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HV INSULATION DIAGNOSTICS

METREL®

TeraOhm 10 kV
TeraOhm 5 kV
ISOTest

TeraOhm 10kV Professional diagnostic insulation tester

TeraOhm 10 kV is a professional diagnostic insulation tester, which allows measurements on high voltage rated equipment.
It is specially well suited for:
- testing insulation resistance of rotating machinery and cables,
- production line periodic testing and maintenance,
- troubleshoting and analysis of all kinds of insulation problems.

Because of its robustness / CAT IV protection / it is best suited for industrial environment.

Main features:
- Insulation resistance up to 10TΩ
- DC Test voltage 500 V - 10 kV in step of 25 V
- The short circuit current is 5 mA
- Auto-calibration of measuring system
- Operates from mains or rechargeable supply
- Automatic discharge of capacitive loads
- Digital and bar graph results with date and time
- User friendly PC software with RS232 or USB isolated communication port
- High quality accessories
- High noise immunity
- The highest protection degree CAT IV 600V

Powerful features of Diagnostic tests:
- Discharge Current, Voltage and Capacitance measured on the equipment under test.
- Polarization Index (**PI**) calculation.
- Dielectric Absorption Ratio (**DAR**) calculation in first minute.
- Dielectric Discharge Ratio (**DD**) calculation.

Standards applied:
Instruments: EN61557-2, EN61326, EN61010-1, EN61010-31
Applications: EN60345, EN61010, IEEE43:2000

Technical Specification

Measuring range:	0.01MΩ ÷ 10TΩ	(5% of r. + 3 dig.)
Test voltage ranges (DC):	500V ÷ 10000V	
	in steps by 25V	(3% of r. + 3V)
Bar Graph Trend:	0 ÷ 1TΩ	
Withstanding test voltage:	500V ÷ 10000V	(3% of r. + 40V)
Leakage current range:	0 ÷ 5 mA	(3% of r. + 3 dig.)
Voltage AC/DC range:	0 ÷ 600V	(3% of r. + 3V)
Capacitance range:	0 ÷ 50μF	(5% of r. + 2 dig.)
Polarization index (PI) range:	0 ÷ 99.9	(5% of r. + 2 dig.)
Dielectric discharge test (DD) range:	0 ÷ 99.9	(5% of r. + 2 dig.)
Dielectric absorption ratio (DAR) range:	0 ÷ 99.9	(5% of r. + 2 dig.)

General	
Battery power supply:	7.2V DC (6 x 1.2V NIMH, IEC LR20, D size)
Mains power supply:	90 - 260V AC, 45-65Hz
Protection classification:	Double insulation
Over-voltage category:	CAT IV 600V
Pollution degree:	2
Degree of protection:	IP 44
Dimensions:	34 X 26 X 16 cm
Weight:	(with batteries,without accessories) 5.5 kg
Visual and sound warnings:	Yes
Display:	LCD dot matrix with backlight (160 X 116)
Memory:	Non-volatile internal memory, 1000 measurements with time and date
Working temperature range:	0 ÷ 40 °C
Nominal temperature range:	10 ÷ 30 °C
Storage temperature range:	-20 ÷ 70 °C
Maximum humidity:	95% RH (0 ÷ 40 °C) non-condensing
Nominal humidity range:	40 ÷ 60% RH

The guard terminal is at the same potential as the negative terminal. Since the leakage resistance is effectively in parallel with the resistance to be measured, the use of guard terminal causes the current flowing through surface to be diverted from the measuring circuit. The unwanted surface leakages are drained by the guard terminal and are not considered in the measuring result. Guard terminals enable reliable measuring of high insulation resistance values. Simple connection of shielded leads.

Mains power supply with built-in battery charger for NiMH batteries enables measurement during the charging. Communication to PC with RS 232 port or USB cable.

Recommended procedure for testing of insulation with high voltage

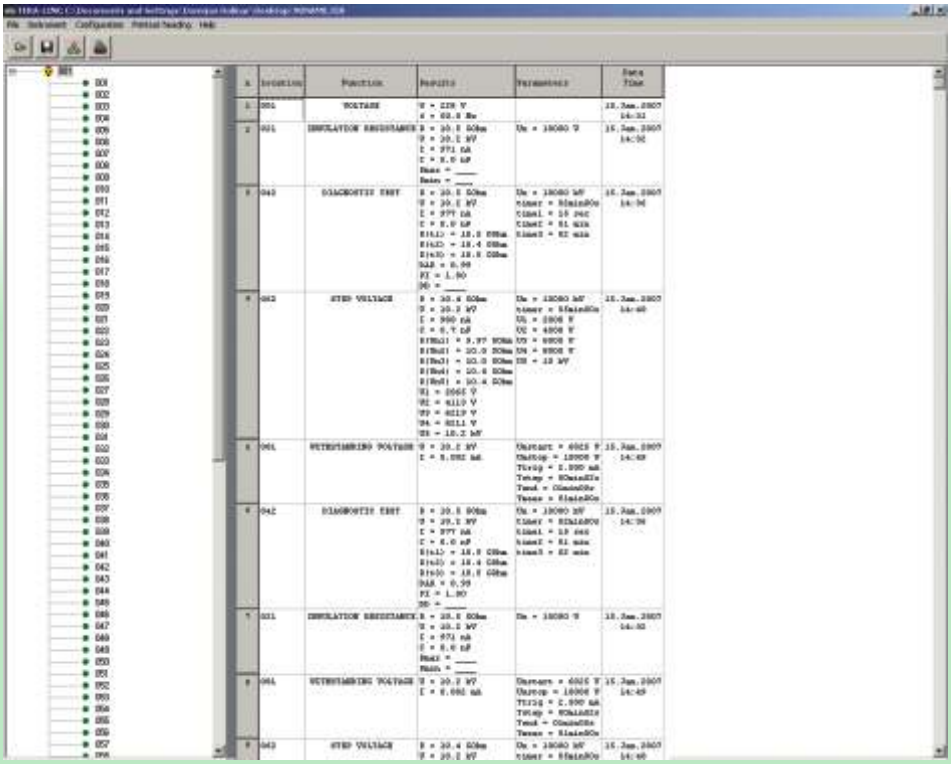
TeraOhm 10kV

Save your time and be competitive.
User friendly!

TeraOhm 10 kV can store up to 1000 results

Print test report

Transfer stored results to PC



Windows PC SW TeraLink

Shielded cables ensure better quality of measurements. They provide higher accuracy and immunity to disturbance of measurements in industrial environment.

Ordering information

Standard Set Part No. **MI 3200**

- Instrument TeraOhm 10kV
- 12 kV shielded test lead with tip, 2m
- 12 kV shielded test lead red, 2m
- 12 kV shielded test lead black, 2m
- 10 kV alligator red
- 10 kV alligator black
- Test guard lead (green,with alligator clip), 2 m
- Mains cable
- 6 X 1.2 NiHM batteries
- Instruction manual
- Instruction manual on CD
- Handbook "Modern Insulation Testing" on CD

Optional accessories

A 1230 - PC software TeraLink with RS 232 and USB cable
S 2029 - 12 kV shielded test lead, 8m
S 2030 - 12 kV shielded test lead, 15m
S 2036 - 10 kV alligator set

TeraOhm 5kV Diagnostic insulation tester

Advanced, field proven instrument. Technical demands require high performance measuring instruments capable of measuring polarization index (PI), dielectric absorption ratio (DAR), dielectric discharge (DD), insulation system capacitance. Easiness of use, low EMI susceptibility and automatic discharge of load after completed measurement are just some of many outstanding features that distinguish Metrel HV testers from other similar products on the market.

High Insulation Resistance measurement:
- Pre-set DC test voltages 250 V ÷ 5000 V in steps of 50 V.
- Measuring range up to 5 TΩ.
- Timer mode from 1 s up to 30 min.
- Capacitance measurement up to 50 μF.

Step voltage measurement of Insulation Resistance.
- Pre-set DC test voltage up to 5000 V automatically divided in 5 steps.
- Pre-setting of the test time for the voltage step.

Withstanding voltage test up to 5500 V.
- Leakage current measurement.
- Ramp mode rising voltage within the selected values.
- Pre-set threshold test current from 1 mA to 1.4 mA.
- Time programmable step voltage test

External voltage
- 0 ÷ 600 V AC/DC and frequency.
- Automatic discharge of capacitive loads.
- Guard terminal to eliminate surface leakage current.
- Digital and bar graph display show results with date and time.
- Built-in battery charger.
- User-friendly PC software with RS 232 isolated communication port.

Application testing of insulation on:
- Rotating machines,
- Transformers,
- Cables,
- High Voltage generators,
- Electrical circuits,
- Surge arresters,
- Insulation systems, etc.

Standards applied:
- Instruments operation: IEC/EN 61557-2
- Electromagnetic compatibility: (EMC) EN 61326 Class B
- Safety: EN 61010-1 (instruments), EN 61010-031 (accessories)

Technical Specification

Measuring range:	0.01 MΩ ÷ 5 TΩ	± (5 % of r. + 3 dig.)
Test voltage ranges (DC):	250 V ÷ 5000 V	
	in steps by 50 V	± (3 % of r. + 3 V)
Bar Graph Trend:	0 ÷ 1 TΩ	
Withstanding test voltage:	0 ÷ 5500 V	± (3 % of r. + 40 V)
Leakage current range:	0 ÷ 1.4 mA	± (3 % of r. + 3 dig.)
Voltage AC/DC range:	0 ÷ 600 V	± (3 % of r. + 3 V)
Capacitance range:	0 ÷ 50 mF	± (5 % of r. + 2 dig.)
Polarization index (PI) range:	0 ÷ 99.9	± (5 % of r. + 2 dig.)
Dielectric discharge test		
(DD) range:	0 ÷ 99.9	± (5 % of r. + 2 dig.)
Dielectric Absorption Ratio		
(DAR) range:	0 ÷ 99.9	± (5 % of r. + 2 dig.)

General	
Power supply:	7.2 V DC (6 x 1.2 V) NiMH batteries or 9 V AC
	(6 x 1.5 V) alkaline batteries
Display:	LCD dot matrix with backlight
Protection classification:	double insulation
Overvoltage category:	CAT III 600 V
Pollution degree:	2
Degree of protection:	IP 44
Working temperature range:	-10 ÷ +50 °C
Storage temperature range:	-20 ÷ +70 °C
Communication:	Serial port RS 232, optically isolated
Memory:	1000 measurement results
Dimensions (w x h x d):	265 x 110 x 185 mm
Mass (with batteries):	2.3 kg

Key Features

Large custom LCD dot matrix display with bar graph and with back light.
Simultaneous display of measurement parameters.
Built-in timer and real time clock.

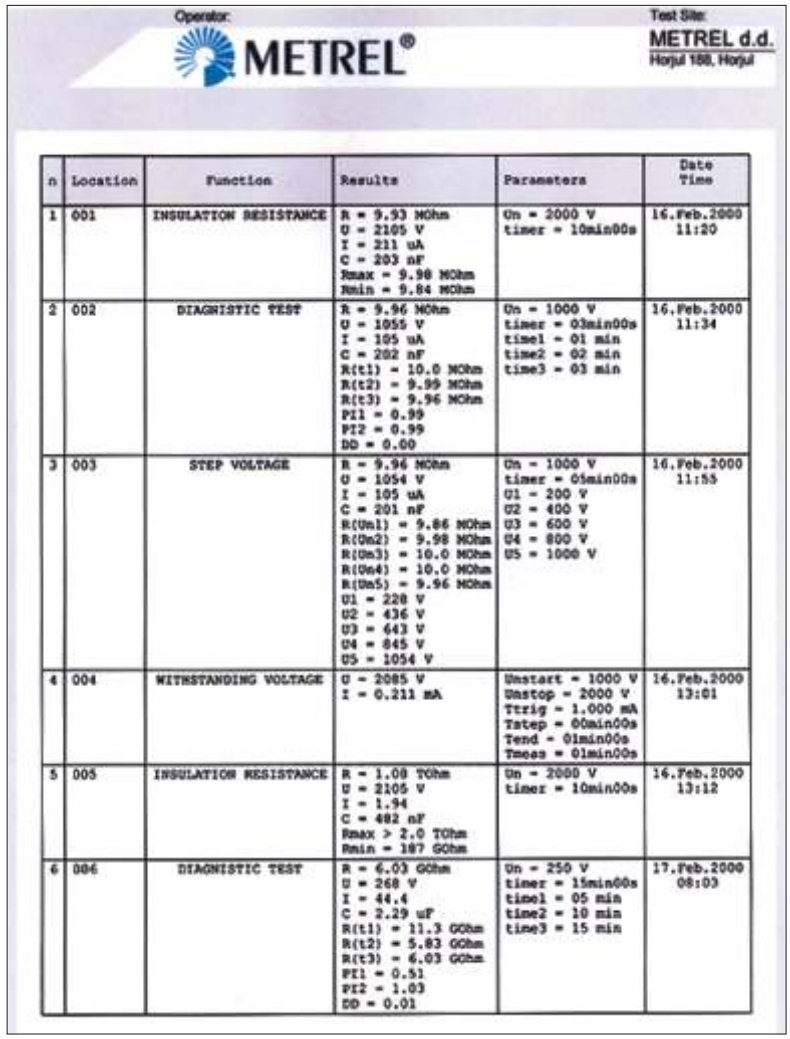
Guard terminal to eliminate effects of surface leakage current.
Three safety banana sockets galvanic separated.
RS 232 port for communication to PC.

230 V power supply with built-in battery charger for NiMH batteries enables measurement during the charging.
110 V power supply available on request.

Simple and fast manipulation.

Diagnostic test of motor windings

Windows PC Software Tera Link



n	Location	Function	Results	Parameters	Date Time
1	001	INSULATION RESISTANCE	R = 9.93 MOhm U = 2105 V I = 211 uA C = 203 nF Rmax = 9.98 MOhm Rmin = 9.84 MOhm	Un = 2000 V timer = 10min00s	16.Feb.2000 11:20
2	002	DIAGNISTIC TEST	R = 9.96 MOhm U = 1055 V I = 105 uA C = 202 nF R(t1) = 10.0 MOhm R(t2) = 9.99 MOhm R(t3) = 9.96 MOhm PI1 = 0.99 PI2 = 0.99 DD = 0.00	Un = 1000 V timer = 03min00s time1 = 01 min time2 = 02 min time3 = 03 min	16.Feb.2000 11:34
3	003	STEP VOLTAGE	R = 9.96 MOhm U = 1054 V I = 105 uA C = 201 nF R(Un1) = 9.86 MOhm R(Un2) = 9.98 MOhm R(Un3) = 10.0 MOhm R(Un4) = 10.0 MOhm R(Un5) = 9.96 MOhm U1 = 228 V U2 = 436 V U3 = 643 V U4 = 845 V U5 = 1054 V	Un = 1000 V timer = 05min00s U1 = 200 V U2 = 400 V U3 = 600 V U4 = 800 V U5 = 1000 V	16.Feb.2000 11:55
4	004	WITHSTANDING VOLTAGE	U = 2085 V I = 0.211 mA	Unstart = 1000 V Unstop = 2000 V Ttrig = 1.000 mA Tstep = 00min00s Tend = 01min00s Tmeas = 01min00s	16.Feb.2000 13:01
5	005	INSULATION RESISTANCE	R = 1.08 TOhm U = 2105 V I = 1.94 C = 482 nF Rmax > 2.0 TOhm Rmin = 187 GOhm	Un = 2000 V timer = 10min00s	16.Feb.2000 13:12
6	006	DIAGNISTIC TEST	R = 6.03 GOhm U = 268 V I = 44.4 C = 2.29 uF R(t1) = 11.3 GOhm R(t2) = 5.83 GOhm R(t3) = 6.03 GOhm PI1 = 0.51 PI2 = 1.03 DD = 0.01	Un = 250 V timer = 15min00s time1 = 05 min time2 = 10 min time3 = 15 min	17.Feb.2000 08:03

- TeraOhm 5 kV can store 1000 measurement results.
- Transfer of measurement values to a PC.
- Print-out of tabular display used as a measuring report.

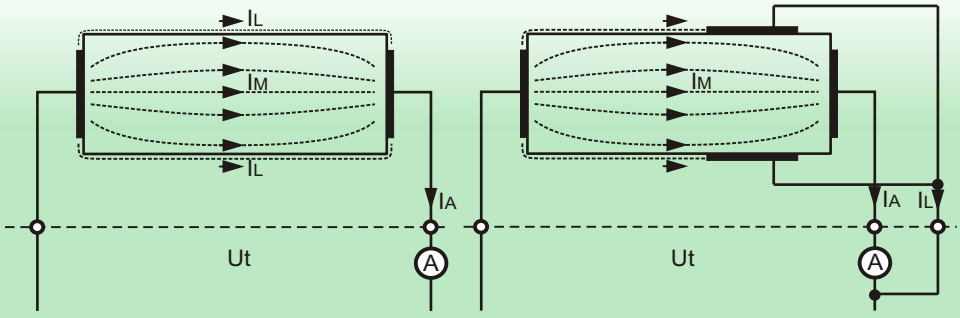
Ordering information

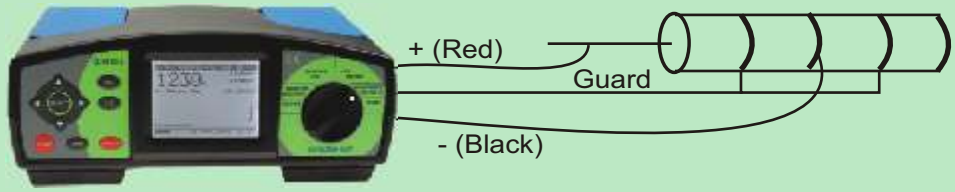
Standard Set Part No. **MI 2077**

- Instrument TeraOhm 5kV
- Test lead, black, 2 m
- Test lead, red, 2 m
- Test guard lead (green,with alligator clip), 2 m
- Test tip, black
- Test tip, red
- Alligator clips, black, 2 pcs
- Mains cable
- Soft carrying bag
- Instruction manual
- Instruction manual on CD
- Handbook "Modern Insulation Testing" on CD

Optional accessories

A 1046 - 6 x 1.2 V NiMH batteries
A 1056 - Windows Software "Tera Link" with RS 232 cable
A 1171 - USB/RS 232 converter with 1m fixed cable
S 2003 - High Voltage Cable Set





Connection of GUARD terminal to measured object (an example for measuring cable insulation is shown)

ISO Test Electronic Insulation Tester

ISOTest is a simple to use, portable analogue measuring instrument. It is convenient for less demanding applications and intended for testing insulation of:

- motors, electrical equipment and devices,
- electric traction systems of trams, trolley buses and other electric gears,
- high voltage cables,
- high voltage transformers,
- electrical instruments,
- electrical appliances

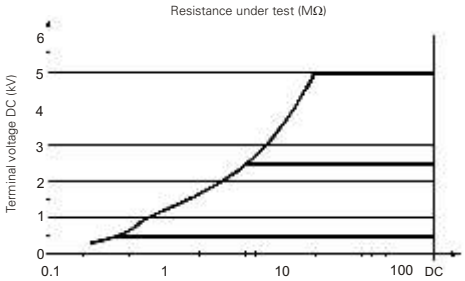
It can also be used for measurements of AC and DC voltage up to 600 V. Voltage ranges are 0.5 kV, 1 kV, 2.5 kV and 5 kV. The tester was developed by taking special care of safety standards. It is battery powered (4 × 1.5 V dc IEC R 20) for autonomous operation up to 2500 measurements under normal conditions. Its casing is very practical, with excellent insulating features.

Technical Specification

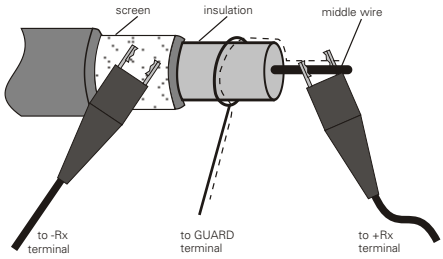
Insulation resistance	
Measuring range:	500 kΩ ÷ 500 GΩ
Measuring voltage:	500, 1000, 2500, 5000 Vd.c.
Short circuit measuring current:	approx. 1.3 mA
Scale:	logarithmic, l = 90 mm
Accuracy:	± 2 mm
START HOLD system:	included
Discharging of line:	automatic, when START key is not pressed

Voltage	
Measuring range:	0 ÷ 600 V AC/DC
Input resistance:	DC voltage 3 MΩ
Input resistance:	AC voltage 1.35 MΩ
Scale:	linear, l = 90 mm
Accuracy:	± 2 % of full scale
General	
Power supply-batteries:	4 × 1.5 Vd.c. IEC R20
LOW BAT indicator:	red LED
Dimensions (W × H × L):	345 × 130 × 250 mm
Case:	robust, plastic
Working temp. range:	0 ÷ 40 °C
Nominal temp. range:	10 ÷ 30 °C
Weight:	4.5 kg

Voltage resistance diagram

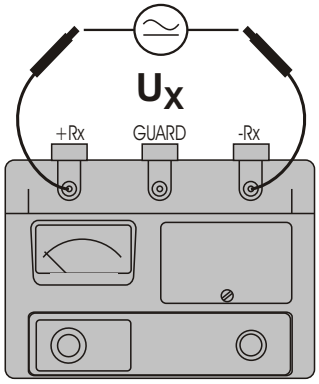


Measurement of Insulation Resistance



Measurements of insulation resistance are mostly carried out without using the GUARD terminal. If you want to eliminate the influence of the surface conductivity (which appears either due to humidity in the atmosphere or because of dirt), the terminal GUARD should be used as shown in the figure.

Measurement of DC or AC voltage



The instruments indicate the value of DC voltage or RMS AC voltage (50Hz) without depressing START key.

Ordering information

Standard Set Part No. **MA 2060**

- Instrument ISO test
- Measuring lead, safety banana/safety banana, black, 2 m
- Measuring lead, safety banana/safety banana, red, 2 m
- Measuring lead, banana/crocodile, black, 2 m
- Safety crocodile, 2 pcs
- Instruction manual

Optional accessories Part No. **MA 2060**

A 1150 - Calibration Unit
S 2003 - High Voltage Cable Set

Comparison table

Measurement functions Part No.:	MI 3200	MI 2077	MA 2060
Test Voltages 250 V, 500 V, 1000 V, 2500 V, 5000 V, 10 kV	10 kV	5 kV	5 kV
Test Voltages 500 V ÷ 10000 V in step of 25 V	✔		
Test Voltages 250 V ÷ 5000 V in step of 50 V		✔	
Insulation resistance measuring range	10 Tera Ω	5 Tera Ω	500 Tera Ω
Voltage measuring range	0 ÷ 600 V, AC/DC	0 ÷ 600 V, AC/DC	0 ÷ 600 V, AC/DC
Timer	✔	✔	
Start HOLD	✔	✔	✔
Capacitance measurement	✔	✔	
Diagnostics tests with **PI, DAR** and **DD**	✔	✔	
Step voltage	✔	✔	
Withstanding voltage ramp test	✔	✔	

Short Glossary

PI - Polarization index Ratio between two insulation resistances values measured in different time slots during continuous measurement. It shows quality, contamination, and degradation of insulation material.

DAR - Dielectric absorption ratio Similar to PI, the ratio of two insulation resistances values measured in different time slots during continuous measurement; these time slots are shorter than those for determination of PI.

IR - Insulation resistance Resistance of insulator, IEV 151-15-43: resistance under specified conditions between two conductive elements, separated by insulating materials.

DD - Dielectric discharge test Useful for testing a multi-layer insulation. This test can identify excess discharge currents that occur when one layer of a multi-layer insulation is damaged or contaminated. This condition will not be detected by both - the spot test and the polarization index test. Discharge current will be higher for known voltage and capacitance if an internal layer is damaged. The time constant of this individual layer will differ from other layers, causing a higher current than that of a sound insulation.

Step voltage test Step voltage test involves testing the insulation at two or more voltages and comparing the results. Good insulation will show a relatively consistent resistance reading regardless of the voltage applied. On the other hand, when the resistance level drops as the voltage level increases, it is usually an indication that the insulation is aging, contaminated, or brittle. This occurs because small imperfections like pinholes and cracks reveal themselves under increased electrical stress. When performing a step voltage test, it is important that you start with the lowest test voltage and then move to a higher voltage level. Typical test duration is 60 seconds.

Withstanding voltage The voltage applied to insulator which has to be kept without a breakdown.

Guard A conductive area that makes barrier between two test nodes. It shunts unwanted (mostly surface) leakage currents and bypasses them out of current measurement node. Its use of guard enables testing of very high insulation resistance values.

Leakage AC or DC current that flow through insulation and over its surfaces.

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Measuring and Regulation Equipment Manufacturer

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