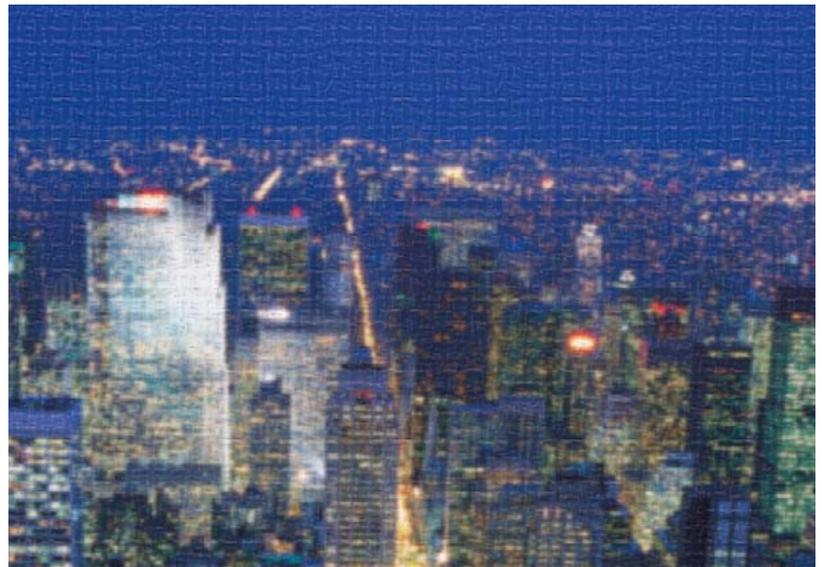


Mitsubishi Electric Low-voltage products PLM (Product Lifecycle Management)



Replacements at appropriate time lead

We are surrounded by technologies, and electricity is one of the important social infrastructures especially in factories and buildings. Therefore, safe and reliable electrical systems are required in order to maintain stable supply of electric power.



Concerns or Experiences

- High maintenance expenses and lack of maintenance persons.
- Product Lifetime of aging equipment.
- Troubles caused by unexpected black-out or power failure.
- The longer time required for recovery.



You may consider the Renewal of products.

Minor failure may cause serious problems

Reliability of power supply is highly-demanded with information networking such as Factory Automation, Computer Integrated Manufacturing, Office and Building Automation.

For example, what will happen if sudden power black-out occurs in your company now?

- How much is the loss due to power outage for 1 hour?
 - What is the impact of unexpected shutdown of production lines or calculators?
- The failure may spread, which may cause black-out in other areas as well.
- It costs money and takes time to recover. (Some old products can not be replaced)

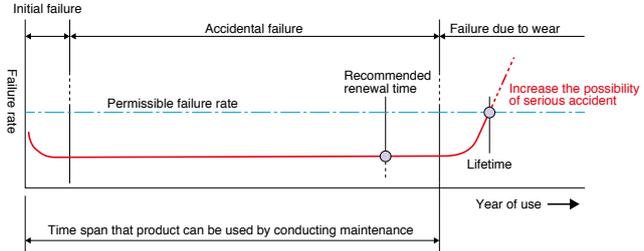
Aging of equipment causes these problems

- Can not be operated properly.
 - Switching and control devices: can not make/break or trip.
- Causes short-circuit fault.
 - Switching and control devices: cause short-circuit fault due to insulation deteriorations.

to facility's reliability

Lifetime of products

It is difficult to find aging of equipment, however sudden failures can occur and it takes a long time to recover. Therefore, preventive maintenance is very important.



Environmental factors for shortening product lifetime

- Salty or corrosive gas environment.
- Insufficient air-condition with rainwater and condensation due to gaps.
- Fulfilled with exhaust gas.
- Fulfilled with nitrate ion from metal pickling and etching circuit board.

Benefit of renewals

- Preventive maintenance ensures safety and reliability.
 - All products are aging.
 - It is difficult to find deteriorations.
 - Sudden faults may occur.
- Improvement of product performances.
 - Product performance has been improved compared to products from 30 years ago.
- Optimization with advanced products.
 - Network devices enable to measure, display and transmit the collected data.

Circuit breakers and Power management meters with communication function



Air circuit breaker (AE-SW series)



Molded case circuit breaker with MDU (WS-V series)



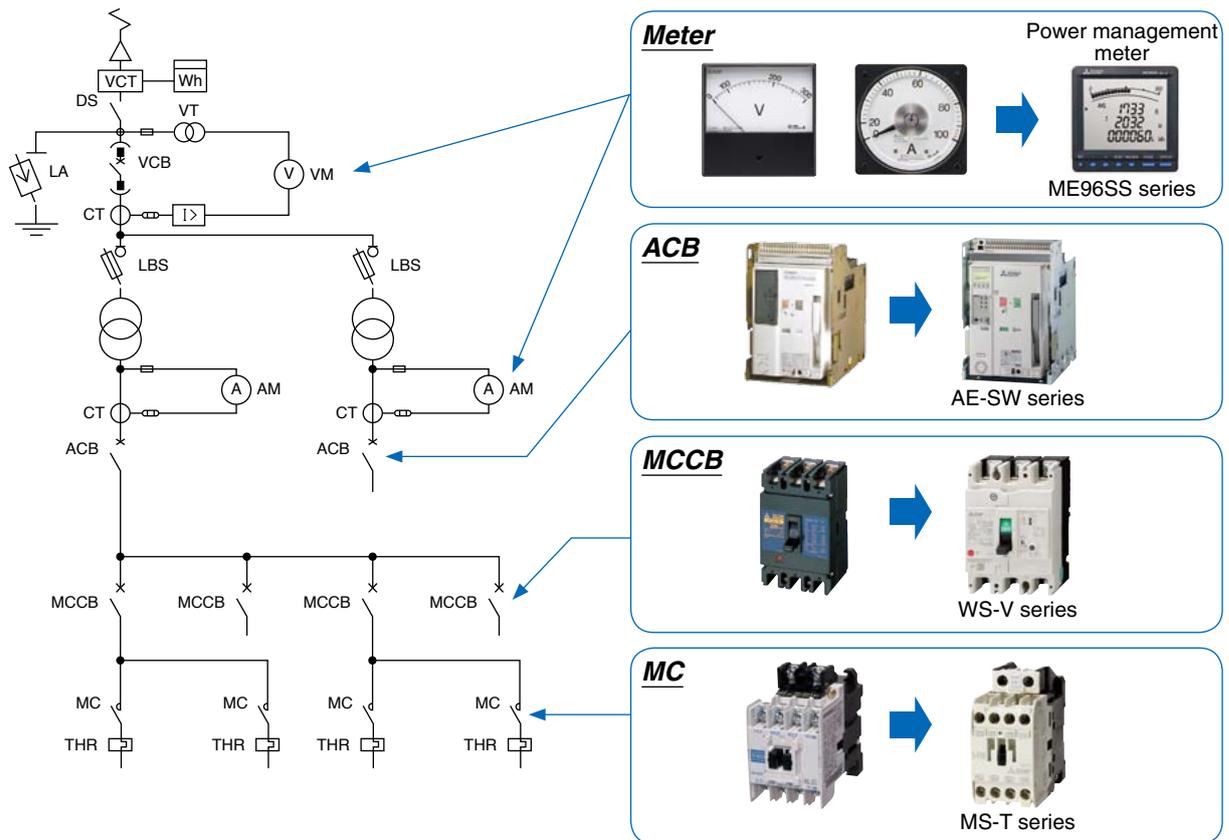
Power management meter (ME96SS series)

Life cycle of each product

| Degree | Environment | Actual example | Guide for replacement (years) |
|------------------|--|--|-------------------------------|
| Good environment | Place where air is always clean and dry | Electricity room with dust-proof and air-conditioning, etc. | Approx. 10 to 20 |
| | Indoors where levels of dust, etc., are low and there is no corrosive gas | Independent electricity room's power distribution panel with no dust-proofing or air-conditioning, and breakers installed in enclosure | Approx. 7 to 15 |
| Poor environment | Place with gases containing sulfurous acid, hydrogen sulfide, salt or high levels of moisture, etc., but with low levels of dust | Geothermal power plant, sewage treatment plant, iron and steel mill, paper mill, pulp plant, etc. | Approx. 3 to 7 |
| | Place with particularly high levels of corrosive gases and dust, where humans cannot stay for long periods of time | Chemical plants, quarries, mines, etc. | Approx. 1 to 3 |

* Each product shall be replaced when operating cycle exceeds specified period of time even within expected product lifetime.
 * The above period of time is only for reference, and not the warranty period of products.
 * Replacement period for circuit breakers with liquid crystal display (Ex. MDU breakers) is approximately 7 to 15 years.
 * For Electronic Multi-measuring Instruments (ME96SS), the replacement period of time is about 10 years depending on the application environment.

Case-sample of product renewals

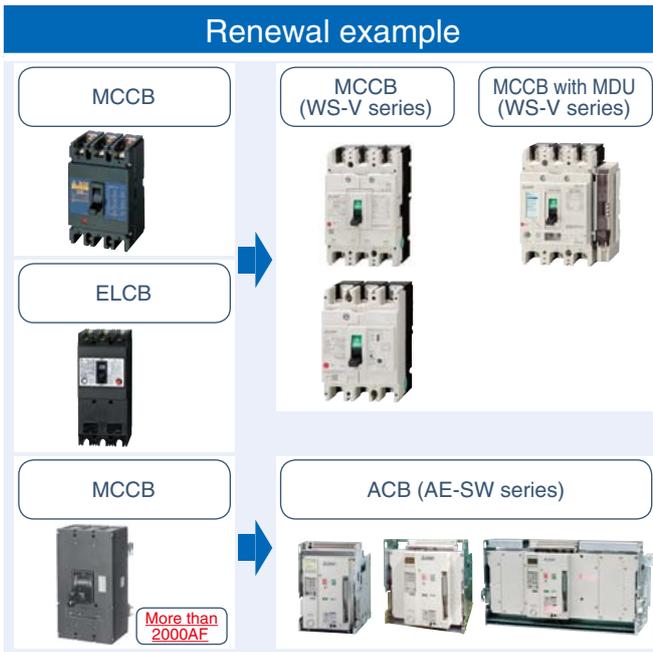


History of Low-voltage Power Distribution Products

| | 1933 | 1960 | 1965 | 1970 | 1975 | 1980 | 1985 | 1990 | 1995 | 2000 | 2005 | 2010 | 2015 | Now |
|---------------------------|--|--|------|---|------|-------------------------|------------------------|-------------------------------|------------------------|--------------------------|----------------------|----------------------------|----------------------------|-----|
| MCCB ELCB | | First launch of circuit breakers in Japan (1933) | | SCHAT series (1965-'71) SCHAT+RU series (1972-'76) | | SCRUM series (1977-'85) | | SUPER-SCRUM series (1986-'94) | | PSS series (1995-'00) | WS series (2001-'05) | W & WS series (since 2005) | * WS-V series (since 2010) | |
| ACB | | | | | | | | AE-S series (1976-'00) | AE-H series (1985-'00) | AE-SS series (1991-'05) | | AE-SW series (since 2005) | | |
| Magnetic Contactor | EC series (1933-'53) EK series (1953-'60) | ES series (1960-'63) EM series (1963-'68) | | MS series (1968-'76) | | MS-A series (1976-'82) | MS-K series (1982-'94) | | | MS-N series (since 1994) | | | MS-T series (since 2012) | |

* WS-V series is up to 250 Ampere frame.

Renewal of low-voltage circuit breakers



Check your circuit breaker's lifetime

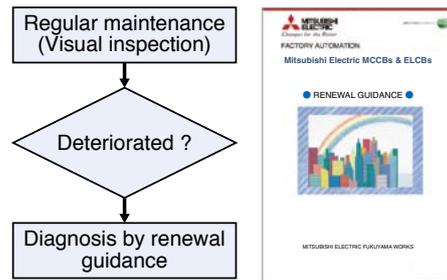
- How long have you used your circuit breaker?
 - Expected product lifetime of circuit breaker is approximately 10 ~ 20 years after the date of manufacturing with normal usage condition.
 - It would be replaced when operating cycle exceeds specified period of time even within 10 ~ 20 years.
- * Low-voltage Air Circuit Breaker is required to have regular maintenance and inspection (such as lubrication) by the manufacturer. When the products are stored for long time, proper maintenance and inspection are required before use.

| Item | Normal service conditions |
|---------------------|---|
| Ambient temperature | From -10°C to 40°C and the average is less than 35°C |
| Humidity | Relative humidity is from 45% to 85% with no condensation |
| Shock and vibration | No abnormal shocks or vibrations |
| Carrying current | The average is less than 80% of the rated current |
| Others | No dust, smoke or corrosive gas |

◆ Self-regular maintenance by the user (preventive maintenance)

| Checked item | Checking point | Deteriorated condition |
|-----------------------|---|---|
| Appearance | <ul style="list-style-type: none"> • Accumulation of dust and metal particles. • Cracking or chipping of molded parts. | <ul style="list-style-type: none"> • Adherence of dust and metal particles. • Cracking or chipping of molded parts. |
| Operation | <ul style="list-style-type: none"> • Handle operation. • Nuisance trip | <ul style="list-style-type: none"> • Unsmoothness of operation. (Handle is heavy, nuisance trip occurs) |
| Insulation resistance | <ul style="list-style-type: none"> • Between phases, between earth (with 500V insulation resistance tester) * Cables shall be taken off | <ul style="list-style-type: none"> • 5MΩ or less |
| Temperature rise | <ul style="list-style-type: none"> • Measure temperature of mold part by infrared temperature sensor or thermo-label | <ul style="list-style-type: none"> • Terminal parts have nearly 70K higher than the ambient temperature |

◆ Flowchart of regular maintenance to diagnosis



Diagnostic criteria

- **Rank A (0 ~ 20 points)**
It is possible to use without any procedures
- **Rank B (21 ~ 29 points)**
It is still possible to use but required to consider renewals and be careful to use it if some parts are deteriorated.
- **Rank C (more than 30 points)**
It is required to consider renewals.

MCCB/ELCB deterioration diagnosis check list

| Sample NO. | | | | | |
|---|------------------------------------|--|--|---|---|
| Installation location | | | | | |
| Model/ Number of poles / Rating | | | | | |
| Specifications | | | | | |
| Accessories | | | | | |
| Serial number | | | | | |
| Installation date | | | | | |
| Item | Factor | Conditions | Score | | |
| 1. Year of use | × 3 | Less than 10 years | 1 | | |
| | | Less than 15 years | 2 | | |
| | | Less than 20 years | 3 | | |
| | | Less than 30 years | 6 | | |
| | | 30 years or more | 8 | | |
| 2. Number of operating cycles | × 5 | Less than specified operating cycles | 1 | | |
| | | Less than double of specified operating cycles | 4 | | |
| | | More than double of specified operating cycles | 5 | | |
| 3. Operating environment and conditions | (1) Ambient temperature | × 4 | Low (Monthly average is 30°C or less) | 0 | |
| | | | Normal (Monthly average is 35°C or less) | 1 | |
| | | | High (Monthly average exceeds 35°C) | 2 | |
| | (2) Humidity | × 4 | Low (Monthly average is 45% or less) | 0 | |
| | | | | Normal (Monthly average is 85% or less) | 1 |
| | (3) Corrosive gas | × 10 | Not exist | 0 | |
| | | | | Exist | 1 |
| | | | | Exist | 1 |
| | (4) Carrying current (The average) | × 3 | 50% or less of rating | 1 | |
| | | | 80% or less of rating | 2 | |
| | 4. Appearance | (1) Pollution | × 3 | Almost nothing | 0 |
| | | | | There is dust, oilmist etc (small amount) | 1 |
| There is dust, oilmist etc (large amount) | | | | 2 | |
| (2) Dust at line side barrier area | | × 5 | Nothing | There is soot (little) | 1 |
| | | | | There is soot (much) | 2 |
| | | | | There is metal powder | 3 |
| | | | | No discoloration | 0 |
| | | | | Slightly discolored due to overheat | 1 |
| (3) Sign of overheating in terminal area | | × 7 | Remarkably discolored due to overheat | 2 | |
| | | | | 2 | |
| 5. Insulation resistance | × 4 | Exceed 100MΩ | Exceed 100MΩ | 0 | |
| | | | 5~100MΩ | 1 | |
| | | | less than 5MΩ | 5 | |
| Total score (factor × score) | | | | | |
| Necessity of consideration for renewal | | | Yes / No | | |

Renewal of magnetic contactors

Renewal example



How to check manufacture date

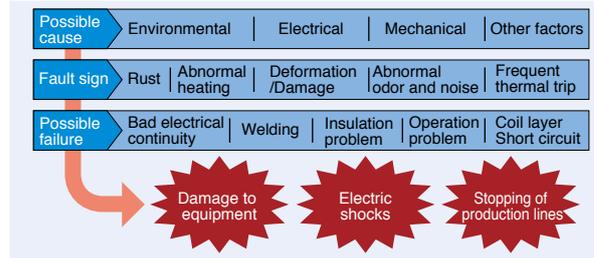
| N series | K series | A series |
|--|--|---|
| <p>ex) 00 2S Year: 2000 / February</p> | <p>ex) 90 9S Year: 1990 / September</p> | <p>ex) 2 06A Showa year: 52 (Japanese calendar) = Year: 1997 / June</p> |
| <p>* The last two digits of the year and the month are described. October to December are represented alphabetically as below. ex) Sep → 9, Oct → X, Nov → Y, Dec → Z</p> | <p>* K, A series may have been manufactured in Showa-period. (Japanese calendar) If so, the year is described by the last one digit of Showa year and month.</p> | |
| <p>If the lifetime (10 years) has passed, we recommend you to upgrade it.</p> | <p>Since it is highly likely that the lifetime (10 years) has passed, we recommend you to upgrade it.</p> | |

Check your magnetic contactor lifetime

- How long have you used your magnetic contactor?
 - Expected product lifetime of magnetic contactors is approximately 10 years after the date of first-use of the product with normal usage condition.
 - It shall be replaced when the operating cycle exceeds specified period of time even within 10 years.
- * The degree of deterioration changes depending on environmental conditions or conditions of use such as frequent opening and closing operations, inching operations and continuous energization etc.

| | N10 ~ N35/ T10 ~ T50 | N50 ~ N800/ T65 ~ T100 | |
|--|-------------------------|---------------------------|-------------|
| Mechanical durability [Unit: 10,000 cycles] | 1000 | 500 | |
| | N10 ~ N65/ T10 ~ T65 | N80 ~ N300/ T80 ~ T100 | N400 ~ N800 |
| Electrical durability [Unit: 10,000 cycles] (Category AC3) | 200 | 100 | 50 |

Factors and signs that lead to deterioration and failure



< End of life of contact due to wearing >

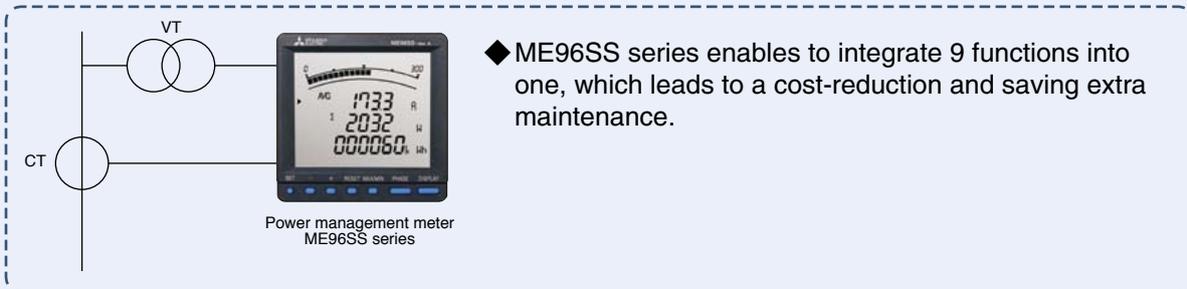
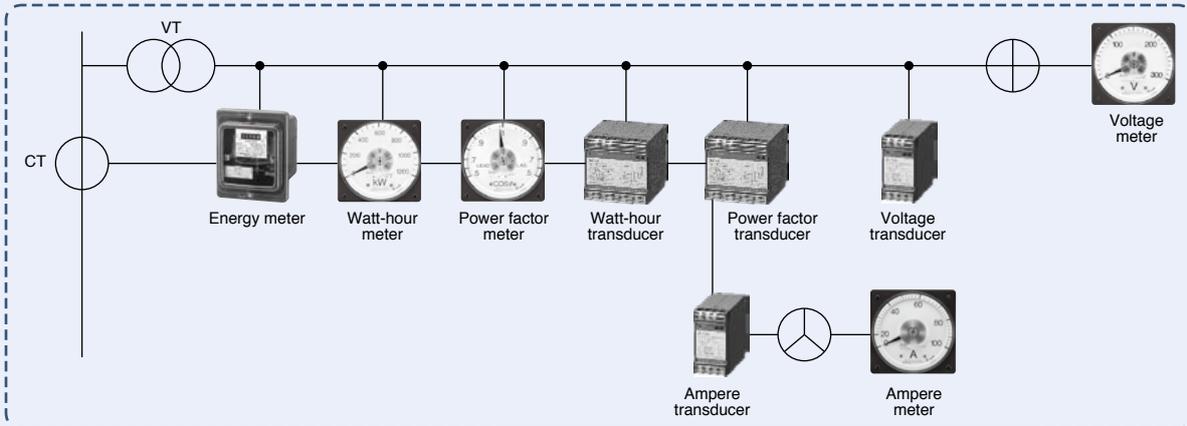
Severe application requires frequent operations to start and stop the load (motors), such as conveyor and crane control that needs frequent making and breaking operations and crane that need inching operations.

As opening and closing operations increase, wear particles are generated and it accelerates contact wearing. When the thickness of contact (Part A) becomes 50% of the new contact, we determine that it is the end of life of the contact.

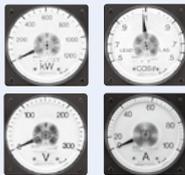


Renewal of meter

Renewal example



Mechanical indicating instrument



- Lower measuring accuracy.
- Misreading scale

Power management meter ME96NS series (old type)



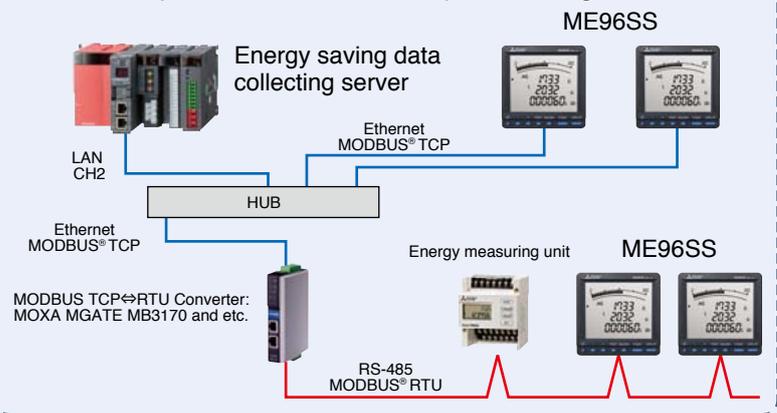
- Lower visibility
- Limited measuring items
- Non-availability for MODBUS[®] TCP

Power management meter ME96SS series



- High and clear visibility.
- Data collection with multiple communication functions.
< MODBUS[®] RTU is equipped as standard >
(MODBUS[®] TCP, CC-Link is optional)
- Collected data storage with SD card logging (Optional)
- Analog, Pulse and Alarm output unit (Optional)

< Example of MODBUS[®] TCP system configuration >



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for a greener tomorrow

Eco Changes is the Mitsubishi Electric Group's environmental statement, and expresses the Group's stance on environmental management. Through a wide range of businesses, we are helping contribute to the realization of a sustainable society.



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