VDE Recognized "ZNR®" Transient/Surge Absorbers

Series: **W**
Type: **D**

■ Featurest

- Series W, Type D is recognized ZNR Transient Surge absorbers according to CECC by VDE.
- Series W, Type D can apply to equipment which need to have CE Marking, conform to EU Directive (Machinery, Electromagnetic Compatibility and Low Voltage Directive etc.).
- Series W, Type D fit Surge immunity test (IEC1000-4-5/EN61000-4-5 etc.).

■ Related Standard and Certification Number

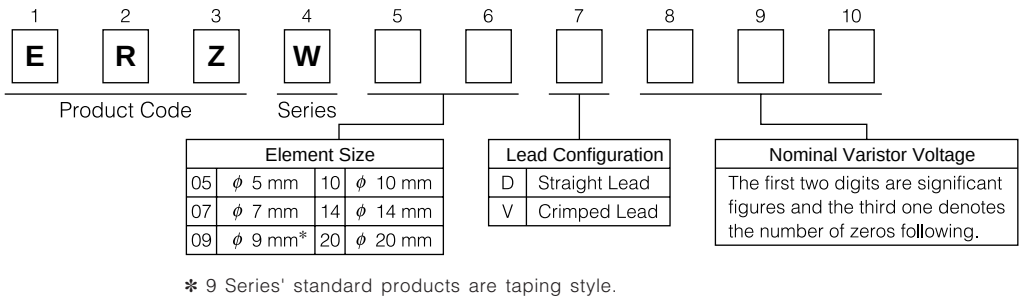
Related Standard	VDE/CECC42201
Title	SURGE SUPPRESSION VARISTORS
Certification Number	5912

■ Recommended Applications

- Surge protection in equipment which need to have CE Marking.

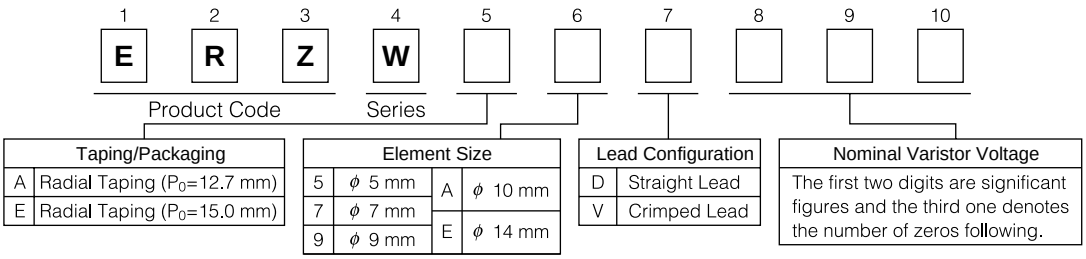
■ Explanation of Part Numbers

(Bulk)



* 9 Series' standard products are taping style.

(Taping)



■ Precautions for Handling (See page 36 to 38)

■ Rating and Charcteristics (An outline)

Part Number	Varistor Voltage	MaximumAllowable Voltage		ClampingVoltage** (V)(max.)			Maximum Peak Current (A) at. 8/20μs, 1time					
				Element Size Code □□			Element Size Code □□					
	V1mA (V)*	ACrms (V)	DC (V)	05	07,09	10,14,20	05	07	09	10	14	20
ERZW□□D820	82 (74– 90)	50	65	145	135	135	800	1750	3000	3500	6000	10000
ERZW□□D101	100 (90– 110)	60	85	175	165	165	800	1750	3000	3500	6000	10000
ERZW□□D121	120 (108– 132)	70	100	210	200	200	800	1750	3000	3500	6000	10000
ERZW□□D151	150 (135– 165)	95	125	260	250	250	800	1750	3000	3500	6000	10000
ERZW□□D201	200 (185– 225)	130	170	355	340	340	800	1750	3000	3500	6000	10000
ERZW□□D221	220 (198– 242)	140	180	380	360	360	800	1750	3000	3500	6000	10000
ERZW□□D241	240 (216– 264)	150	200	415	395	395	800	1750	3000	3500	6000	10000
ERZW□□D271	270 (247– 303)	175	225	475	455	455	800	1750	3000	3500	6000	10000
ERZW□□D331	330 (297– 363)	210	270	570	545	545	800	1750	3000	3500	6000	10000
ERZW□□D361	360 (324– 396)	230	300	620	595	595	800	1750	3000	3500	6000	10000
ERZW□□D391	390 (351– 429)	250	320	675	650	650	800	1750	3000	3500	6000	10000
ERZW□□D431	430 (387– 473)	275	350	745	710	710	800	1750	3000	3500	6000	10000
ERZW□□D471	470 (423– 517)	300	385	810	775	775	800	1750	3000	3500	6000	10000
ERZW□□D511	510 (459– 561)	320	410	—	845	845	—	1750	3000	3500	6000	10000
ERZW□□D621	620 (558– 682)	385	505	—	—	1025	—	—	—	3500	5000	7500
ERZW□□D681	680 (612– 748)	420	560	—	—	1120	—	—	—	3500	5000	7500
ERZW□□D751	750 (675– 825)	460	615	—	—	1240	—	—	—	3500	5000	7500
ERZW□□D821	820 (738– 902)	510	670	—	—	1355	—	—	—	3500	5000	7500
ERZW□□D911	910 (819– 1001)	550	745	—	—	1500	—	—	—	3500	5000	7500
ERZW□□D102	1000 (900– 1100)	625	825	—	—	1650	—	—	—	3500	5000	7500
ERZW□□D112	1100 (990– 1210)	680	895	—	—	1815	—	—	—	3500	5000	7500
ERZW□□D182	1800 (1700– 1980)	1000	1465	—	—	2970	—	—	—	3500	5000	7500

□□: Element Size Code
✻ Element size code 05:$V_{0.1mA}$(V)
✻✻ 05:V_{5A} 07:V_{10A} 09:V_{25A} 10:V_{25A} 14:V_{50A} 20:V_{100A}

■ Detail Specification

Detail specifications of Ratings and Characteristics, Dimensions, Lead Style, Taping etc. are the same of Series V.

See page 15 to 28 as substitute Part Number of W Series for Part Number of V Series as follows.

Part Number of W Series ERZW□□□□□□ ➡ Part Number of V Series ERZV□□□□□□

■ Notes

- VDE recognized "ZNR®" Transient/Surge Absorbers (Series W, Type D) are order production.
- Ordering unit quantity is 1000 pcs per part number. (500 pcs for ERZW20D182)

"ZNR® " Transient/Surge Absorbers, Series V, Type D
"ZNR® " Transient/Surge Absorbers, Series W, Type D
"ZNR® " Transient/Surge Absorbers, Type CF and SF (SMD)

Precautions for Handling

The "ZNR" Transient/Surge Absorbers (hereafter referred to as "The ZNR Varistors") may fail in a short-circuit mode or in an open-circuit mode, when subjected to severe conditions of electrical, environmental and/or mechanical stresses beyond their specified "Ratings" and specified "Conditions", resulting in burnout, flaming or glowing in the worst case.
Following "⚠Precautions for Safety" and "Application Notes" shall be taken in your major consideration. If you have a question about the "Precautions for Handling", please contact our engineering section or factory.

1. ⚠Precautions for Safety

1.1 Operating Conditions

1.1.1 The ZNR Varistors shall not be operated beyond the specified "Ratings" and "Environmental Conditions" in the Catalog or the Specifications to prevent them from deterioration, breakdown, flaming or glowing.

- The ZNR Varistors shall not be operated exceeding the specified "Maximum Allowable Voltage" in the Catalog or the Specification.
- The ZNR Varistors shall not be subjected to energy levels above their specified "Maximum Energy Ratings" in the Catalog or the Specifications.
- In case of application to repeated surge/overvoltages, the ZNR Varistors shall not be subjected to surge currents and energy levels above the specified maximum ratings in "Impulse Life Rating" in the Catalog or the Specifications.
- When surge/overvoltages are intermittently applied to the ZNR Varistors with short durations, the devices shall not be operated beyond the specified "Rated Power" in the Catalog or the Specifications.
- The ZNR Varistors shall not be operated beyond the specified "Operating Temperature Range" in the Catalog or the Specifications.
- It is recommended that the ZNR Varistors, if not fused, shall be located away from other combustibe components.

1.1.2 The ZNR Varistor shall be operated correctly under following conditions to prevent Varistors from causing mechanical damages and ruptures and to protect human from serious injuries;

- The ZNR Varistors shall not be operated exceeding the specified "Maximum Allowable Voltage Ratings" in the Catalog.
- The ZNR Varistors shall not be operated beyond the "Maximum Peak Current Ratings" in the Catalog.
- Some safety countermeasure such as a protective case covering the Varistor is recommended, if necessary.

1.1. 3 When the ZNR Varistors are applied to between a live part and a metallic chassis of equipment, following safety countermeasures shall be taken to protect human from electric shock.

A) The metallic chassis shall be earthed to the ground.
B) The live part shall be equipped with a protective cover for preventing electric shock.

2. Application Notes

2.1 Protective Devices for Varistors

2.1.1 The ZNR Varistors shall be protected from serious accidents due to unexpected physical phenomenor by following safety countermeasures.

- In case of "Across-the Line Use", the ZNR Varistors shall be protected by connecting a ground fault circuit interrupter of fusing in series to the devices. (See Table 1)
- In case of "Line to Ground Use", the short-circuit of the Varistor may not blow the current type fuse due to the grounding resistance (between Line and Ground), which may cause flaming or burnout of the devices in the worst case.

Following safety countermeasures (A or B) are recommended;

A) Connecting a "leakage current circuit breaker" in series to the Varistor to be protected. (See Table 1)
B) Use current type fuses and a thermal type fuse which are thermally coupled each others. (See Table 1)

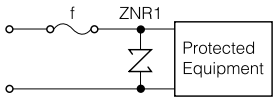
Table 1.
(Line Protection)

Application Examples

Connections

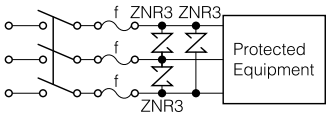
Across-the-Line/Line to Line Protection

DC
AC Single phase



f : fuse

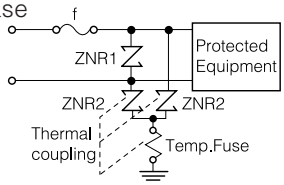
AC three phase



f : fuse

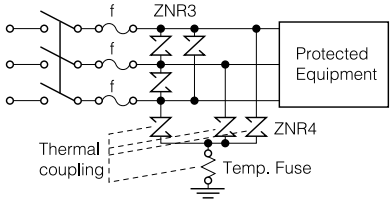
Line to Line and Line to Ground Protection

DC
AC Single phase



f : fuse

AC three phase



f : fuse

Selection Examples

Across the Line Use/Line to Line

ZNR	Nominal Line Voltage	Part Number of ZNR Type D	Part Number of ZNR Type CF/SF
ZNR1	AC 100 V	ERZ○□□D201	ERZ△△1MK201
		ERZ○□□D221	ERZ△△1MK221
		ERZ○□□D241	ERZ△△1MK241
		ERZ○□□D271*	ERZ△△1MK271*
	AC 120 V	ERZ○□□D241	ERZ△△1MK241
		ERZ○□□D271	ERZ△△1MK271
		ERZ○□□D331*	——
ZNR3	AC 200 V	ERZ○□□D471	ERZ△△1MK471
	AC 220 V	ERZ○□□D471	ERZ△△1MK471
	AC 240 V	ERZ○□□D511	——
	AC 380 V	ERZ○⬚⬚D821	——

Line to Ground Use

ZNR	Nominal Line Voltage	Part Number of ZNR Type D	Part Number of ZNR Type CF/SF
ZNR2	AC 100 V AC 220 V	ERZ○□□D471	ERZ△△1MK471
		ERZ○□□D511	——
		ERZ○⬚⬚D821**or higher Varistor Voltage	——
		ERZ○⬚⬚D182***	——
ZNR4	AC 230 V AC 240 V	ERZ○□□D511	——
		ERZ○⬚⬚D821**or higher Varistor Voltage	——
		ERZ○⬚⬚D182***	——
	AC 380 V	ERZ○⬚⬚D112**or higher Varistor Voltage	——
		ERZ○⬚⬚D182***	——

Notes:
1. ○ : "V" for Series V and "W" for Series W
2. □□: Element size; "05", "07", "09", "10", "14", or "20"
3. ⬚⬚: Element size; "10", "14" or "20"
4. △△: "CF" for Type CF or "SF" for Type SF

2.2 Circuit Design 1 (Selection of Varistor Voltage Rating)

2.2.1 General Precautions

In selection of Varistor Voltage Ratings for line protection, following general precautions shall be taken in your consideration;

(1) Maximum operating voltage shall be lower than the specified "Maximum Allowable Voltage" of the Varistor applied.

(2) Some reasonable margin is required against fluctuation of the primary AC line Voltage where the Varistor is applied for preventing mechanical and/or electrical failures of the device.

2.2.2 Across-the-Line Use

(Line to Line surge protection)

● Select the ZNR Varistors recommended in Table 1.

Notes: Because the primary line voltage temporarily rises due to load unbalance of separately wired loads, short circuit between the live line and the nutral line or LC resonance at switching for a capacitive load, ZNR Varistors with ✻ are recommended for AC120 V or 240 V applications. (See Table 1)

2.2.3 Line to Ground Use

(Line to Ground Surge protection)

● Select the ZNR Varistors recommended in Table 1.

Notes: When 500 V insulation resistance test of the circuits employing ZNR Varistor is conducted, the ZNR Varistor shall be removed after getting approval from the customer, or the ZNR Varistor ✻✻ with the Maximum Allowable Voltage exceeding to the test voltage shall be applied. (See Table 1)

When AC1000 V or 1200 V dielectric with standing test is conducted, ZNR Varistors shall be removed after getting approval from the customer according to the relevant regulations, or ZNR Varistor ✻✻✻ with the Maximum Allowable Voltage exceeding to the test voltage shall be applied. (See Table 1)

2.3 Circuit Design 2 (Fusing Varistors)

2.3.1 Fusing The ZNR Varistors

- For Varistor protection, it is recommended to select suitable fuses in Table 2.
- The recommended fuse locations are shown in Table 1.

Table 2.

Part No.	ERZV05D□□□	ERZV07D□□□	ERZV09D□□□ ERZV10D□□□	ERZV14D□□□	ERZV20D□□□
Recommended Fuse* Ratings	3 A max.	5 A max.	7 A max.	10 A max.	10 A max.

Part No.	ERZCF1M□□□	ERZSF1MK□□□
Recommended Fuse* Ratings	3 A max.	5 A max.

Notes:
* The voltage rating of fuse shall be appropriate to the circuit applied.
** In application to CSA Safety Standard, the rating of applicable fuse shall conform to CSA class 2221 01.

2.3.2 When a line current of equipment is higher than the recommended current rating of the fuse in Table 2, the location of the fuse shall be arranged according to Fig 2.

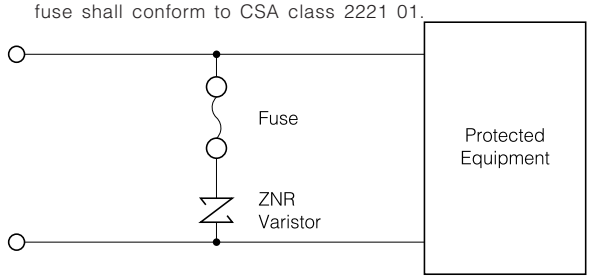


Fig. 2 Alternative Fuse Location/placement for Varistor Protection

2.4 Environmental Conditions

(1) The ZNR Varistors shall not be exposed outdoors, because of being designed for indoors use.
(2) The ZNR Varistors shall not be operated beyond the Specified Operating Temperature Range and shall not be exposed to direct sunlight and heating part of equipment.
(3) The ZNR Varistors shall not be operated under severe conditions of high temperatures and high humidities such as places exposed to rain, wind and vapor.
(4) The ZNR Varistors shall be free from dust, salty wind and atomospheres polluted by corrosive gas.

2.5 Precautions for Assemblies and Handlings

2.5.1 Solvent Cleaning

Organic solvents such as thinner and acetone etc. shall not be applied to the ZNR Varistors for preventing deterioration of the external coating or molding resin.

2.5.2 Abnormal Mechanical Stresses

Abnormal mechanical stresses beyond the specified values such as strong falling shocks, ribrations and bending/pulling forces, shall be kept minimum to prevent mechanical/electrical failures of the devices.

2.5.3 Plastic Molding

If another plastic molding is applied to the ZNR Varistors on your option, the influences on reliability of the ZNR Varistors shall be carefully investigated in your equipment.

2.5.4 Soldering Conditions

In soldering of the ZNR Varistors, the soldering conditions shall conform to the each individual specification of the device for prevent mechanical/electrical failures.

2.6 Long Term Storage

(1) The ZNR Varistors shall not be stored under severe conditions of high temperatures and high humidities. Store them indoors under 40 °C max. and 75 %RH max. Use them within one year, if stored beyond the limit, check the solderbility before use.
(2) The ZNR Varistors shall not be stored under corrosive atomospheres such as hydrogen sulfide, sulfurous acid, chlorine and ammonia.
(3) The ZNR Varistors shall not be exposed to direct sunlight and shall not be stored under dew formation.

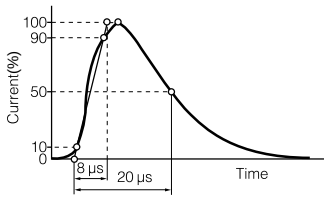
2.7 Regarding to "Safety Regulations of the Varistors"

In case of applications to UL and CSA standards, refer to "Application Notes for UL and CSA Recognized" ZNR "Varistors"

2.8 Parallel Capacitances of the ZNR Varistors

The ZNR Varistors have relatively high capacitances specified in the individual specifications, special consideration shall be taken into account in applications to high frequency transmission lines or circuits.

■ Performance Characteristics (Series V, Type D)

	Characteristics		Test Methods/Description	Specifications
Electrical	Standard Test Condition		Unless otherwise specified, electrical measurements (initial/after tests) shall be conducted at temperature of 5 to 35 °C, relative humidity of 45 to 85 % and atmospheric pressure of 860 to 1060 hPa.	———
	Varistor Voltage		The voltage betwen two terminals with the specified measuring current C_{mA} DC applied is called V_C or V_{CmA}. The measurement shall be made as fast as possible to avoid heat affection.	To meet the specified value.
	Maximum Allowable Voltage		The maximum sinusoidal RMS voltage or maximum DC voltage that can be applied continuously in the specified operating temperature range.	
	Clamping Voltage		The maximum voltage between two terminals with the specified standard impulse current (8/20 µs) illustrated below applied. 	
	Rated Power		The power that can be applied in the specified ambient temperature.	
	Maximum Energy		The maximum energy within the varistor voltage change of ±10 % when a single impulse current of 2 ms or 10/1000 µs is applied.	
	Maximum Peak Current (Withstanding Surge Current)	2 times	The maximum current within the varistor voltage change of ±10 % when a standard impulse current of 8/20 µs is applied two times with an interval of 5 minutes.	
		1 time	The maximum current within the varistor voltage change of ±10 % with a single standard impulse current of 8/20 µs is applied.	
	Temperature Coefficient of Varistor Voltage		$\frac{V_{CmA} \text{ at } 85\,^\circ\text{C} - V_{CmA} \text{ at } 25\,^\circ\text{C}}{V_{CmA} \text{ at } 25\,^\circ\text{C}} \times \frac{1}{60} \times 100\ (\%/^\circ\text{C})$	0 to −0.05 %/°C max.
	Capacitance		Capacitance shall be measured at 1 kHz ±10 %, 1 Vrms max. (1 MHz ±10 % below 100 pF), 0 V bias and 20±2 ˚C.	To meet the specified value
	Withstanding Voltage (Body Insulation)		The specified voltage shall be applied between both terminals of the specimen connected together and metal foil closely wrapped round its body for 1 minute. Classification (Nominal varistor voltage) / Test Voltage (AC) $V_{0.1\,mA}$, $V_{1\,mA} \leqq 330$ V / 1000 Vrms $V_{0.1\,mA}$, $V_{1\,mA} > 330$ V / 1500 Vrms	No breakdown
	Impulse Life		The change of V_C shall be measured after the impulse current listed below is applied 10000 or 100000 times continuously with the interval of 10 seconds at room temperature.	$\Delta V_{CmA}/V_{CmA} \leqq \pm 10$ %

Part No. \ Item / Cycles / Current	Impulse Life (I) ×10⁴ Times Impulse Current	Impulse Life (II) ×10⁵ Times Impulse Current
ERZV05D180 to ERZV05D680	8 A (8/20 µs)	5 A (8/20 µs)
ERZV07D180 to ERZV07D680	25 A (8/20 µs)	15 A (8/20 µs)
ERZVA9D180 to ERZVA9D680	50 A (8/20 µs)	35 A (8/20 µs)
ERZV10D180 to ERZV10D680	50 A (8/20 µs)	35 A (8/20 µs)
ERZV14D180 to ERZV14D680	90 A (8/20 µs)	50 A (8/20 µs)
ERZV20D180 to ERZV20D680	130 A (8/20 µs)	65 A (8/20 µs)
ERZV05D820 to ERZV05D471	40 A (8/20 µs)	25 A (8/20 µs)
ERZV07D820 to ERZV07D511	100 A (8/20 µs)	60 A (8/20 µs)
ERZVA9D820 to ERZVA9D511	125 A (8/20 µs)	75 A (8/20 µs)
ERZV10D820 to ERZV10D112	150 A (8/20 µs)	85 A (8/20 µs)
ERZV10D182	120 A (8/20 µs)	75 A (8/20 µs)
ERZV14D820 to ERZV14D112	200 A (8/20 µs)	110 A (8/20 µs)
ERZV14D182	150 A (8/20 µs)	90 A (8/20 µs)
ERZV20D820 to ERZV20D112	250 A (8/20 µs)	120 A (8/20 µs)
ERZV20D182	200 A (8/20 µs)	100 A (8/20 µs)

■ Performance Characterisitcs (Series V, Type D)

<table>
<tr><th colspan="2">Characteristics</th><th>Test Methods</th><th>Specifications</th></tr>
<tr><td rowspan="4">Mechanical</td><td>Robustness of Terminations (Tensile)</td><td>After gradually applying the force specified below and keeping the unit fixed for 10 seconds, the terminal shall be visually examined for any damage.
Terminal diameter — Force
ϕ0.6 mm, ϕ0.8 mm — 9.8 N (1.0 kgf)
ϕ1.0 mm — 19.6 N (2.0 kgf)</td><td rowspan="3">No remarkable mechanical damage</td></tr>
<tr><td>Robustness of Terminations (Bending)</td><td>The unit shall be secured with its terminal kept vertical and the force specified below shall be applied in the axial direction.
The terminal shall gradually be bent by 90 ° in one direction, then 90 ° in the opposite direction, and again back to the original position.
The damage of the terminal shall be visually examined.
Terminal diameter — Force
ϕ0.6 mm, ϕ0.8 mm — 4.9 N (0.5 kgf)
ϕ1.0 mm — 9.8 N (1.0 kgf)</td></tr>
<tr><td>Vibration</td><td>After repeadly applying a single harmonic vibration (amplitude: 0.75 mm, double amplitude: 1.5 mm) with 1 minute vibration frequency cycles (10 Hz to 55 Hz to 10 Hz) to each of three perpendicular directions for 2 hours. Thereafter, the unit shall be visually examined.</td></tr>
<tr><td>Solderability</td><td>After dipping the terminals to a depth of approximately 3 mm from the body in a soldering bath of 235±5 ˚C for 2±0.5 seconds, the terminal shall be visually examined.</td><td>Approximately 95 % of the termainals shall be covered with new solder uniformly.</td></tr>
<tr><td>Resistance to Soldering Heat</td><td>After each lead shall be dipped into a solder bath having a temperature of 260±5 ˚C to a point 2.0 to 2.5 mm from the body of the unit, using shielding board (t=1.5 mm), be held there for 10±1 s (5 series: 5±1 s) and then be stored at room temperature and normal humidity for 1 to 2 hours. The change of V_{CmA} and mechanical damages shall be examined.</td><td>$\Delta V_{CmA}/V_{CmA} \leqq \pm 5$ %
No remarkable mechanical damage</td></tr>
<tr><td rowspan="5">Environmental</td><td>High Temperature Storage/ Dry Heat</td><td>The specimen shall be subjected to 125±2 ˚C for 1000 hours in a thermostatic bath without load and then stored at room temperature and normal humidity for 1 to 2 hours. Thereafter, the change of V_{CmA} shall be measured.</td><td>$\Delta V_{CmA}/V_{CmA} \leqq \pm 5$ %</td></tr>
<tr><td>Humidity (Steady State)</td><td>The specimen shall be subjected to 40±2 ˚C, 90 to 95 % RH for 1000 hours without load and then stored at room temperature and normal humidity for 1 to 2 hours. Thereafter, the change of V_{CmA} shall be measured.</td><td>$\Delta V_{CmA}/V_{CmA} \leqq \pm 5$ %</td></tr>
<tr><td>Temperature Cycle</td><td>The temperature cycle shown below shall be repeated five cycles and then stored at room temperature and normal humidity for 1 to 2 hours. The change of V_{CmA} and mechanical damage shall be examined.
Step — Temperature (˚C) — Period (minutes)
1 — –40±3 — 30±3
2 — Room temperature — 15±3
3 — 125±2 — 30±3
4 — Room temperature — 15±3</td><td>$\Delta V_{CmA}/V_{CmA} \leqq \pm 5$ %
No remarkable mechanical damage</td></tr>
<tr><td>High Temperature Load/ Dry Heat Load</td><td>After being continuously applied the Maximum Allowable Voltage at 85±2 ˚C for 1000 hours, the specimen shall be stored at room temperature and normal humidity for 1 to 2 hours. Thereafter, the change of V_{CmA} shall be measured.</td><td>$\Delta V_{CmA}/V_{CmA} \leqq \pm 10$ %</td></tr>
<tr><td>Damp Heat Load/ Humidity Load</td><td>The specimen shall be subjected to 40±2 ˚C, 90 to 95 % RH and the Maximum Allowable Voltage for 1000 hours and then stored at room temperature and normal humidity for 1 to 2 hours. Thereafter, the change of V_{CmA} shall be measured.</td><td>$\Delta V_{CmA}/V_{CmA} \leqq \pm 10$ %</td></tr>
<tr><td>Low Temperature Storage/Cold</td><td>The specimen shall be subjected to –40±2 ˚C without load for 1000 hours and then stored at room temperature and normal humidity for 1 to 2 hours. Thereafter, the change of V_{CmA} shall be measured.</td><td>$\Delta V_{CmA}/V_{CmA} < \pm 5$ %</td></tr>
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