applies to capacitor voltage transformers for non-protected region, and "L" and "H" apply to transformers for 500 kV system.

- (2) Induced Withstand Voltage When the induced withstand voltage of a voltage transformer is tested in accordance with 7.6 (3), the specimen shall withstand the appropriate test voltage to the classification given in Table 18.

Table 18. Test Voltage for Induced Withstand Voltage
Test of Voltage Transformer

Kind	Test voltage
Unearthed voltage transformer	2 times rated primary voltage
Earthed single-phase voltage transformer	3.46 times rated primary voltage ⁽¹²⁾
Earthed three-phase voltage transformer ⁽¹¹⁾	2 times rated primary voltage ⁽¹²⁾
Electromagnetic unit of capacitor voltage transformer	The "intermediate test voltage" specified in Table 17

Note ⁽¹⁴⁾ The test voltage for earthed three-phase voltage transformers shall be induced between primary terminal and earth terminal.

⁽¹⁵⁾ The induced withstand voltage of voltage transformers used in a line of effectively earthed system shall be the appropriate test voltage to the insulation level given in Table 17.

- (3) Withstand Voltage between Winding Terminals When the withstand voltage between terminals of a current transformer is tested in accordance with 7.6 (4), the specimen shall withstand the voltage induced when the rated current at the rated frequency is passed through the primary or secondary winding or the voltage with peak value of 3 kV whichever is the lower.
- (4) Lightning Impulse Withstand Voltage When the lightning impulse withstand voltage of an instrument transformer is tested in accordance with 7.6 (5), the specimen shall withstand the appropriate test voltage to the insulation level given in Table 19. However, window type current transformers without dielectric strength are excluded.

Table 19. Test Voltage for Lightning Impulse Withstand Voltage of Instrument Transformer

Insulation level (No.)	Test voltage kV	
	Full wave	Chopped wave
	Current transformers, unearthed and earthed voltage transformers	Unearthed and earthed voltage transformers (excluding capacitor voltage transformers)
3 A	45	50
3 B	30	—
6 A	60	65
6 B	45	—
10 A	90	100
10 B	75	—
15 A ⁽¹⁶⁾	115 ⁽¹⁶⁾	125 ⁽¹⁶⁾
15 B ⁽¹⁶⁾	100 ⁽¹⁶⁾	—
20 A	150	165
20 B	125	—
30 A	200	220
30 B	170	—
60	350	385
60 S	420	—
70	400	440
70 S	480	—
100	550	605
100 S	660	—
140	750	825
140 S	900	—
170	900	990
170 S	1 080	—
200	1 050	1 155
200 S	1 260	—
500 L	1 550	1 705
500 H	1 800	—

Note ⁽¹⁶⁾ The instrument transformers of insulation level No. 15 A or No. 15 B are only for use in a generator circuit.

Remark: In this table, "A" applies to standard level transformers, "B" applies to lower level transformers, "S" applies to capacitor voltage transformers for non-protected region, and "L" and "H" apply to transformers of 500 kV system.

- (5) Switching Impulse Withstand Voltage When the switching impulse withstand voltage of an instrument transformer of insulation level No. 500 L or No. 500 H is tested in accordance with 7.6 (6), the specimen shall withstand the impulse voltage of 1175 kV.

5.7 Withstanding Current When the withstanding current of a current transformer is tested in accordance with 7.7, the specimen shall not be damaged thermally or mechanically.

5.8 Secondary Short Circuit When the secondary short circuit of a voltage transformer is tested in accordance with 7.8, the specimen shall not be damaged thermally or mechanically.

5.9 Temperature Rise The temperature rise of instrument transformers shall not exceed the appropriate limit given in Table 20, when tested in accordance with 7.9.

Table 20. Limit of Temperature Rise of Instrument Transformer

		Unit: °C	
Testing point		Limit of temperature rise	
		Class A insulation	Class B insulation
Winding	Dry type self-cooled	55	75
	Oil immersed self-cooled		—
Oil	When oil in main body tank directly comes in contact with external air	50	—
	When oil in main body tank does not directly come in contact with external air	55	
Surface of terminal and other metal parts adjacent to insulation		Temperature not to damage adjacent insulating materials	

5.10 Partial Discharge When the partial discharge of a moulded type instrument transformer of highest system voltage 6.9 kV or over is tested in accordance with 7.10, the discharged electric charge, including the effect of outgoing noise and the like, shall not exceed 100 pC. However, current transformers having no primary conductor are excluded.

5.11 Long-Time Power-Frequency Withstand Voltage When the long-time power-frequency withstand voltage of an instrument transformer of highest system voltage 550 kV is tested in accordance with 7.11, the discharged electric charge, including the effect of outgoing noise and the like, shall not exceed 100 pC.

5.12 Abnormal Phenomenon Capacitor voltage transformers shall not cause any abnormal voltage between the secondary terminals, when tested in accordance with 7.12.