TOSHIBA

MOTOR CONTROL CENTER

Recommendation of Renewal

History of the Toshiba Motor Control Center

Motor control centers (MCCs) are becoming highly-integrated and highly-functional to support the need for high functionality at plants; increasingly adopting electronic parts.
Some of these may interfere with the continuous operation of MCCs due to failure caused by aging deterioration. To ensure system reliability, it is recommended that the devices be updated or preventive maintenance and renewal (unit or entire panel update) implemented, using the service life of each part as a guide.

History of Toshiba Motor Control Centers

Year		1960s	1970s	19 80s	1990s	2000s
Motor control center MCC		(1963) Type CDDN (1965) Type TN (H) MCC (1980) Type TC MCC (1987) Type TM MCC (2003) Type TE MCC				
Device	Motor multi-relay MMR			CCR10	CCR11 / CCR12 / CCR20 / CCR21	CCR22 (Since 2010)
	Molded case circuit breaker MCCB (52)	AD Series	BD Series / ESPER Series	NEW ESPER	Mighty / NJ	WS-V TemBreak2 (Since 2016)
	Magnetic contactor MC (88)	CA Series	ESPER Series	NEW ESPER	Mighty / J Series / TeSys Mighty	MS-T Series SC Series, NEO SC
	Thermal overload relay THR (49)	RC Series	ESPER Series	NEW ESPER	Mighty / J Series / TeSys Mighty	MS-T Series SC Series, NEO SC


Type CDDN


Type TN (H) MCC


Type TC MCC


Type TM MCC


Type TE MCC

Some of the motor control centers currently used have already exceeded their service lifespan. It is recommended that they be updated immediately to prevent any accident due to age-related deterioration of the equipment and improve operational reliability. It is also recommended that update plans be created ahead of time for motor control centers that will reach their update period.

Motor control centers that will reach their update period
1960s to 1980s: Type TN (H) MCC
1980s to 1990s: Type TC MCC
1980s to 1990s: Type TM MCC

Unit size and panel dimension

Type MCC	Minimum unit size (mm)	Maximum stages (one side) panel dimension
TN	240	8 600W×500D×2300H
TC	180	12 600W×550D×2300H
TM	200	9 600W×550D×2300H
TE	200 150	10 14 600W×550D×2300H

Recommendation of a Reliability Check

Expected failure modes of major parts and their influence to the motor control center

Part name	Roughly-estimated life	Deterioration mode	Failure mode	Influence to MCC
Motor multi-relay (MMR) communication device	12 years	Corrosion of the board pattern due to leakage from electrolytic capacitors	Malfunction	Erroneous start/stop
		Electrolyte dry-out	Low capacitor capacity	Disabled instantaneous power failure restart function
Molded case circuit breaker *1	15 years	Worn contact	Conduction failure	Smoke and fire spread, erroneous trip
		Worn mechanism	Defective input	Unable to operate
			Unable to trip	Burned unit due to overload continuation
Magnetic contactor *1 Auxiliary relay	10 years	Moisture absorption of mold parts	Low insulation/strength	Short-circuit and burnout in the unit
		Deteriorated coil insulation	Layer short/break	Burned unit
		Worn main contact	Overheat	Smoke and fire spread
		Corrosion of auxiliary contact	Defective contact	Unable to operate
		Corrosion of contact face by acid gases	Defective operation	Unable to operate
Thermal overload relay	10 years	Lower operation performance of mechanism	Unable to trip	Overload continuation, smoke and fire spread
Inverter *2	7 to 10 years	Worn board part	Unable to control	Stop of ASD function
Main circuit disconnecting part	15 years	Low contact pressure	Overheat	Smoke and fire spread
Control circuit disconnecting part	20 years	Corrosion of contact face	Defective conduction	Unable to operate
Bus support	20 years	Moisture absorption	Low insulation/strength	Bus grounding/short-circuit
Wire	20 years	Deterioration of coating surface	Low insulation	Grounding and short-circuit

*1: According to "Survey on Update Recommendation Periods of Low Voltage Equipment" issued by JEMA.
*2: When parts are replaced in 2 to 5 years according to "Recommendation of Generic Inverter Periodic Inspection" issued by JEMA.

Cases of motor control center deterioration diagnosis

Deterioration state in terms of structure and performance (items delivered in 1973)

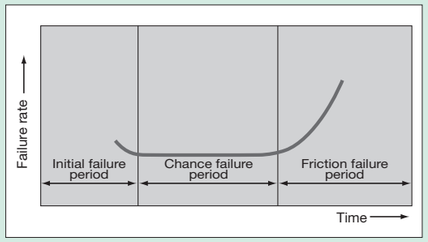
Part name	Survey result
Drawout unit	1. Chipped tip of the MCCB handle 2. No operational abnormality 3. No abnormality in insulation characteristics
Molded case circuit breaker (MCCB)	1. Conduction of R-phase is unstable. 2. No abnormality in insulation performance or operation performance 3. Both moving and fixed contacts are discolored black. 4. The T-phase does not operate under 200% overcurrent tripping characteristics. 5. INST standard value exceeds the upper limit.
Magnetic contactor (MC)	1. Significant deterioration of the terminal part, which is discolored dark gray 2. Significant dust accumulation on the top 3. No abnormality in the insulation or operational performance 4. Contact resistance value is high, and conduction fails sometimes.
Primary disconnecting switch (PDS)	1. No abnormality in its appearance 2. Significant decrease of insulating resistance under high humidity when dust is accumulated
Wire	Control circuit wire (IV) 1. Elongation and insulating resistance values satisfy the standard.
	Main circuit wire (LHH) 1. Elongation and insulating resistance values satisfy the standard.

Recommendation of Renewal

Renewal procedure

An electric item used for an extended period generally shown below, passing through the wear-out failure period and reaching its life.
In the wear-out failure period, signs of failure such as defective operation, noise, or vibrations may occur doe to deterioration of the internal devices.
This is an opportunity for renewal. If the opportunity is missed, the work-hours and cost for maintenance will increase significantly caused by the more frequent failures or part replacements as a sign of failure.
In the worst-case scenario, part failure may result in shutdown of the plant.
To avoid this, Toshiba recommends the following renewal procedure:

1. Diagnosis
   Estimate the priority of renewal according to the operational and environmental conditions.
2. Examination
   Conduct sampling by part or unit to examine the deterioration state at the factory.
3. Proposal
   Propose a specific renewal procedure based on the result of the diagnosis and examination.
   (1) For the respective characteristics of part renewal, unit renewal, and panel renewal, refer to the next page.
   (2) Proposal of a renewal plan related to the future operation plan of the plant
   (3) Proposal of a budget according to the customer's renewal plan



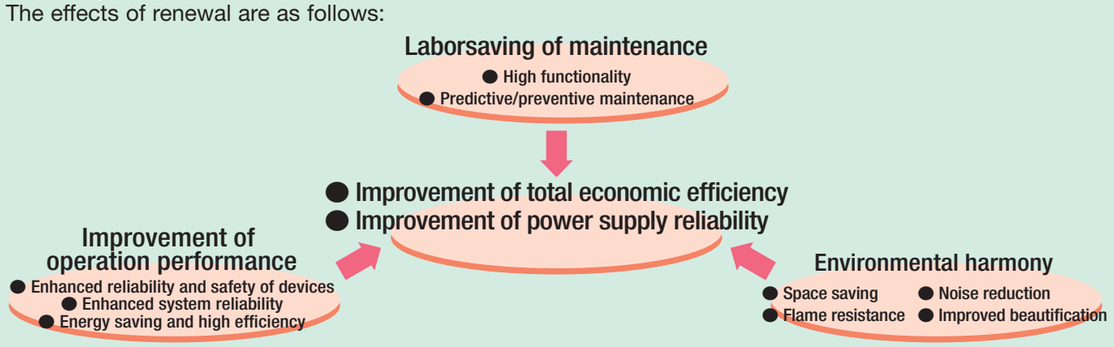
Recommendation of renewal

Renewal of the motor control center is recommended for various purposes in addition to an expired service life.

1. Service life
2. Performance deterioration (defective characteristics)
3. Increased failure rate (repair cost, facility operation, safety)
4. Automation and labor-saving (streamlining of maintenance)
5. High functionality/high performance
6. Natural disasters and accidents
7. Difficulty in maintaining functions (difficulty in obtaining parts, etc.)

Effects of renewal

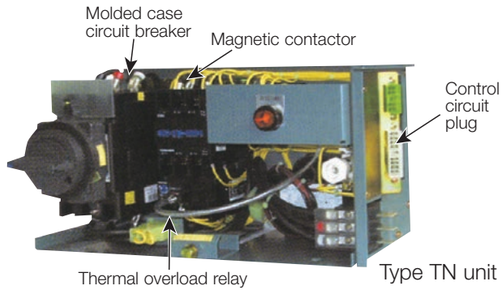
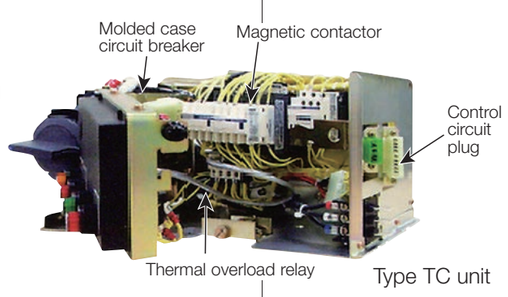
Renewal of aging electric equipment/facilities not only means the failure rate of the equipment and facilities reverts to the brand-new state but facilitates the construction of streamlined facilities with the latest technologies.
The effects of renewal are as follows:



Actions for Checking Reliability

Renewal method

Renewal methods include updating devices that have almost reached their lifespan, updating units, and updating the entire panel.
When selecting an update method, the future operation period, economic efficiency, and hours of work need to be considered. Part and unit updates should be planned early to avoid risks.

Method	Description	Notes for update
Part update	**Individual part update** ●Update of unit components Molded case circuit breaker, magnetic contactor, auxiliary relay, thermal overload relay ●Motor multi-relay Update of motor multi-relay. Update of capacitors. (for CCR21 or CCR22)  Motor multi-relay	●Sequential updates are required. ●Extended work period ●Unable to update if any obsolete part exists
Unit update	Unit update example ●The unit size is the same as the existing unit. ●For internal devices, parts for the Type TE are used. ●The handle and door are also updated. ●The control circuit disconnecting part is changed from the automatic coupling type to plug (Type TN). (Panel side: Replacement of the crimping terminal)  Type TN unit  Type TC unit * A unit compatible with the model is manufactured using the current devices.	●Easy work ●Short work period ●Batch update of limited-life parts is possible.
Panel update	Example of updating the MCC main body to the Type TE ●The existing channel base and cables are used. The Type TN has a different depth dimension. A base replacement or special structure will be used to deal with it. Please make requests in advance.  Type TE MCC	●High quality and reliability ●High functionality is available.

Effects of Renewal of the Type TE

The protection/monitoring functions are enhanced by the adoption of a motor multi-relay to prevent accidents.

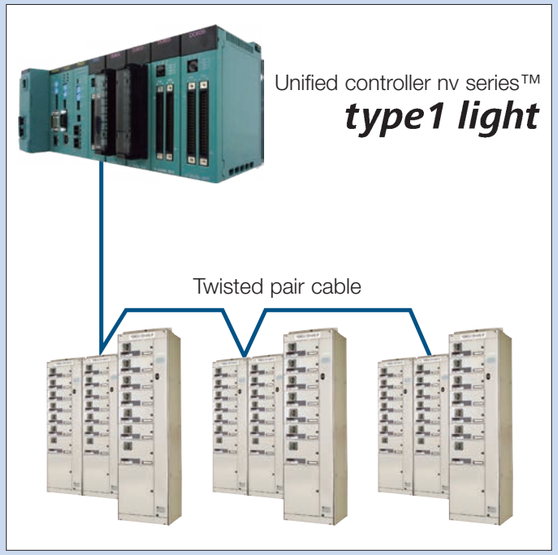
1. Conventionally, monitoring and protection have been performed by individual protection devices. Batch monitoring and protection can be done by adopting the multi-relay.
   (In addition to the protection against overload, single phase, grounding, instantaneous overcurrent, and undercurrent, protection against power overload and power low load protection are available done by power measurement.)
2. Approximate power and power consumption can be displayed based on current and voltage measurement.
3. The current waveform and voltage waveform can be indicated by using a personal computer.
4. Failure analysis data is provided, such as the elapsed time from a trip, percentage of faulty current, and faulty current for 20 sec when it is connected to the personal computer.

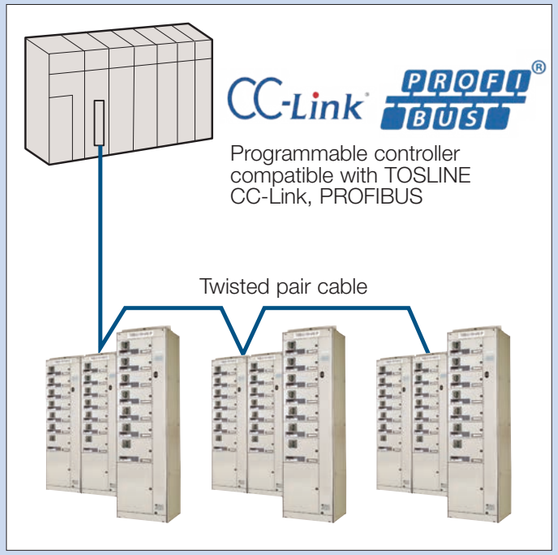
Environmental friendliness

1. Energy saving due to the adoption of energy saving control devices and the resulting downsizing of the operation transformer
2. Regarding the current transformer (transducer) output, the motor multi-relay function without addition of another current transformer.
3. Material names are indicated on the plastic components
4. Easier disassembling at final disposal due to less screws/parts

Centralized monitoring can be performed via transmission

1. Centralized control is available via network connection.
2. High-speed and multi-station transmission equipment (TOSLINE-F10M) can be mounted to the motor control center for more efficient operation of plant and reduction of total equipment costs.
3. An open field network (CC Link and PROFIBUS) can be mounted to meet the needs of a great variety.





Notes on safety

- Before installation, connection, operation, or maintenance, the catalog, manual, documents attached to the products must be read with great care.
- The customer must be acquainted with the performance and principle of equipment and lows relevant to electrical equipment and work.

Toshiba Industrial Products and Systems Corporation

2121, NAO, ASAHI-CHO, MIE-GUN, MIE-PREFECTURE, 510-8521, JAPAN FAX +81-59-376-6106 http://www.toshiba-tips.co.jp

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