Masterpact MTZ

Circuit Breakers and Switch-Disconnectors
Maintenance Guide

09/2016

DOCA0099EN-00

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All pertinent state, regional, and local safety regulations must be observed when installing and using this product. For reasons of safety and to help ensure compliance with documented system data, only the manufacturer should perform repairs to components.

When devices are used for applications with technical safety requirements, the relevant instructions must be followed.

Failure to use Schneider Electric software or approved software with our hardware products may result in injury, harm, or improper operating results.

Failure to observe this information can result in injury or equipment damage.

Table of Contents

Safety Information

Important Information

NOTICE

Read these instructions carefully, and look at the equipment to become familiar with the device before trying to install, operate, service, or maintain it. The following special messages may appear throughout this documentation or on the equipment to warn of potential hazards or to call attention to information that clarifies or simplifies a procedure.

The addition of this symbol to a “Danger” or “Warning” safety label indicates that an electrical hazard exists which will result in personal injury if the instructions are not followed.

This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

⚠ DANGER

DANGER indicates a hazardous situation which, if not avoided, **will result in** death or serious injury.

⚠ WARNING

WARNING indicates a hazardous situation which, if not avoided, **could result in** death or serious injury.

⚠ CAUTION

CAUTION indicates a hazardous situation which, if not avoided, **could result** in minor or moderate injury.

NOTICE

NOTICE is used to address practices not related to physical injury.

PLEASE NOTE

Electrical equipment should be installed, operated, serviced, and maintained only by qualified personnel. No responsibility is assumed by Schneider Electric for any consequences arising out of the use of this material.

A qualified person is one who has skills and knowledge related to the construction and operation of electrical equipment and its installation, and has received safety training to recognize and avoid the hazards involved.

About the Book

At a Glance

Document Scope

Schneider Electric recommends routine inspections and periodic maintenance to ensure that devices retain the operating and technical characteristics specified in the catalogs during their service life. Inspections and maintenance must be carried out by qualified personnel, in accordance with instructions specified in this Masterpact MTZ maintenance guide.

This guide contains information on:

- Maintenance intervals depending on the environment and operating conditions.
- Maintenance required after prolonged storage.
- The parts of the Masterpact MTZ devices that must be maintained.
- The risks involved when a part is not fully operational.
- The preventive maintenance program to be carried out in normal environment and normal operating conditions, and the competence level required for each task.
- Environmental and operating conditions that cause accelerated aging of a device.
- Limits governing the use of mechanical and electrical accessories and subassemblies.
- Links to product guides and related documents that can help to maintain the Masterpact MTZ devices in proper operating order.

Maintenance procedures with Basic and Advanced levels listed in this guide can be performed by qualified customer personnel or by Schneider Electric certified partners. Maintenance procedures with Exclusive level must only be performed by Schneider Electric field service representatives (FSRs).

For general information on Schneider Electric maintenance policies and expertise and tools, contact your Schneider Electric representative.

Audience

This guide is intended for qualified personnel in charge of equipment maintenance and for Schneider Electric field service representatives in charge of system diagnostics.

Validity Note

This Maintenance Guide applies to all Masterpact MTZ circuit breakers and switch-disconnectors.

The information contained in this Maintenance Guide is likely to be updated at any time. Schneider Electric strongly recommends you to have the most recent and up-to-date version available on *www.schneider-electric.com*.

Convention

In these procedures, the term *Masterpact MTZ device* covers circuit breakers and switch-disconnectors.

Related Documents

Title of Documentation	Reference Number
Masterpact MTZ Maintenance Procedures - Basic and Advanced Levels	DOCA0103EN DOCA0103ES DOCA0103FR

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Chapter 1
Maintenance Intervals

What Is in This Chapter?

This chapter contains the following topics:

Preventive Maintenance Intervals Depending on Environmental and Operating Conditions

Preventive Maintenance Definition

Preventive maintenance consists in carrying out, at predetermined intervals or according to prescribed criteria, checks intended to reduce the probability of a failure or deterioration in the operation of a system.

There are two types of preventive maintenance:

- Periodic maintenance:
  For each type of product, maintenance instructions are laid out by the technical department. These verification procedures, intended to maintain systems or their subassemblies in correct operating condition over the targeted service life, must be carried out according to the time intervals stipulated in this document. Under no circumstances can Schneider Electric be held responsible for any damage caused by the failure of device if the periodic checks were not carried out in accordance with the instructions in this document.
- Conditional maintenance:
  To a certain extent, conditional-maintenance operations are a means to reduce (but not eliminate) the periodic-maintenance operations (thus limited to the strict minimum) that require an annual shutdown of the installation.
  These operations are launched when programmed alarms indicate that a predefined threshold has been reached. To that end, sensors must be installed on the switchgear and in the switchboard. Conditional maintenance is the means to optimize installation maintenance.

⚠ WARNING

RISK OF EQUIPMENT DAMAGE

Follow the recommendations for the maintenance given in the different chapters of this document, for each part of the product which is maintainable.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

If preventive maintenance is not done as required, the service life of electrical distribution equipment is reduced.

For more information on the possibilities offered by conditional maintenance, contact Schneider Electric.

Preventive Maintenance Intervals

Maintenance recommendations for each product are intended to maintain the equipment or subassemblies in a satisfactory operational state for their useful service life.

The following table summarizes maintenance operations and intervals for the three preventive maintenance levels in normal environmental and operating conditions:

Maintenance interval	Maintenance operations	Performed by
1 year	Basic level tasks: visual inspection and functional testing, replacement of inoperative accessories.	• Qualified customer personnel with basic training • Schneider Electric certified partner • Schneider Electric field service representative
2 years	Advanced level tasks: Basic level tasks, plus operational servicing and subassembly tests.	• Qualified customer personnel with advanced training • Schneider Electric certified partner • Schneider Electric field service representative
5 years	Exclusive level tasks: Advanced level tasks, plus manufacturer diagnostics and part replacements by Schneider Electric Services.	Schneider Electric field service representative

Normal Environmental and Operating Conditions

The maintenance program *(see page 25)* for Masterpact MTZ circuit breakers and switch-disconnectors is designed for normal environmental and operating conditions.

This program defines the recommended preventive maintenance intervals as follows:

- Basic level maintenance tasks to be performed every year
- Advanced level maintenance tasks to be performed every two years
- Exclusive level maintenance tasks to be performed every five years by the Schneider Electric field service representatives only

The maintenance program must be systematically repeated at the end of each five-year period.

Normal environmental and operating conditions are defined in the following table:

Normal environmental and operating conditions	
Temperature	Ambient temperature outside the switchboard Ta < 25 °C (77 °F) (IEC 61439-1)
Percent load	< 80 % of In 24/24 hours
Harmonics	Harmonic current per phase < 30 % of device rated current (In)
Relative humidity	< 70 %
Corrosive atmosphere	Device installed in environment category 3C1 or 3C2 (IEC 60721-3-3)
Salt environment	No salt mist
Dust	Low level. Device installed in a switchboard equipped with filters or a ventilated IP54 enclosure.
Vibration	Permanent vibration < 0.2 g

Outside of these operating conditions, in harsh environments, the devices suffer accelerated aging that may rapidly result in degraded operation. In such cases, periodic checks must be carried out at shorter time intervals than the recommended yearly or two-yearly programs.

On the other hand, under enhanced operating and environment conditions, the recommended yearly or two-yearly programs can be carried out less frequently. This does not apply for the five-year Exclusive check-up program that must be carried out every five years regardless of favorable operating conditions.

Favorable Conditions or Device Installed Inside a Switchboard

When Masterpact MTZ devices benefit from a favorable environment or are installed inside a switchboard that creates favorable operating conditions, time intervals between maintenance operations can be extended.

The time interval between two basic maintenance visits or two Advanced maintenance visits can be doubled **if all the conditions** listed below are met.

The five-year Exclusive check-up program must be carried out every five years regardless of favorable operating conditions.

Favorable environmental and operating conditions or device installed inside a switchboard	
Temperature	Ambient temperature outside the switchboard Ta < 25 °C (77 °F) (IEC 61439-1). The device is installed in an air-conditioned room or in a ventilated switchboard.
Percent load	< 50 % of In 8/24 hours or 24/24 hours
Relative humidity	< 50 %
Corrosive atmosphere	Device installed in category 3C1 environment or in a closed room that creates favorable operating conditions (air is conditioned and purified).
Salt environment	None
Dust	Negligible. Device installed in a switchboard equipped with filters or a ventilated IP54 enclosure.
Vibration	None

Example of task for which the maintenance interval is dependent on operating conditions:

- Normal: check on charging time = every 2 years
- Favorable: check on charging time = 2 x 2 = every 4 years

Harsh Conditions or Device Not Installed Inside a Switchboard

When Masterpact MTZ devices are likely to suffer in a harsh environment or are not installed inside a switchboard that creates favorable or even standard operating conditions, time intervals between maintenance operations must be reduced.

Harsh environmental and operating conditions prevail in marine and wind power applications, for example.

The time interval between two preventive maintenance visits must be reduced by half **if any of the conditions** listed below are present.

Harsh environmental and operating conditions	
Temperature	Ambient temperature outside the switchboard Ta between 35 °C (95 °F) and 45 °C (113 °F) (IEC 61439-1)
Percent load	> 80 % of In 8/24 hours or 24/24 hours
Relative humidity	> 80 %
Corrosive atmosphere	Device installed in category 3C3 or 3C4 environment without any particular protection
Salt environment	Device installed less than 10 kilometers from the coast without any particular protection
Dust	High level. Device not installed inside an enclosure equipped with filters or a ventilated IP54 enclosure.
Vibration	Continuous vibrations between 0.2 g and 0.5 g

Example of task for which the maintenance interval is dependent on operating conditions:

- Normal: check on charging time = every 2 years
- Harsh: check on charging time = 0.5 x 2 = 1 (every year)
  This reduced time interval must be applied to all levels of maintenance operations and checks, Basic, Advanced, and Exclusive.

Device Check-up

During the fifth year of operation, the device must undergo a complete check-up to determine its condition. This check-up must be done by a Schneider Electric field service representative.

The complete check-up must also be done systematically when:

- Tripping occurs due to a short-time or instantaneous short-circuit.
- Five trips have occurred due to overloads.

Preventive Maintenance Inspections After Prolonged Storage

Storage Conditions

Devices must be stored in a dry, ventilated room, protected from rain, water, and chemical agents. They must be protected against dust, rubble, and paint.

If stored for an extended period, the relative humidity in the room must be maintained below 70 %.

Storage temperature:
- Devices without the Micrologic X control unit: -55 °C to +85 °C (-67 °F to +185 °F).
- Devices with the Micrologic X control unit: -40 °C to +85 °C (-40 °F to +185 °F).

Devices must be stored in the open (OFF) position with the charging springs discharged.

Check-up and Maintenance After Prolonged Storage

After extended storage and if the storage conditions listed above were respected, the checks below must be carried out to ensure correct device operation:

Part or subassembly	Under two years of storage	Over two years of storage
Device mechanisms	Basic and Advanced programs	Advanced and Exclusive programs
Micrologic X control unit	Basic and Advanced programs	Advanced and Exclusive programs
Device and chassis locking	Basic and Advanced programs	Advanced and Exclusive programs
Chassis	Basic and Advanced programs	Advanced and Exclusive programs
Control auxiliaries	–	Advanced and Exclusive programs

In addition, if the devices were stored under harsh conditions (high temperature, corrosive atmosphere):
- Check the surface condition of the metal parts (zinc) and the copper parts (silver coatings (Ag) on connection terminals or tinning (Sn)).
- Check the greasing for the device and chassis.
- Clean and regrease the clusters and disconnecting contacts.

Chapter 2
Parts to Be Maintained and Why

Overview

This chapter describes the maintenance that needs to be done on the fixed parts and mechanisms of the Masterpact MTZ device, on the Micrologic X control unit, and on accessories, as well as why they need to be maintained.

What Is in This Chapter?

This chapter contains the following topics:

How to Maintain Main Body Parts

Overview

This section describes how to maintain the main body parts of Masterpact MTZ devices:

- Case
- Arc chutes and filters
- Main contacts

Device Case

The case of the device provides the following functions:

- Functional insulation between adjacent phases, and insulation between phases and exposed conductive parts for protection against transient overvoltage caused by the distribution system.
- An insulation barrier to prevent users from touching live parts of the device.
- Protection against the effects of electrical arcs and overpressure caused by short-circuits.

It also fulfills an operational function by supporting the entire pole operating mechanism as well as the mechanical and electrical accessories of the circuit breaker.

On the case, there should be:

- No traces of grime (grease), no excessive dust, and no condensation, which all reduce insulation.
- No signs of burns, and no cracks, which reduce the mechanical solidity of the case and thus its capacity to withstand short-circuits.

Preventive maintenance for the case consists of:

- A visual inspection of its general condition.
- Cleaning with a dry cloth or a vacuum cleaner.
- Measuring the insulation at least every five years and after every trip due to a short-circuit.

All cleaning products with solvents are strictly forbidden. The case must be replaced if there are signs of burns or cracks.

Arc Chutes and Filters

During a short-circuit, the arc chute extinguishes the arc and absorbs the high level of energy along the entire path of the short-circuit. Arc chutes also help to extinguish arcs under rated current conditions.

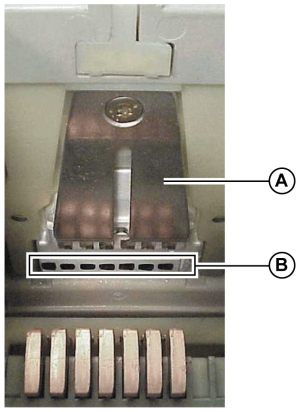
Each time an arc is interrupted by an arc chute, the separator plates of arc chute are eroded. As the condition of the arc chute deteriorates, it is less effective at clearing short-circuits completely. The circuit breaker can be damaged or destroyed as a result.

Preventive maintenance for the arc chutes consists in regular inspection. The fins can be slightly blackened (due to the gases produced at In), but must not be significantly damaged. In addition, the filters must be inspected because blocked filters can cause overpressure. It is recommended to use a vacuum cleaner instead of a cloth to remove dust from the outside of the arc chutes.
The arc chutes must be replaced after a specified number of electrical operations. Arc chutes are available as spare parts.

Main Contacts

The main contacts make and break the current under normal conditions (rated current for the installation) and under exceptional conditions (overloads and short-circuits).

Repeated opening and closing cycles erode the contacts. Contacts are deteriorated by short-circuit currents. Worn contacts can cause abnormal temperature rise and accelerate device aging.



A Arcing contact
B Fixed contact tips

It is imperative to remove the arc chutes and check the contacts for wear at least once a year and after every short-circuit.
The contact wear indicators materialize the absolute minimum allowance that must not be overrun.

How to Maintain Connections

Overview

This section describes how to maintain the connections of Masterpact MTZ devices:

- Power connections
- Sliding connections between the chassis and the device
- Fixed connections to the equipment

Power Connections

⚠ WARNING

RISK OF EQUIPMENT DAMAGE AND THERMAL RUNAWAY

Power connections must never use other material than copper or aluminum.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

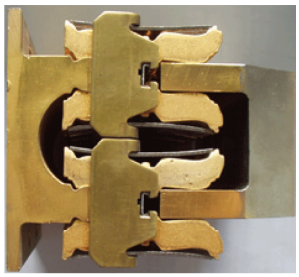
Power connections between the various distribution systems in a switchboard (busbars, cables) and the switchgear are a major source of heat loss.

Incorrect tightening can cause thermal runaway, which in turn can damage the device or cable insulation and can cause a short-circuit and even a fire. It is often due to disregard for installation requirements during switchboard assembly.

Sliding Connections Between Chassis and Device

The sliding connections between the chassis and device are made up of two parts: clusters and disconnecting contacts. Grease between the clusters and the disconnecting contacts facilitates the connection and avoids damaging the silver-coated surface by reducing the racking-in friction.

The grease breaks down over time and it is therefore necessary to replace it regularly.



Preventive maintenance for the sliding connections consists in periodic removing grease and applying new grease in compliance with grease types recommended by Schneider Electric.
In case of corrosive atmosphere, special care must be taken.
Contact your Schneider Electric field service representative for advice.

Fixed Connections to the Equipment

When connections using lugs or bars are made in compliance with Schneider Electric instructions (tightening torque, class 8.8 steel hardware and contact washer), no particular maintenance is required.
Otherwise, regularly check the temperature-rise points (change in color of copper or tinning), disassemble the connections, clean, and scrape the contact surfaces. Then reassemble the connections using new hardware. Check the terminals.

How to Maintain Moving Parts of Chassis and Charging Mechanism

Overview

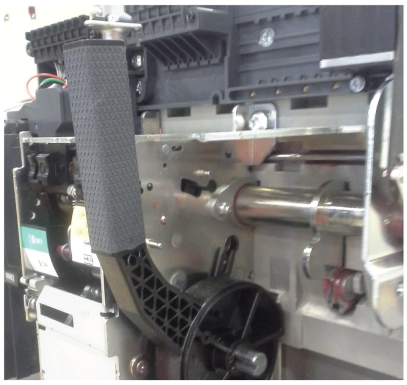
This section describes how to maintain the moving parts of the chassis and the charging mechanism of Masterpact MTZ devices.

Operation capability of the device is improved by dusting and general cleaning, proper greasing, and regular opening and closing.

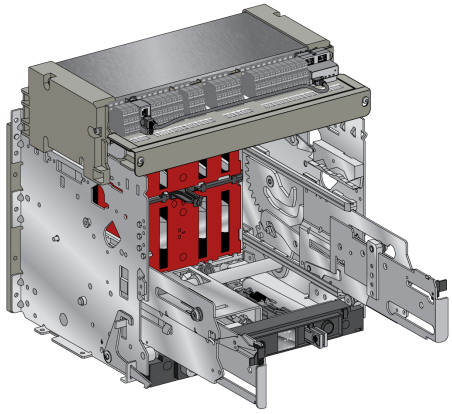
The device mechanism is used to open and close the main contacts.

The chassis mechanism is used to rack the main body in and out.

Charging mechanism



Chassis and system of racking in and out



Dusting

It is recommended to use a vacuum cleaner to remove dust.

Cleaning

Cleaning must be done using a clean and dry cloth or brush. Do not use solvents. Avoid greased parts of the mechanisms, except for grease on electrical contacts.

Never use pressurized cleaning products or products containing solvents (trichloroethane or trichloro-ethylene) such as WD40.

Pressurized cleaning products can cause the following problems:

- Removal of grease from inaccessible lubrication points. These areas are greased for the life of the product and cannot be regreased.
- Corrosion of points that are not regreased.
- Damage caused by the pressure applied by the cleaning product.
- Temperature rise due to the presence of an insulating solvent in the contact zones.
- Elimination of special protection.
- Deterioration of plastic materials.

Greasing

Do not use too much grease. When excess grease mixes with dust it can affect the mechanism operation.

Greasing must be done after cleaning of some mechanical parts as described in the maintenance procedures. Use only grease recommended by Schneider Electric.

- The clusters and disconnecting contacts must be greased following the defined intervals, using the greases indicated by Schneider Electric.
- The main contacts must not be greased.
- Under normal operating conditions, the pole-operating mechanism does not need to be regreased (greased for the life of the product).

Opening and Closing

The need to ensure continuity of service in an installation generally means that power circuit breakers are rarely operated. Although an excessive number of opening and closing cycles accelerates device aging. The maximum number of operations is given in the catalog according to the device frame size. There is a limitation of three cycles maximum per minute for the MCH gear motor.

In installations where power circuit breakers are used in source change over systems, it is necessary to periodically operate the circuit breaker for the alternate source.

The circuit breakers can be equipped with a mechanical or electronic counter to give a precise indication of the number of operations. It is also possible to configure Micrologic X to send an alert when a threshold is reached to plan preventive maintenance, or when the end of useful life is reached to plan the replacement of the device.

How to Maintain Micrologic X Control Unit and Communication System

Overview

This section describes how to maintain the Micrologic X control unit and the communication system:

- Micrologic X control unit
- Communication module and accessories
- Firmware

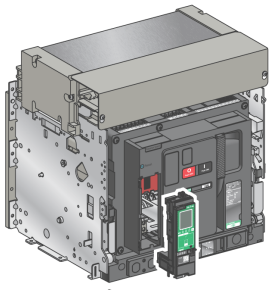
Electronic and electromechanical components have different aging modes:

- Electronic components age mainly by operating time (the amount of time that the electronics are powered) and environmental conditions (temperature, temperature from energy load, vibration, and humidity.
- Electromechanical components age mainly in dynamic mode, due to the frequency and number of operations.

Micrologic X Control Unit

When an electrical fault occurs in the installation, the control unit detects the electrical fault and orders the circuit breaker to open.

Electronic components and circuit boards are sensitive to the environment (ambient temperature, humid and corrosive atmospheres), and to severe operating conditions (magnetic fields, vibrations, and so on).



To help ensure correct operation, you must periodically check:

- The chain of action resulting in a trip.
  The Micrologic X control unit has an integrated Ready LED that flashes when the fault detection chain is working correctly. Checking the Ready LED can avoid preventive primary injection tests on the device.
- The response time as a function of the level of the fault current. Dedicated hardware and software tools are developed for such tests.

The replacement frequency of the control unit depends on the operating conditions and environmental conditions.

Electronic component qualification data is usually quoted for a 10-year lifetime by the component suppliers according to the product mission profile. The control unit can operate more than 10 years, depending on the operating environmental conditions (temperature, humidity, vibrations, mechanical shocks, corrosive atmosphere, and so on).

To help prevent control units from deviating from their original performance, Schneider Electric Services recommends regular checks. For more information, refer to Preventive Maintenance Programs *(see page 10)*.

Firmware

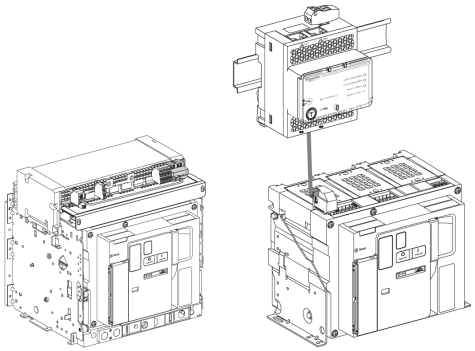
The control unit firmware must be updated regularly.

Communication Module and Accessories

Communication bus transmit data between interconnected modules and to the remote site or to the cloud. Maintenance, production, management, and other departments can use this data to manage energy and assets, and monitor the quality of the network.

In Masterpact MTZ circuit breakers, the data can be accessed by using the ULP port module connected to an Ethernet interface and an appropriate software tool such as Ecoreach.

Masterpact MTZ devices connected to an Ethernet interface



A break in the transmission of data can cause:

- Production downtime because the status of a circuit breaker is unknown.
- Financial losses, due to incorrect system management.
- Wrong diagnosis.

To maintain high reliability and confidence in the communication system, periodically check the orders transmitted by the communication bus (read, write, commands).

How to Maintain Auxiliary Circuits

Overview

This section describes how to maintain the connection system:
- Control auxiliaries
- Auxiliary wiring
- Indication contacts
- MCH gear motor

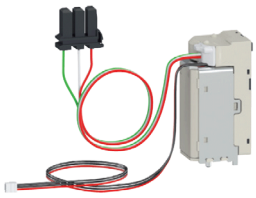
Control Auxiliaries

Control auxiliaries include:
- MN undervoltage release
- MX opening voltage release
- XF closing voltage release

MX opening voltage releases remotely open the circuit breaker, and XF closing voltage releases remotely close the circuit breaker when they receive an electrical signal coming from an external order in the case of standard voltage releases or from a supervisor through the communication network in the case of communicating voltage releases.

The MN undervoltage release is used to open the power circuit if the distribution system voltage drops or fails (in the case of an emergency off application, for example).

MX and XF communicating voltage releases and MN undervoltage releases are continuously connected to the power supply. If the temperature of the device increases, the internal electronic components can accelerate aging.



In Masterpact MTZ devices, communicating voltage releases are continuously supervised by the control unit. If a breakdown or power outage occurs, an alarm is generated to take action for replacement.
It is important to periodically check operation of the voltage releases at minimum values. Whether the auxiliary needs to be replaced depends on the operating conditions and environmental conditions.

Auxiliary Wiring

Auxiliary wiring is used to transmit the following information:
- Orders to the control devices
- Status-condition information

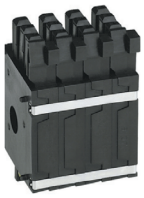
Incorrect connections or damaged insulation can cause unexpected opening or non-operation of the circuit breaker. The auxiliary wiring must be regularly inspected and replaced as required, particularly in environments with vibrations, high ambient temperatures, or corrosive atmosphere.

Indication Contacts

Contacts indicate the following information:

- ON/OFF: position of the main contacts
- CE, CT, CD: position of the device in the chassis (connected, test, or disconnected)
- SDE: trip due to an electrical fault
- PF: the device is ready to close

This information enables a remote operator to respond as necessary. Incorrect indications can result in erroneous device operation.



Improper contact performance can be caused by vibrations, corrosion, or abnormal temperature rises.
Preventive maintenance consists in regularly checking that contacts conduct or isolate correctly, depending on their position.

MCH Gear Motor

The MCH gear motor automatically recharges the operating mechanism springs as soon as the circuit breaker is closed.

The MCH gear motor makes it possible to close the device immediately after opening. The charging lever serves as a backup if the auxiliary voltage is interrupted.

Given the mechanical forces exerted to charge the mechanism, the MCH gear motor wears quickly.
Periodic checks on the operation of the MCH gear motor and the charging time are required to help ensure the device closing function.
With Masterpact MTZ devices, the number of charging operations is recorded, giving information on the remaining useful life of the MCH gear motor.

Chapter 3
Preventive Maintenance Programs

What Is in This Chapter?

This chapter contains the following topics:

General Safety Instructions

General Safety Instructions

Read the following instructions carefully and make sure to follow them while performing a maintenance program.

⚠ ⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E or CSA Z462 or local equivalent.
- This equipment must be installed and serviced by qualified electrical personnel.
- Disconnect all power sources before performing maintenance inspections.
  Assume that all circuits are live until they are de-energized, tested, grounded, and tagged. Consider all sources of power, including the possibility of backfeeding and control power.
- Always use a properly rated voltage sensing device to confirm that power is off.
- Replace all devices, doors, and covers before turning on power to this equipment.

Failure to follow these instructions will result in death or serious injury.

Basic Level Preventive Maintenance Program to Be Performed Every Year

Basic Level Preventive Maintenance Tasks

Basic preventive maintenance tasks such as operational checks, as well as repairs by standard exchange of certain assemblies can be carried out by qualified customer personnel with basic training.

Part	Check	Year 1	Year 2	Year 3	Year 4	Year 5(1)	Procedure name(2)
Device	Check the general condition of the device	♦	♦	♦	♦	♦	Device NII_Z_1
Mechanism	Operate the device manually and electrically	♦	♦	♦	♦	♦	Mechanism NII_Z_1
	Charge the device electrically	♦	♦	♦	♦	♦	Mechanism NII_Z_2
	Check the complete closing of device poles	♦	♦	♦	♦	♦	Mechanism NII_Z_3
	Check the number of device operating cycles	♦	♦	♦	♦	♦	Mechanism NII_Z_4
Breaking unit (arc chutes + contacts)	Check mounting of arc chutes and filter cleanliness	♦	♦	♦	♦	♦	Breaking Unit NII_Z_1
Auxiliaries	Check auxiliary wiring and insulation	♦	♦	♦	♦	♦	Auxiliaries NII_Z_1
Control unit	Check device tripping and operation of SDE fault-trip indication contacts	♦	♦	♦	♦	♦	Control Unit NII_Z_1
	Check ground-fault (Micrologic 6.0 X) or earth-leakage (Micrologic 7.0 X) protection function	♦	♦	♦	♦	♦	Control Unit NII_Z_2
Device locking	Operate device keylocks	♦	♦	♦	♦	♦	Device Locking NII_Z_1
	Operate device padlocks	♦	♦	♦	♦	♦	Device Locking NII_Z_2
Chassis	Check device racking operation	♦	♦	♦	♦	♦	Chassis NII_Z_1
	Check operation of CD, CT, CE position contacts and EF auxiliary contacts	♦	♦	♦	♦	♦	Chassis NII_Z_2
	Check operation of safety shutters	♦	♦	♦	♦	♦	Chassis NII_Z_3
	Check IBPO racking interlock between racking handle and opening pushbutton (Masterpact MTZ2/MTZ3)	♦	♦	♦	♦	♦	Chassis NII_Z_4
Chassis locking	Operate chassis keylocking system	♦	♦	♦	♦	♦	Chassis Locking NII_Z_1
	Operate chassis padlocking system	♦	♦	♦	♦	♦	Chassis Locking NII_Z_2

(1) Fifth year diagnostic checks are carried out by Schneider Electric Services.
(2) Refer to *Masterpact MTZ Maintenance Procedures - Basic and Advanced Levels*.

Tools

Performing the procedures of the maintenance program requires the following:

- A standard toolbox with electrical tools and equipment for an electrician
- Specific tools, detailed in the maintenance procedures. Refer to *Masterpact MTZ Maintenance Procedures - Basic and Advanced Levels*.

Time Required

The global time required to perform this maintenance program is as follows:

- 15 minutes typically for a fixed device with all accessories installed
- 20 minutes typically for a drawout device with all accessories installed

Advanced Level Preventive Maintenance Program to Be Performed Every Two Years

Advanced Level Preventive Maintenance Tasks

General preventive maintenance tasks such as troubleshooting, repairs by replacement of components or functional parts, and minor mechanical repairs can be carried out by qualified customer personnel with advanced training using the tools and measurement/setting devices specified in the Schneider Electric maintenance procedures.

Part	Check	Year 1	Year 2	Year 3	Year 4	Year 5(1)	Procedure name(2)
Mechanism	Check the MCH gear motor charging time at 0.85 Un		♦		♦	♦	Mechanism NIII_Z_1
	Check the general condition of the mechanism		♦		♦	♦	Mechanism NIII_Z_2
Breaking unit (arc chutes + contacts)	Check the condition of the breaking unit		♦		♦	♦	Breaking Unit NIII_Z_1
Auxiliaries	Check operation of indication contacts (OF, PF)		♦		♦	♦	Auxiliaries NIII_Z_1
	Check closing operation with XF closing voltage release at 0.85 Un		♦		♦	♦	Auxiliaries NIII_Z_2
	Check opening operation with MX opening voltage release at 0.70 Un		♦		♦	♦	Auxiliaries NIII_Z_3
	Check closing and opening operations with MN undervoltage release		♦		♦	♦	Auxiliaries NIII_Z_4
	Check time delay of MNR delayed undervoltage release		♦		♦	♦	Auxiliaries NIII_Z_5
Control unit	Check overcurrent protection		♦		♦	♦	Control Unit NIII_Z_1
Chassis	Clean chassis and check presence of grease on chassis		♦		♦	♦	Chassis NIII_Z_1
	Check disconnecting contact clusters		♦		♦	♦	Chassis NIII_Z_2
Power connections	Check connection system		♦		♦	♦	Power Connections NIII_Z_1

(1) Fifth year diagnostic checks are carried out by Schneider Electric Services.
(2) Refer to *Masterpact MTZ Maintenance Procedures - Basic and Advanced Levels*.

Tools

Performing the procedures of the maintenance program requires the following:

- A standard toolbox with electrical tools and equipment for an electrician
- Specific tools, detailed in the maintenance procedures. Refer to *Masterpact MTZ Maintenance Procedures - Basic and Advanced Levels*.

Time Required

The additional time required to perform this maintenance program after the Basic level program is as follows:

- 45 minutes typically for a fixed device with all accessories installed
- 1 hour typically for a drawout device with all accessories installed

Schneider Electric Expert Diagnostics Tools Used by Field Service Representatives

Performing Diagnosis on Your Masterpact with Schneider Electric

Schneider Electric offers a large portfolio of proprietary diagnostic services for electrical distribution (ED) equipment.

These services are based on long-term experience, using manufacturing data gathered over many years and analytics supported by expert diagnostic tools: **ProDiag Trip Unit** and **ProDiag Breaker** for low and medium voltage (LV/MV) circuit breakers and switch-disconnectors.

The ProDiag Trip Unit and ProDiag Breaker diagnostic tools deliver a formal report with technical results, clear analyses, and expert recommendations, giving you the ability to anticipate any downtime and improve availability of your installation.

ProDiag Trip Unit Diagnostic Tool

ProDiag Trip Unit monitors circuit breaker control unit tripping performance.

- **Customer needs**
  Accurate tripping time operation in accordance with control unit settings defined for an electrical installation is now a strategic function for evaluating protection performance. Fault detection and tripping speed reaction stops short circuits from developing.
  Regular diagnosis of LV circuit breaker control unit tripping performance according to manufacturer recommendations is required to secure LV ED equipment protection and service continuity, which are important for customers.The ProDiag Trip Unit service solution can be used on LV circuit breaker control units that have not received any maintenance intervention in the last four years (under normal operating conditions, and less if operating in severe environments or depending on their criticality in the installation).
  Designed by Schneider Electric, the purpose of ProDiag Trip Unit (a hardware-software proprietary solution) is notably to mitigate the risks of potential failure of LV circuit breaker control unit performance on tripping time drifts, causing unwanted effects. Such problems can lead to unexpected power failures, downstream industrial equipment inefficiencies, potential breakdowns. They can also lead to longer short-circuits with resulting internal fires, circuit breaker and switchgear destruction, or even complete destruction of the electrical room.
- **Customer benefits**
  The ProDiag Trip Unit helps customer visualize, discover, and understand LV circuit breaker control unit performance and criticality. Tripping times are highlighted on the original equipment tripping curve and give a clear indication in a customer report of whether they fall within the specified parameters.Thanks to the ProDiag Trip Unit, customers can implement, manage, and enrich their maintenance plans.
  Schneider Electric field service representatives conclude their on-site intervention with an exhaustive report about ED equipment conformity. If ED equipment is declared nonconforming, Schneider Electric field service representatives suggest the corrective actions (including spare parts to be replaced) required to get correct operation of circuit breaker and service continuity.Customer can augment their preventive maintenance plans with a corrective interventions plan during the most convenient time for each ED device. ProDiag Trip Unit helps customers implement, manage, plan, and smooth annual maintenance budgets and minimize total cost of ownership.

ProDiag Breaker Diagnostic Tool

ProDiag Breaker monitors opening, closing, and spring-loading operations drifts.

- **Customer needs**
  A quick and reliably opening LV/MV circuit breaker is now a strategic function for evaluating the full operating chain.
  Its fault detection rate and reaction speed stops short circuits from developing. Regular diagnosis of the complete operating chain performance in accordance with the manufacturer recommendations is necessary to secure ED equipment protection and service continuity.
  LV/MV ED equipment used to run the ProDiag Breaker diagnostic service are LV and MV circuit breakers that have not received any maintenance intervention in the last four years (under normal operating conditions, and less if operating in severe environments).
  The aim of ProDiag Breaker (hardware-software proprietary solution) is to mitigate the risks of circuit breaker full operating chain kinematic drifts and contacts simultaneity causing of unwanted effects.
  The result of extra low/high speed opening/closing/spring-loading of operating mechanisms can create stress on internal moving parts with consequent accelerated wear and tear, overheating and/or resulting internal fi res, total destruction of the circuit breaker and switchgear, even the complete destruction of the electrical room.
- **Customer benefits**
  ProDiag Breaker helps customers visualize, discover, and understand circuit breaker performance and equipment wear and tear as compared to original performance.
  This solution monitors the opening, closing, spring-loading operations, and deviations (de-energized circuit breakers) in order to anticipate potential failures.
  Thanks to ProDiag Breaker, customer can implement, manage, and enrich their maintenance plans.
  Schneider Electric field service representatives conclude their on-site intervention with an exhaustive report on ED equipment conformity. If ED equipment is non-conforming, the Schneider Electric field service representatives suggest the corrective action (including spare parts to be replaced) required to get correct operation of circuit breaker and service continuity.
  Customer should enrich their preventive maintenance plans with this corrective action for the most convenient time for each ED device.
  Preventive maintenance, including regular diagnostics, is what is called On-site condition maintenance. It helps customers implement, manage, plan, and smooth annual maintenance budgets, and minimize the total cost of ownership.

Chapter 4
Device Aging

What Is in This Chapter?

This chapter contains the following topics:

Causes of Aging

Introduction

Switchboards and switchgear age whether they are in operation or not. Aging is due primarily to the influence of the environment and the operating conditions.

Influence of the Environment

A device placed in a given environment is subjected to its effects. The main environmental factors that accelerate device aging are:

- Temperature
- Percent load
- Relative humidity
- Salt environment
- Current harmonics
- Dust
- Corrosive atmosphere
- Vibration
- Operating cycles
- Current interruptions

The tables in this chapter summarize for each factor:

- Why it is harmful: influence
- How to identify it: appearance
- Impact on operation: consequences

Influence of Temperature on Aging

Ambient Temperature Outside the Switchboard

The ambient temperature affects the device temperature, which is itself affected by the percent load.

Major variations in temperature (greater than 30 °C (86 °F)) cause both mechanical stresses (thermal expansion) and condensation, both of which can accelerate aging.

Influence	Appearance	Consequences
The mechanical characteristics of plastic parts (insulation, case) are increasingly deteriorated by temperature the higher it rises.	Change in color	Breaking of parts leading to potential failure of functions
• Hardening of grease. • Elimination of grease on disconnecting contact clusters.	• Change in color and viscosity • Caramel color of clusters	• Device cannot be operated • Increase of racking forces exerted on clusters
Deterioration of insulating varnishes on coils.	Burning smell	Potential failure of coils (current transformers, MN, MX, or XF voltage releases, MCH gear motor, RES electrical remote reset)
Hardening of glues.	Visual	Loss of labels
Deterioration of electronic components.	Modified display of LCDs	• Interruption of display • Nuisance tripping or no tripping
Deterioration of opto-electronic devices and SCRs.	Not identifiable	Possible transmission of erroneous orders
Interruption of battery backup power.	Not identifiable	Trip-cause indication not displayed

Recommendations

The maintenance and installation recommendations according to the ambient temperature are defined in the following table:

Ambient temperature	Description	Maintenance recommendations	Installation recommendations
25 °C (77 °F)	Optimum operating conditions	Implement the standard program.	No particular recommendation
25 to 35 °C (77 to 95 °F)	A 10 °C (50 °F) increase in the ambient temperature is equivalent to a 5 % increase in the percent load.	Carry out more frequent periodic checks *(see page 10)*.	No particular recommendation
35 to 45 °C (95 to 113 °F)	A 20 °C (68 °F) increase in the ambient temperature is equivalent to a 10 % increase in the percent load.	Carry out more frequent periodic checks *(see page 10)*.	Install forced-air ventilation in the switchboard, or air conditioning for the electrical room.

Example: Influence of the ambient temperature on the service life for a 1,000 A device, with an 80 % load.

Annual average ambient temperature	Typical service life
25 °C (77 °F)	30 years
35 °C (95 °F)	27 years
45 °C (113 °F)	25 years

Influence of Load on Aging

Percent Load (I/In)

The percent load affects the device temperature, which is itself affected by the ambient temperature.

Influence	Appearance	Consequences
Aging of plastic insulation	Change in color of insulation	Breaking of parts leading to potential failure of functions.
Aging of grease	Change in color and viscosity	Increase in mechanical friction.
Aging of electronic components	Modified display of LCDs	A 10 °C (50 °F) increase (that is, an 85 % load) reduces the service life of components by approximately half.
Deterioration of characteristics: ● Steel springs (above 100 °C (212 °F)) ● Stainless steel springs (above 200 °C (392 °F))	Rupture	Non-operation of mechanisms.

Recommendations

The maintenance and installation recommendations according to the value of percent load (I/In) are defined in the following table:

Percent load	Description	Maintenance recommendations	Installation recommendations
I/In ≤ 80 %, 24/24 h	Maximum percent load taken into account in sizing the installation. At this percent load, temperature rise is reduced approximately 40 % with respect to a 100 % load.	Implement the standard program.	Normal conditions
I/In ≤ 90 %, 8/24 h	At this percent load, temperature rise is reduced only 20 %. Heating and cooling cycles impact on the mechanical junctions of the power circuit.	Carry out more frequent periodic checks *(see page 10)*.	Normal conditions
I/In ≤90 %, 24/24 h	The thermal stress for continuous operation is three times higher than in the previous case, but the absence of thermal cycles slows aging of the electromechanical components.	Preventive maintenance is difficult due to the continuous process	Normal conditions
I/In = 100 %, 8/24 h	Between 90 % and 100 %, temperature rise is close to its maximum value. Heating and cooling cycles impact on the mechanical junctions of the power circuit, with major impact on aging	● Carry out more frequent periodic checks *(see page 10)*. ● Inspect for condensation.	Provide ventilation for the switchboard.
I/In = 100 %, 24/24 h	Between 90 % and 100 %, temperature rise is close to its maximum value. This situation has a major impact on aging. It is not recommended.	● Preventive maintenance is difficult due to the continuous process. ● Plan more frequent periodic checks.	● Spread the load over other outgoers. ● Install a device with a higher rating.

Influence of Relative Humidity on Aging

Relative Humidity

Influence	Appearance	Consequences
Corrosion of metal surfaces that is accelerated when a pollutant is present (for example, corrosive gas, salt, chlorine).	Appearance of: ● Red rust on iron ● White rust on zinc ● Blue deposit on copper ● Black deposit on silver	● Increase in friction ● Potential risk of mechanical rupture resulting in non-operation of mechanisms ● Increase in contact resistance (clusters and main contacts)
Deterioration of dielectric qualities of plastics.	White traces on case	Potential risk of a reduction in insulation
Deterioration of electronic components, in particular SMCs and silver-coated components. This phenomenon is worsened by the presence of H_2S corrosive gas (hydrogen sulphide).	● Not visible ● Appearance of dendrites on electronic boards	Short-circuiting of circuits resulting in non-operation of control unit protection, measurement, indication and communication functions
Deterioration of electronic components, in particular non-varnished copper circuits.	● Not visible ● Erosion of copper tracks ● Oxidation of metal connectors of components and metal cases ● Oxidation of connectors of integrated-circuits mounted on supports	● Potential failure due to short-circuit or open circuit on electronic components ● Rupture of component connectors along case ● Poor contact with integrated-circuit supports
Degradation of opto-electronic components.	–	Potential failure of data transmission

Recommendations

The maintenance and installation recommendations according to the relative humidity are defined in the following table:

Relative humidity	Description	Maintenance recommendations	Installation recommendations
≤ 70 %	Level of relative humidity generally found in continental and temperate zones. The level is generally lower in switchboards due to the internal temperature rise. No significant deterioration is noted at this level.	Preventive maintenance	No particular recommendation
70 % to 85 %	Level of relative humidity generally found in zones close to water. Possible appearance of condensation on cold parts and accelerated rusting.	● Carry out more frequent periodic checks *(see page 10)*. ● Measurement of insulation is advised every five years.	No particular recommendation
> 85 %	● Level of relative humidity generally found in tropical zones and certain factories (for example, paper mills). ● Increased possibility of condensation and rust resulting in difficulties to disconnect devices, possibility of non-opening or non-closing.	● Carry out more frequent periodic checks *(see page 10)*. ● Inspect for rust on metal parts. ● Measurement of insulation is imperative every two years.	Install heating resistors in the switchboard.

Influence of Salt Environment on Aging

Salt Environment

Influence	Appearance	Consequences
Corrosion of metal parts	Appearance of: ● White rust on zinc coatings ● Red rust on steel	● Increase in friction ● Freezing of mechanism ● Broken springs ● Blocking of cores of MX/XF/MN voltage releases
Possibility of salt deposits on electronic circuits when thick salt mists occur.	Appearance of salt bridges on electronic boards	Potential failure of electronic systems due to short-circuiting of circuits, particularly non-varnished circuits.
Possibility of conducting salt deposits on the device when thick salt mists occur.	White deposit	Deterioration of device dielectric withstand resulting in possibility of phase-to-frame short-circuit and a phase-to-phase short-circuit if an overload occurs.

Recommendations

The maintenance and installation recommendations according to the salt environment are defined in the following table:

Thresholds	Description	Maintenance recommendations	Installation recommendations
No salt mist	No influence	Implement the standard program.	No particular recommendation
Moderate salt mist < 10 km (6.21 miles) from coast	Moderate aging of switchgear	Carry out more frequent periodic checks *(see page 10)*.	No particular recommendation
Significant salt mist < 1 km (0.621 miles) from coast	● Rapid aging of exposed switchgear. ● On average, service life is divided by a factor of three for devices not installed in a switchboard.	● Carry out more frequent periodic checks *(see page 10)*. ● Test the dielectric withstand every two years.	● Install the switchgear in a switchboard or a room offering protection from the salt mist. ● Increase the switchboard IP value (IP54 is advised).

Influence of Harmonics on Aging

Harmonics

Influence	Appearance	Consequences
Increase in skin effect, proximity effect, iron loss, Foucault currents	• Change in color of terminals, insulators, and grease • Modified display of LCDs	Harmonics cause temperature rise greater than that of the fundamental current
Possible overload of neutral if third-order harmonics and their multiples are present	Distorted waveform.	• Erroneous current value • Nuisance tripping if non-rms control units

Recommendations

The maintenance and installation recommendations according to the harmonics are defined in the following table:

THDi in % of In	Description	Maintenance recommendations	Installation recommendations
≤ 30 %	No notable influence on aging.	Implement the standard program.	No particular recommendation
30 % to 50 %	At 40 % THDI, heat loss is approximately 10 % higher, corresponding to 5 % more current.	Carry out more frequent periodic checks *(see page 10)*.	Standard filtering with an inductor to reduce harmonics
> 50 %	–	Carry out more frequent periodic checks *(see page 10)*.	If necessary: • Oversize the neutral • Oversize switchgear • Filtering is mandatory

Influence of Dust on Aging

Dust

Influence	Appearance	Consequences
Deposit on grease of mechanisms (device and chassis)	Change in color and texture of greases	• Premature wear of mechanisms because dust mixed with grease can be abrasive. • Increase in mechanical friction and freezing of moving parts • Possibility of device not moving on chassis • Possibility of device non-opening or non-closing
Deposit on grease of clusters	Change in color and texture of greases	• Increase in racking forces exerted. • Increased contact resistance and temperature rise
Deposit on displays	–	Screen data not legible
Deposit on insulation	–	• Reduced insulation resistance (depends on type of dust) • This phenomenon is worsened by the presence of humidity.
Deposit on device contacts	–	Increased contact resistance and temperature rise
Deposit on opto-electronic communication system between devices	–	Potential failure of communication data transmission

Recommendations

The maintenance and installation recommendations according to the dust levels are defined in the following table:

Dust deposit	Description	Maintenance recommendations	Installation recommendations
Low level	Quantity of dust generally deposited on and around devices in commercial buildings and on standard industrial premises	• Implement the standard program. • Use a vacuum cleaner to remove dust deposits.	Switchboard with standard IP
Moderate	Quantity of dust deposited on and around devices inside switchboards equipped with filters or a ventilated IP54 enclosure, and installed in dusty environments (for example, cement works, grain mills, incineration installations, plastic and steel mills, and mines)	Carry out more frequent periodic cleaning *(see page 19)*.	Make sure that the switchboard remains closed.
High	Quantity of dust deposited on and around devices inside switchboards without filters or without ventilated IP54 enclosure, and installed in dusty environments (for example, cement works, grain mills, incineration installations, plastic and steel mills, and mines)	Carry out more frequent periodic cleaning *(see page 19)*.	It is mandatory to install the switchgear in special equipment offering protection against dust.

Influence of Corrosive Atmosphere on Aging

Corrosive Atmosphere

Corrosive atmosphere	Influence	Appearance	Consequences	Thresholds per class in ppm (1)
SO_2 Sulphur dioxide	Corrosion of silver, aluminum, and bare copper Phenomenon accelerated by high temperature and relative humidity.	• Blackening of exposed silver surfaces • Appearance of dendrites on electronic and power circuits	• Increased resistance of disconnecting contacts exposed to air • Excessive device temperature rise • Short-circuiting of circuits resulting in non-operation of the control unit	• 3C1: 0.037 • 3C2: 0.11 • 3C3: 1.85 • 3C4: 4.8
H_2S Hydrogen sulphide	Sulphurization of silver. Phenomenon accelerated by high temperatures.	• Major blackening of exposed silver surfaces • Appearance of dendrites on electronic and power circuits	• Increased resistance of disconnecting contacts exposed to air • Excessive device temperature rise • Short-circuiting of circuits resulting in non-operation of the control unit	• 3C1: 0.0071 • 3C2: 0.071 • 3C3: 2.1 • 3C4: 9.9
Cl_2 Chlorine	Corrosion of metal parts	• Oxidation • Inter-granular corrosion of stainless steel	• Increase in friction • Possibility of mechanical rupture • Breaking of stainless-steel springs	• 3C1: 0.034 • 3C2: 0.034 • 3C3: 0.1 • 3C4: 0.2
NH_3 Ammoniac	• Attacks polycarbonates • Corrodes copper	• Cracking of polycarbonates • Blackening of copper	• Possibility of rupture • Increased temperature rise	• 3C1: 0.42 • 3C2: 1.4 • 3C3: 14 • 3C4: 49
NO_2 Nitrogen oxide	Corrosion of metal parts	Oxidation	Increased temperature rise	• 3C1: 0.052 • 3C2: 0.26 • 3C3: 1.56 • 3C4: 5.2
Oily atmospheres	Attacks polycarbonates	Cracking of polycarbonates	• Possibility of rupture • Increased temperature rise	–
(1) ppm = parts per million in volume				

Recommendations

The maintenance and installation recommendations according to the environment categories as per IEC 60721-3 standard are defined in the following table:

Class	Zone	Presence of corrosive gases	Impact on device	Maintenance recommendations	Installation recommendations
3C1	Rural zones or urban zones with low industrial activity	Negligible	No impact on service life because concentrations are very low	Implement the standard program.	No particular recommendation
3C2	Urban zones with scattered industrial activity and heavy traffic	Low level	Moderate impact on service life	• Implement the standard program. • PYRATEX grease can be used for the disconnecting contacts, but must be changed annually (see the manufacturer procedure).	No particular recommendation
3C3	Immediate vicinity of industrial pollution Example: paper mills, water treatment, chemicals, synthetic fibers, smelting plants	Significant level	• Major impact, particularly concerning temperature rise • For electronic systems, no impact on varnished boards and gold-plated contacts	• Carry out more frequent periodic checks *(see page 10)*. • Change the grease on the disconnecting contacts.	Use fixed rather than drawout devices
3C4	Inside polluting industrial premises **Example:** paper mills, water treatment, chemicals, synthetic fibers, smelting plants	High level	• Significantly reduced service life if no particular precautions are taken • For electronic systems, no impact on varnished boards and gold-plated contacts	• Carry out more frequent periodic checks *(see page 10)*. • Change the grease on the disconnecting contacts.	• Install the switchgear in a room offering protection from the pollution • Use fixed rather than drawout devices, or implement special solutions (gold-plated disconnecting contacts)

Influence of Vibration on Aging

Vibration

Influence	Appearance	Consequences
Premature deterioration of contact surfaces (clusters and main contacts)	Not identifiable	Increased device temperature rise
Untightening of bolted assemblies	Not identifiable	Increase in mechanical play
Wear of mechanical parts	Not identifiable	Broken springs. Increase in mechanical play between parts
Appearance of fretting corrosion on auxiliary connections	Not identifiable	Erroneous information or interruption of continuity in data or supply, excessive temperature rise
Breaking of connectors on large electronic components (for example, large capacitors)	Not identifiable	Potential failure of protection function
Wear of thumbwheel contacts on the control unit	Not identifiable	Nuisance tripping or no tripping

Recommendations

The maintenance and installation recommendations according to the vibrations are defined in the following table:

Thresholds (g)	Description	Maintenance recommendations	Installation recommendations
≤ 0.2 g	Normal condition, no impact on service life	Implement the standard program.	No particular recommendation
0.2 g to 0.5 g	Reduced service life	Carry out more frequent periodic checks *(see page 10)*.	No particular recommendation
0.5 g to 0.7 g	Significant increase in incidents	• Carry out more frequent periodic checks *(see page 10)*. • Check in particular the tightness of connections.	Install switchgear on a rubber mounting bush
≥ 0.7 g	Forbidden for standard devices	–	Use special devices

Influence of Operating Cycles on Aging

Number of Operating Cycles

Influence	Consequences
The number of operating cycles depends directly on the electrical and mechanical endurance of the device.	Device service life depends on the daily number of operating cycles.

The device service life depends on the daily number of operating cycles.

Number of cycles	Service life (1)
≤ 30 cycles per month, or one cycle per day	27 years
≤ 60 cycles per month, or two cycles per day	13 years
≤ 120 cycles per month, or 4 cycles per day	7 years
(1) Service life is defined for endurance of 10,000 cycles and an interrupted current of less than 0.4 In.	

Influence of Current Interruptions on Aging

Current Interruptions

Influence	Appearance	Consequences
Wear of fixed and moving contacts	Deterioration of contacts	Beyond the electrical-endurance limit, device temperature rise increases due to the greater contact resistance and a reduction in the pressure of contacts.
Wear of the arc chutes (insulating materials, separators)	Deterioration of insulation	Beyond the electrical-endurance limit, the insulation (input/output and between phases) is reduced, which results in a reduction of device suitability for isolation. In this case, the safety of persons is not guaranteed.

Recommendations

The maintenance and installation recommendations according to the interrupted clients are defined in the following table:

Thresholds	Description
I/In ≤ 0.4	This level of interrupted current corresponds to the mechanical durability (see Mechanical endurance).
I/In ≤ 0.8	This level of interrupted current corresponds to approximately 125 % of the electrical durability.
I/In	This level of interrupted current corresponds to the electrical durability at the specified voltage (see Electrical endurance).

Appendices

Appendix A
Appendices

What Is in This Chapter?

This chapter contains the following topics:

Operating Limits for Masterpact MTZ Devices

Operating Limits of Masterpact MTZ1 Devices

The maximum number of opening/closing cycles with no load depends on the rating and performance levels of the Masterpact MTZ1 devices.

Type of Masterpact MTZ1	Maximum number of cycles with periodic preventive maintenance
MTZ1 H1, H2, L1	12,500
MTZ1 H3	10,000

Operating Limits of Masterpact MTZ1 Parts

This table shows the maximum possible number of operating cycles before the parts below must be replaced during the device service life.

Type of Masterpact MTZ1	Maximum number of cycles before replacement of the part			
	Arc chute (at In)	Main contacts (at In) (1)	Connecting-rod springs, gear motor, interlocking mechanisms	MX/XF/MN voltage releases
MTZ1 06–16 440 V H1, H2, H3	6,000	6,000	12,500	12,500
MTZ1 06–16 690 V H1, H2	3,000	3,000		
MTZ1 06–10 440 V L1	3,000	3,000		
MTZ1 06–10 690 V L1	2,000	2,000		
(1) If any contacts are worn, all contacts must be changed. It means that the complete breaking block is replaced.				

Operating Limits of Masterpact MTZ2/MTZ3 Devices

The maximum number of opening/closing cycles with no load depends on the rating and performance levels of the Masterpact MTZ2/MTZ3 devices.

Type of Masterpact MTZ2/MTZ3	Maximum number of cycles with periodic preventive maintenance
MTZ2 08–16 N1, H1, H2, H10, L1	25,000
MTZ2 20 N1, H1, H2, H3, H10, L1	20,000
MTZ2 25–40 H1, H2, H3, H10	20,000
MTZ3 40–63 H1, H2	10,000

Operating Limits of Masterpact MTZ2/MTZ3 Parts

In order to reach the maximum possible number of operating cycles, the parts below must be replaced during the device service life.

Type of Masterpact MTZ2/MTZ3	Maximum number of cycles before replacement of the part			
	Arc chute (at In)	Main contacts (at In) (1)	Connecting-rod springs, gear motor, interlocking mechanisms	MX/XF/MN voltage releases
MTZ2 08–16 N1, H1, H2	10,000	10,000	12,500	12,500
MTZ2 08–16 16 L1	3,000			
MTZ2 20 440 V N1, H1, H2	8,000	8,000	10,000	
MTZ2 20 690 V N1, H1, H2	6,000	6,000		
MTZ2 20 440 V H3	2,000	8,000		
MTZ2 20 690 V H3		6,000		
MTZ2 20 L1	3,000	10,000		
MTZ2 25–40 440 V H1, H2	5,000	5,000		
MTZ2 25–40 690 V H1, H2	2,500	2500		
MTZ2 25–40 440 V H3	1,250	5,000		
MTZ2 25–40 690 V H3		2,500		
MTZ3 40–63 H1, H2	1,500	3,000	5,000	

(1) If any contacts are worn, all contacts must be changed. It means that the complete breaking block is replaced.

Related Documents for Masterpact MTZ Devices

Related Documents for Masterpact MTZ1 Devices

Document title	Part number
Masterpact MTZ Catalogue	LVPED216026EN LVPED216026FR
Masterpact MTZ Maintenance Procedures - Basic and Advanced Levels	DOCA0103EN DOCA0103ES DOCA0103FR
Masterpact MTZ1 Circuit Breakers and Switch-Disconnectors - User Guide	DOCA0100EN DOCA0100ES DOCA0100FR
Masterpact MTZ1/MTZ2/MTZ3 Position Contacts (Connected / Disconnected / Test) - Instruction Sheet	NVE16135
Masterpact MTZ1/MTZ2/MTZ3 - Micrologic Transparent Cover - Instruction Sheet	NVE16151
Masterpact MTZ1/MTZ2/MTZ3 EIFE Embedded Ethernet Interface for one Masterpact MTZ Drawout Circuit Breaker - Kits and Spare Parts - Instruction Sheet	NVE23550
Masterpact MTZ1/MTZ2/MTZ3 Auxiliary Terminals - Instruction Sheet	NVE35463
Masterpact MTZ1/MTZ2/MTZ3 VDC Mismatch Protection - Instruction Sheet	NVE35465
Masterpact MTZ1/MTZ2/MTZ3 PF Ready-To-Close Contact - Instruction Sheet	NVE35466
Masterpact MTZ1/MTZ2/MTZ3 Clusters - Instruction Sheet	NVE35467
Masterpact MTZ1 Fixed Circuit Breaker or Switch-Disconnector - Instruction Sheet	NVE35505
Masterpact MTZ1 Drawout Circuit Breaker or Switch-Disconnector - Instruction Sheet	NVE35506
Masterpact MTZ1 Connectors - Instruction Sheet	NVE35507
Masterpact MTZ1 Interphase Barriers - Instruction Sheet	NVE35508
Masterpact MTZ1 Safety Shutters - Instruction Sheet	NVE35509
Masterpact MTZ1 Arc Chute - Instruction Sheet	NVE35511
Masterpact MTZ1 Arc Chute Cover - Instruction Sheet	NVE35512
Masterpact MTZ1 OF ON/OFF Indication Contacts - Instruction Sheet	NVE35513
Masterpact MTZ1 MCH Gear Motor - Instruction Sheet	NVE35514
Masterpact MTZ1 Auxiliary Terminal Shield for Drawout Masterpact - Instruction Sheet	NVE35515
Masterpact MTZ1 CDM Operation Counter - Instruction Sheet	NVE35516
Masterpact MTZ1 Door Escutcheon - Instruction Sheet	NVE35517
Masterpact MTZ1 Transparent Cover for Drawout Masterpact Door Escutcheon - Instruction Sheet	NVE35518
Masterpact MTZ1 Door Interlock - Instruction Sheet	NVE35519
Masterpact MTZ1 Racking Interlock - Instruction Sheet	NVE35520
Masterpact MTZ1 IPA Cable-Type Door Interlock - Instruction Sheet	NVE35521
Masterpact MTZ1 Mechanical Interlocking for Source Changeover (2 Sources / Cable) - Instruction Sheet	NVE35522
Masterpact MTZ1 Mechanical Interlocking for Source Changeover (2 Sources / Rods) - Instruction Sheet	NVE35523
Masterpact MTZ1 SDE2 Fault-Trip Indication Contact / RES Remote Reset - Instruction Sheet	NVE35524
Masterpact MTZ1/MTZ2/MTZ3 M2C Programmable Contacts - Instruction Sheet	NVE40745
Masterpact MTZ1/MTZ2/MTZ3 Isolation Module - Instruction Sheet	NVE40748
Masterpact MTZ1/MTZ2/MTZ3 MN-MX-XF Voltage Releases - Instruction Sheet	NVE40749
Masterpact MTZ1/MTZ2/MTZ3 MN-MX-XF Communicating Voltage Releases with Diagnostic Function - Instruction Sheet	NVE40766
Masterpact MTZ1 BPFE/BPFET Electrical Closing Pushbutton - Instruction Sheet	NVE40771
ULP Port Module for Fixed Masterpact MTZ1/MTZ2/MTZ3 - Instruction Sheet	NVE40791
ULP Port Module for Drawout Masterpact MTZ1 - Instruction Sheet	NVE40796
Masterpact MTZ1 Microswitches OF/SDE/PF/CH - Instruction Sheet	NVE56767
Masterpact MTZ1 VSPD Disconnected Position Locking - Instruction Sheet	NVE56768
Masterpact MTZ1 VBP Lockable Pushbutton Cover - Instruction Sheet	NVE56769

Document title	Part number
Masterpact MTZ1 VCPO OFF-Position Locking and BPFE Support - Instruction Sheet	NVE56770
Masterpact MTZ1 3P/4P Front Cover - Instruction Sheet	NVE56771
Masterpact MTZ1 Spring Charging Handle - Instruction Sheet	NVE56772

Related Documents for Masterpact MTZ2/MTZ3 Devices

Document title	Part number
Masterpact MTZ Catalogue	LVPED216026EN LVPED216026FR
Masterpact MTZ Maintenance Procedures - Basic and Advanced Levels	DOCA0103EN DOCA0103ES DOCA0103FR
Masterpact MTZ2/MTZ3 Circuit Breakers and Switch-Disconnectors - User Guide	DOCA0101EN DOCA0101ES DOCA0101FR
Masterpact MTZ2 3P/4P Front Cover - Instruction Sheet	NVE16117
Masterpact MTZ1/MTZ2/MTZ3 Position Contacts (Connected / Disconnected / Test) - Instruction Sheet	NVE16135
Masterpact MTZ2/MTZ3 VSPD Disconnected Position Locking - Instruction Sheet	NVE16142
Masterpact MTZ2/MTZ3 VCPO OFF-Position Locking and BPFE Support - Instruction Sheet	NVE16146
Masterpact MTZ2/MTZ3 VBP Lockable Pushbutton Cover - Instruction Sheet	NVE16147
Masterpact MTZ2/MTZ3 Spring Charging Handle - Instruction Sheet	NVE16150
Masterpact MTZ1/MTZ2/MTZ3 - Micrologic Transparent Cover - Instruction Sheet	NVE16151
Masterpact MTZ1/MTZ2/MTZ3 EIFE Embedded Ethernet Interface for one Masterpact MTZ Drawout Circuit Breaker - Kits and Spare Parts - Instruction Sheet	NVE23550
Masterpact MTZ1/MTZ2/MTZ3 Auxiliary Terminals - Instruction Sheet	NVE35463
Masterpact MTZ1/MTZ2/MTZ3 VDC Mismatch Protection - Instruction Sheet	NVE35465
Masterpact MTZ1/MTZ2/MTZ3 PF Ready-To-Close Contact - Instruction Sheet	NVE35466
Masterpact MTZ1/MTZ2/MTZ3 Clusters - Instruction Sheet	NVE35467
Masterpact MTZ2/MTZ3 Fixed Circuit Breaker or Switch-Disconnector - Instruction Sheet	NVE35469
Masterpact MTZ2/MTZ3 Drawout Circuit Breaker or Switch-Disconnector - Instruction Sheet	NVE35470
Masterpact MTZ2/MTZ3 Connectors - Instruction Sheet	NVE35472
Masterpact MTZ2/MTZ3 Interphase Barriers - Instruction Sheet	NVE35473
Masterpact MTZ2 Disconnectable Front Connections for Fixed Masterpact - Instruction Sheet	NVE35474
Masterpact MTZ2/MTZ3 Safety Shutters - Instruction Sheet	NVE35476
Masterpact MTZ2/MTZ3 VIVC Front Face Shutter Position Indication and Locking - Instruction Sheet	NVE35478
Masterpact MTZ2/MTZ3 Arc Chute - Instruction Sheet	NVE35479
Masterpact MTZ2/MTZ3 KMT Grounding Kit - Instruction Sheet	NVE35480
Masterpact MTZ2/MTZ3 OF ON/OFF Indication Contacts - Instruction Sheet	NVE35481
Masterpact MTZ2/MTZ3 EF Combined Connected/Closed Contact - Instruction Sheet	NVE35482
Masterpact MTZ2/MTZ3 MCH Gear Motor - Instruction Sheet	NVE35483
Masterpact MTZ2/MTZ3 Auxiliary Terminal Shield for Drawout Masterpact - Instruction Sheet	NVE35484
Masterpact MTZ2/MTZ3 CDM Operation Counter - Instruction Sheet	NVE35485
Masterpact MTZ2/MTZ3 Mounting Brackets - Instruction Sheet	NVE35486
Masterpact MTZ2/MTZ3 Door Escutcheon - Instruction Sheet	NVE35491
Masterpact MTZ2/MTZ3 Transparent Cover for Drawout Masterpact Door Escutcheon - Instruction Sheet	NVE35492
Masterpact MTZ2/MTZ3 Door Interlock - Instruction Sheet	NVE35493
Masterpact MTZ2/MTZ3 Racking Interlock - Instruction Sheet	NVE35494
Masterpact MTZ2/MTZ3 IPA Cable-Type Door Interlock - Instruction Sheet	NVE35495
Masterpact MTZ2/MTZ3 Mechanical Interlocking for Source Changeover (2 Sources / Cable) - Instruction Sheet	NVE35496

Document title	Part number
Masterpact MTZ2/MTZ3 Mechanical Interlocking for Source Changeover (2 Sources / Rods) - Instruction Sheet	NVE35497
Masterpact MTZ2/MTZ3 Mechanical Interlocking for 3 Sources - Instruction Sheet	NVE35498
Masterpact MTZ2/MTZ3 Mechanical Interlocking for 2 Sources and 1 Replacement - Instruction Sheet	NVE35499
Masterpact MTZ2/MTZ3 Mechanical Interlocking for 2 Sources and 1 Coupling - Instruction Sheet	NVE35500
Masterpact MTZ2/MTZ3 SDE2 Fault-Trip Indication Contact / RES Remote Reset - Instruction Sheet	NVE35503
Masterpact MTZ1/MTZ2/MTZ3 M2C Programmable Contacts - Instruction Sheet	NVE40745
Masterpact MTZ1/MTZ2/MTZ3 Isolation Module - Instruction Sheet	NVE40748
Masterpact MTZ1/MTZ2/MTZ3 MN-MX-XF Voltage Releases - Instruction Sheet	NVE40749
Masterpact MTZ1/MTZ2/MTZ3 MN-MX-XF Communicating Voltage Releases with Diagnostic Function - Instruction Sheet	NVE40766
Masterpact MTZ2/MTZ3 BPFE/BPFET Electrical Closing Pushbutton - Instruction Sheet	NVE40773
ULP Port Module for Fixed Masterpact MTZ1/MTZ2/MTZ3 - Instruction Sheet	NVE40791
ULP Port Module for Drawout Masterpact MTZ2/MTZ3 - Instruction Sheet	NVE40797
Masterpact MTZ2/MTZ3 Microswitches OF/SDE/PF/CH - Instruction Sheet	NVE56766

Related Documents for Micrologic X Control Units

Document title	Reference number
Masterpact MTZ Catalogue	LVPED216026EN LVPED216026FR
Micrologic X Control Unit - User Guide	DOCA0102EN DOCA0102ES DOCA0102FR
Masterpact MTZ Maintenance Procedures - Basic and Advanced Levels	DOCA0103EN DOCA0103ES DOCA0103FR
Masterpact MTZ - Modbus Communication Guide	DOCA0105EN DOCA0105ES DOCA0105FR
Ecoreach Online Help	DOCA0069EN DOCA0069ES DOCA0069FR
Micrologic X Rectangular Sensor for Earth-Leakage Protection - Instruction Sheet	NVE35468
Micrologic X Mobile Power Pack - Instruction Sheet	NVE40737
Micrologic X VPS Voltage Power Supply Module - Instruction Sheet	NVE40741
Micrologic X Embedded Display - Instruction Sheet	NHA49910
Micrologic X Spare Battery - Instruction Sheet	NHA57283
Micrologic X Sensor Plug - Instruction Sheet	NVE80064

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09/2016