MasterPact™ NT/NW

IEC Circuit Breakers and Switch-Disconnectors

Maintenance Guide

12/2020

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Legal Information

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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

Document Scope

Schneider Electric recommends a preventive maintenance program to ensure that devices retain the operating and technical characteristics specified in the catalogs during their service life. Maintenance must be carried out by trained and qualified personnel, in accordance with instructions specified in this MasterPact™ NT/NW maintenance guide.

This guide contains information on:

- Maintenance frequency depending on the environmental and operating conditions and criticality of the user application.
- Maintenance required after prolonged storage.
- Schneider Electric tools for maintenance assistance.
- The parts of the MasterPact NT/NW devices that must be maintained:
  - Elements of the breaking unit: case, arc chutes, and main contacts
  - Power connections
  - Chassis
  - Charging Mechanism
  - MicroLogic™ control unit
  - Communication system
  - Auxiliary circuits
  - Mechanical interlocking systems
- The risks involved when a part is not fully operational.
- The preventive maintenance program to be carried out, and the competence level required for each program.
- Environmental and operating conditions that cause accelerated aging of a device.
- Limits governing the use of mechanical and electrical accessories and subassemblies.
- Links to device guides and related documents that can help to maintain the MasterPact NT/NW devices in proper operating order.

Audience

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

Validity Note

This guide applies to MasterPact NT/NW IEC circuit breakers and switch-disconnectors.

Online Information

The information contained in this document is likely to be updated at any time. Schneider Electric strongly recommends that you have the most recent and up-to-date version available on www.se.com/docs.

The technical characteristics of the devices described in the present document also appear online. To access the information online, go to the Schneider Electric home page www.se.com/ww/en/download/.

The characteristics that are described in the present document should be the same as those characteristics that appear online. In line with our policy of constant improvement, we may revise content over time to improve clarity and accuracy. If you see a difference between the document and online information, use the online information as your reference.

Convention

In this guide, the term *MasterPact NT/NW device* covers circuit breakers and switch-disconnectors.

Related Documents

Title of Documentation	Reference Number
MasterPact NT - Circuit Breakers and Switch-Disconnectors – User Guide	51201116AA
MasterPact NW - Circuit Breakers and Switch-Disconnectors – User Guide	04443720AA
MasterPact NW – DC Circuit Breakers and Switch-Disconnectors - User Guide	04444163A
MicroLogic Control Units 2.0, 5.0 and 6.0 - User Guide	04443722AA
MicroLogic Control Units 2.0 A, 5.0 A, 6.0 A, 7.0 A 2.0 E, 5.0 E, 6.0 E – User Guide	04443724AA
MicroLogic Control Units 5.0 P, 6.0 P and 7.0 P – User Guide	04443726AA
MicroLogic Control units 5.0 H, 6.0 H and 7.0 H – User Guide	04443728AA

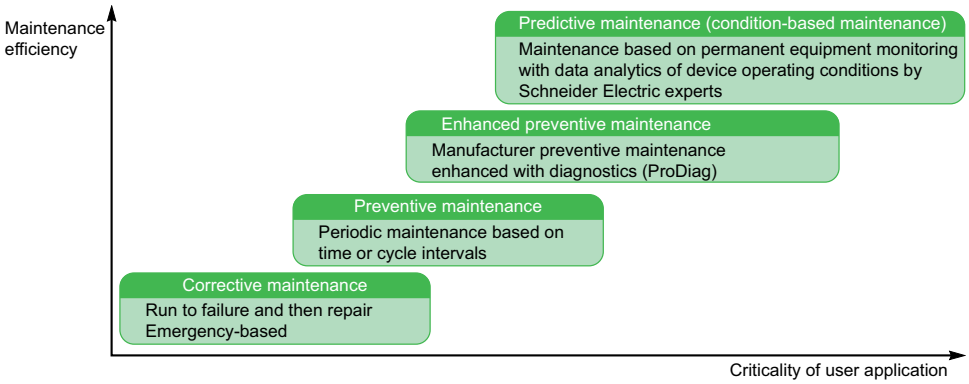
Maintenance Plan

Maintenance Practices

Maintenance Strategy

You can define the optimal maintenance strategy according to criticality of your application by combining four maintenance practices:

- Corrective maintenance
- Preventive maintenance
- Enhanced preventive maintenance
- Predictive maintenance (condition-based maintenance)



Corrective Maintenance

Corrective maintenance:

- Is carried out after fault recognition.
- Is intended to put an item into a state in which it can perform a required function.

Corrective maintenance is recommended only for non-critical applications that have minimal impact in business operations.

Preventive Maintenance

Preventive maintenance:

- Is carried out in either of the following cases:
  - At predetermined frequency in accordance with established time intervals or number of units of use but without previous condition investigation.

    NOTE: The time intervals or number of units of use may be established from knowledge of the failure mechanisms of the item.
  - According to prescribed criteria.
- Is intended to reduce the probability of failure or the degradation of the functioning of an item.

Preventive maintenance is recommended for user applications with low to high criticality.

Preventive maintenance includes three programs:

- Maintenance program that can be performed by the end user:
  - Basic end-user maintenance program
  - Standard end-user maintenance program
- Maintenance program that can be performed by Schneider Electric Services:
  - Manufacturer maintenance program

Each preventive maintenance program is conducted during a scheduled outage as per maintenance frequency or cycles of use in accordance with the recommendations defined in this guide, page 12.

Enhanced Preventive Maintenance

Enhanced preventive maintenance comprises the Manufacturer preventive maintenance program included in the following Schneider Electric offers:

- The Complete Manufacturer Maintenance program is recommended for devices in a user application with moderate criticality. It includes ProDiag Trip Unit diagnostic.
- The Advanced Manufacturer Maintenance program is recommended for devices in a user application with high criticality. It includes the following diagnostics:
  - ProDiag Trip Unit
  - ProDiag Breaker
  - ProDiag Clusters for drawout MasterPact NT/NW devices

Contact your Schneider Electric field service representative for more information.

Predictive Maintenance (Condition-Based Maintenance)

Predictive maintenance is condition-based maintenance carried out following a forecast derived from repeated analysis or known characteristics and evaluation of the significant parameters of the degradation of the item.

A Schneider Electric service bureau assesses data on behalf of the end user to validate and trigger maintenance work orders, and schedule ensuing on-site maintenance.

Contact your Schneider Electric field service representative for more information.

EcoStruxure Facility Expert

EcoStruxure™ Facility Expert optimizes operations and maintenance, helping to ensure business continuity, and provides insights to service providers or facility managers.

EcoStruxure Facility Expert is a real-time collaborative technology available on mobile devices and PCs that enables managers and maintenance personnel to be connected with facilities and equipment. Information exchange between users is simple and fast.

EcoStruxure Facility Expert helps maintenance personnel to diagnose issues remotely and manage maintenance efficiently by:

- Providing relevant information on critical assets.
- Sending immediate state of the equipment and detailed information for diagnostics.

Defining Your Maintenance Plan

Low voltage circuit breakers, for example MasterPact NT/NW circuit breakers, in a power distribution infrastructure play a critical role in helping to protect the equipment and activity against cable overloads, short-circuits, and insulation faults, helping to ensure safety, reliability, security, and sustainability.

If you are a plant manager, maintenance manager, facility manager, or safety manager, you are responsible for helping to ensure your power distribution infrastructure with MasterPact NT/NW devices works in optimum conditions throughout its life cycle.

To achieve the necessary level of protection you need to have a maintenance plan to maintain each MasterPact NT/NW device (system and parts) in a satisfactory

operational state for its useful service life, and you must ensure that the plan is carried out.

This guide provides you with the insights necessary to build your own MasterPact NT/NW maintenance plan, tailored to your device operating conditions (determined by the level of external stress of your device), and the environmental conditions impacting the aging and performance of your MasterPact NT/NW device, and the criticality of the application.

Schneider Electric recommends that you build your MasterPact NT/NW maintenance plan according to:

- The required preventive maintenance programs, page 12:
  - Basic end-user maintenance program
  - Standard end-user maintenance program
  - Manufacturer maintenance program
- The frequency of each maintenance program, defined by:
  - The environmental conditions and device operating conditions:
    - Favorable, page 12
    - Normal, page 13
    - Severe, page 13
  - The criticality of the user application, page 13:
    - Low
    - Moderate
    - High

Example of Maintenance Plan

The following example is a preventive maintenance plan for three MasterPact NT/NW devices operating under different conditions in the facility.

The maintenance plan is based on the following parameters:

- Number and types of maintenance programs: apply the three preventive maintenance programs recommended by Schneider Electric:
  - Basic end-user maintenance program
  - Standard end-user maintenance program
  - Manufacturer maintenance program
- Frequency for each maintenance program: determined according to the following:
  - Environmental and operating conditions
  - Criticality of the user application

Criteria	**MasterPact NT/NW device no. 1**	**MasterPact NT/NW device no. 2**	**MasterPact NT/NW device no. 3**
Temperature	30 °C (86 °F)	25 °C (77 °F)	30 °C (86 °F)
Percent load (I/In)	67%	48%	85%
Relative humidity	75%	85%	70%
Corrosivity	Urban zones, scattered industrial activity, and heavy traffic		
Salt environment	No salt mist	No salt mist	No salt mist
Dust	Moderate level	High level	Low level
Vibration	None	None	None
Environmental and operating conditions	**Normal**	**Severe**	**Severe**
Criticality of the user application	**Low**	**Moderate**	**High**
Maintenance program frequency			

Criteria	MasterPact NT/NW device no. 1	MasterPact NT/NW device no. 2	MasterPact NT/NW device no. 3
Basic end-user maintenance program	**Every year**	Every year	Every year
Standard end-user maintenance program	**Every 2 years**	Every 2 years	Every 2 years
Manufacturer maintenance program	**Every 5 years**	Every 3 years	Every 2 years
Diagnostic services (ProDiag programs)	Contact your Schneider Electric field service representative to plan maintenance operations.		

Based on the data above, the recommended maintenance plan for the three MasterPact NT/NW devices is as follows:

- Maintenance plan for MasterPact NT/NW no. 1 device, operating in normal operating conditions and with user application with low criticality:

Maintenance plan	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12
Basic end-user maintenance program	✓	–	✓	–	–	✓	–	✓	–	–	✓	–
Standard end-user maintenance program	–	✓	–	✓	–	–	✓	–	✓	–	–	✓
Manufacturer maintenance program	–	–	–	–	✓	–	–	–	–	✓	–	–
Diagnostic services (ProDiag programs)	Contact your Schneider Electric field service representative to plan maintenance operations.											

- Maintenance plan for MasterPact NT/NW no. 2 device, operating in severe operating conditions and with user application with moderate criticality:

Maintenance plan	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12
Basic end-user maintenance program	✓	–	–	✓	–	–	✓	–	–	✓	–	–
Standard end-user maintenance program	–	✓	–	–	✓	–	–	✓	–	–	✓	–
Manufacturer maintenance program	–	–	✓	–	–	✓	–	–	✓	–	–	✓
Diagnostic services (ProDiag programs)	Contact your Schneider Electric field service representative to plan maintenance operations.											

- Maintenance plan for MasterPact NT/NW no. 3 device, operating in severe operating conditions and with user application with high criticality:

Maintenance plan	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12
Basic end-user maintenance program	✓	–	✓	–	✓	–	✓	–	✓	–	✓	–
Standard end-user maintenance program	–	–	–	–	–	–	–	–	–	–	–	–
Manufacturer maintenance program	–	✓	–	✓	–	✓	–	✓	–	✓	–	✓
Diagnostic services (ProDiag programs)	Contact your Schneider Electric field service representative to plan maintenance operations.											

Preventive Maintenance Frequency

Preventive Maintenance Safety Instructions

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

Preventive maintenance schedule is calculated by the MicroLogic™ control unit from:

- The operating conditions of the MasterPact NT/NW device.
- The criticality of the user application.

The MicroLogic™ control unit generates events to inform the user that maintenance needs to be planned to conform to the preventive maintenance schedule.

⚠WARNING

UNINTENDED EQUIPMENT OPERATION

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

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

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

Maintenance Programs

The following table summarizes maintenance operations for the three preventive maintenance programs:

Maintenance program	Maintenance description	Performed by
Basic end-user maintenance	Visual inspection and functional testing, replacement of inoperative accessories.	• Trained and qualified end-user personnel • Trained and qualified maintenance services provider personnel • Schneider Electric field service representative
Standard end-user maintenance	Basic end-user maintenance, plus operational servicing and subassembly tests.	• Trained and qualified maintenance services provider personnel • Schneider Electric field service representative
Manufacturer maintenance	Standard end-user maintenance, plus diagnostics and part replacements by Schneider Electric Services.	Schneider Electric field service representative

Favorable Environmental Conditions and Device Operating Conditions

Environmental conditions and device operating conditions are considered to be favorable **when all of the following conditions** are met:

Favorable environmental conditions and device operating conditions	
Temperature	Annual average ambient temperature outside the switchboard Ta < 25 °C (77 °F) (IEC 61439-1). Device installed in an air-conditioned room or in a ventilated switchboard.
Percent load	< 50 % of In (daily process 8/24 h or continuous process 24/24 h)
Relative humidity	< 50 %
Corrosive atmosphere	Device installed in category 3C1 environment, page 48 or in a closed room that creates favorable operating conditions (air is conditioned and purified).
Salt environment	None

Favorable environmental conditions and device operating conditions	
Dust	Negligible. Device installed in a switchboard equipped with filters or a ventilated IP54 enclosure.
Vibration	None

Normal Environmental Conditions and Device Operating Conditions

Environmental conditions and device operating conditions are considered to be normal **when all of the following conditions** are met:

Normal environmental conditions and device operating conditions	
Temperature	Annual average ambient temperature outside the switchboard Ta < 25 °C (77 °F) (IEC 61439-1)
Percent load	< 80 % of In (daily process 8/24 h or continuous process 24/24 h)
Harmonics	Harmonic current per phase < 30 % of In
Relative humidity	< 70 %
Corrosive atmosphere	Device installed in environment category 3C2 or 3C3 (IEC 60721-3-3), page 48
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

Severe Environmental Conditions and Device Operating Conditions

Environmental conditions and device operating conditions are considered to be severe **if any of the following conditions** are present:

Severe environmental conditions and device operating conditions	
Temperature	Annual average ambient temperature outside the switchboard Ta between 35 °C (95 °F) and 45 °C (113 °F) (IEC 61439-1)
Percent load	> 80 % of In (daily process 8/24 h or continuous process 24/24 h)
Relative humidity	> 80 %
Corrosive atmosphere	Device installed in category 3C4 environment without any particular protection, page 48
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

For example, severe environmental conditions and device operating conditions prevail in marine and wind power applications.

Criticality of User Application

The following table describes the three criticality levels of user application.

Criticality level	Description
Low	The loss of function will cause minimal curtailment of operations or may require minimal monetary investment to restore full operations. Normal contingency planning would cover the loss.
Moderate	The loss of function will have noticeable impact on the facility. It may have to suspend some operations briefly. Some monetary investments may be necessary to restore full operations. It may cause minor personal injury.
High	The loss of function will cause personal injury or substantial economic damage. Loss would not be disastrous, but the facility would have to suspend at least part of its operations immediately and temporarily. Reopening the facility would require significant monetary investments.

Recommended Frequency for the Basic End-User Maintenance Program

The following table indicates the recommended frequency to perform the Basic end-user maintenance program according to operating conditions and criticality of the user application.

Operating conditions	Criticality of user application		
	Low	Moderate	High
Favorable	2 years	2 years	2 years
Normal	1 year	1 year	1 year
Severe	1 year	1 year	1 year

Recommended Frequency for the Standard End-User Maintenance Program

The following table indicates the recommended frequency to perform the Standard end-user maintenance program according to operating conditions and criticality of the user application.

Operating conditions	Criticality of user application		
	Low	Moderate	High
Favorable	4 years	4 years	4 years
Normal	2 years	2 years	2 years
Severe	2 years	2 years	2 years

Recommended Frequency for the Manufacturer End-User Maintenance Program

The following table indicates the recommended frequency to perform the manufacturer end-user maintenance program according to operating conditions and criticality of the user application.

Operating conditions	Criticality of user application		
	Low	Moderate	High
Favorable	6 years	5 years	4 years
Normal	5 years	4 years	3 years
Severe	4 years	3 years	2 years

A complete check-up is recommended when tripping occurs due to a short-time or instantaneous short-circuit.

Maintenance 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 control unit: -55 °C to +85 °C (-67 °F to +185 °F).
- Devices with the MicroLogic control unit: -25 °C to +85 °C (-13 °F to +185 °F).

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

Check-up and Maintenance After Prolonged Storage

After prolonged 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	Standard end-user program	Manufacturer maintenance program
MicroLogic control unit	Standard end-user program	Manufacturer maintenance program
Device and chassis locking	Standard end-user program	Manufacturer maintenance program
Chassis	Standard end-user program	Manufacturer maintenance program
Auxiliary circuits	–	Manufacturer maintenance program

In addition, if the devices were stored under severe 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.

Parts to be Maintained and Why

How to Maintain the Case

Functions

The case of the device:

- Insulates the main contacts
- Helps to protect the user against arcing effects
- Provides a support for:
  - Mechanism
  - Control unit
  - Auxiliaries
  - Power connection
- Withstands the thermal and electrodynamic stresses generated during short-circuits

Degradation Factors

The factors which can cause degradation of the case are the following:

- Dusty or dirty environment
- Humidity
- High ambient temperature
- Shocks
- Stresses due to high short-circuit currents

Potential Hazards

Performing regular maintenance on the case can help to avoid the potential hazards and consequences listed in the following table.

Hazard	**Consequence**	
	Personal injury	**Equipment damage**
Arc flash	Death or serious injury	–
Insulation resistance of the case too low and impulse voltage	Electric shock	–
Disruptive discharge	–	Degradation of the breaking unit
High short-circuit current	–	Degradation of the breaking unit

Preventive Action

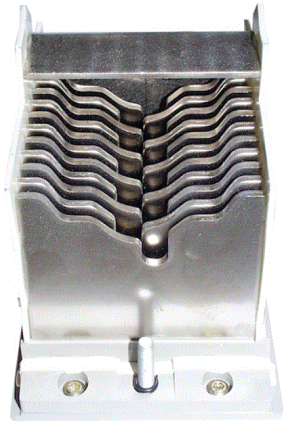
The following table lists the preventive maintenance procedures to be performed to maintain the case of the device.

Maintenance program	**Preventive action**	**Procedure**
Basic end-user preventive maintenance	Check the general condition of the device.	Device NII_1_1
Manufacturer preventive maintenance	Measure the insulation resistance.	Contact your Schneider Electric field service representative.

For more information, refer to Preventive Maintenance Programs, page 32.

How to Maintain the Arc Chutes

Functions



The arc chutes of the device:

- Are mounted on each arc chamber of the breaking unit
- Are composed of splitters and filters

The splitters of the arc chutes limit the stress exerted on the installation by:

- Helping to extinguish the arc
- Absorbing the arc energy under normal electrical operations and electric faults

The filters of the arc chutes filter the pressured gas expelled out of the arc chamber and cool it to a temperature at which it is no longer ionized and is therefore non-conductive.

Degradation Factors

The factors which can cause degradation of the arc chutes are the following:

- Frequent switching operations at rated current
- Stresses due to high short-circuit currents

Potential Hazards

Performing regular maintenance on the arc chutes can help to avoid the potential hazards and consequences listed in the following table.

Hazard	**Consequence**	
	Personal injury	**Equipment damage**
Arc flash	Death or serious injury	–
Insulation resistance of the case too low and impulse voltage	Electric shock	–
High short-circuit current	–	Degradation of the breaking unit

Preventive Action

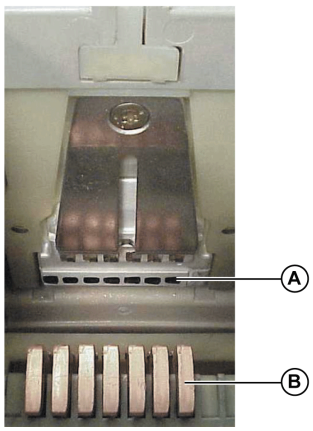
The following table lists the preventive maintenance procedures to be performed to maintain the arc chutes of the device.

Maintenance program	**Preventive action**	**Procedure**
Standard end-user preventive maintenance	Check the condition of the breaking unit.	Breaking Unit NIII_2_1
	Check mounting of arc chutes and filter cleanliness.	Breaking Unit NIII_2_2

For more information, refer to Preventive Maintenance Programs, page 32.

How to Maintain the Main Contacts

Functions



A Fixed contact

B Movable contact

The main contacts of the device:

- Are mounted in the arc chamber
- Are composed of the fixed and the movable contacts

The movable contacts make (close) or break (open) the electrical circuit under normal conditions (at rated current In) or fault conditions (overload and short-circuit).

Degradation Factors

The factors which can cause degradation of the main contacts are the following:

- Frequent switching operations at rated current
- Stresses due to high short-circuit currents

Potential Hazards

Performing regular maintenance on the main contacts can help to avoid the potential hazards and consequences listed in the following table.

Hazard	**Consequence**	
	Personal injury	**Equipment damage**
Fire	Death or serious injury	–
Thermal dissipation due to high-resistance contact	–	Degradation of the breaking unit

Preventive Action

The following table lists the preventive maintenance procedures to be performed to maintain the main contacts of the device.

Maintenance program	**Preventive action**	**Procedure**
Standard end-user preventive maintenance	Check the condition of the breaking unit.	Breaking unit NIII_2_1
Manufacturer preventive maintenance	Measure the contact resistance for each pole.	Contact your Schneider Electric field service representative.

For more information, refer to Preventive Maintenance Programs, page 32.

How to Maintain Power Connections

Functions

⚠WARNING

HAZARD OF HEAT GENERATION

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 are the links between devices and electrical distribution systems (for example, busbars, cables). Connection terminals are used to make the links.

Degradation Factors

The factors which can cause degradation of the power connections are the following:

- Vibration
- Overheating
- Incorrect tightening torque
- Deteriorated washer

Potential Hazards

Performing regular maintenance on the power connections can help to avoid the potential hazards and consequences listed in the following table.

Hazard	Consequence	
	Personal injury	Equipment damage
Fire	Death or serious injury	–
Thermal dissipation due to insufficient tightening torque	–	Burning of the cable insulation

Preventive Action

The following table lists the preventive maintenance procedures to be performed to maintain the power connections of the device.

Maintenance program	Preventive action	Procedure
Standard end-user preventive maintenance	Check connection system.	Power Connections NIII_2_1

For more information, refer to Preventive Maintenance Programs, page 32.

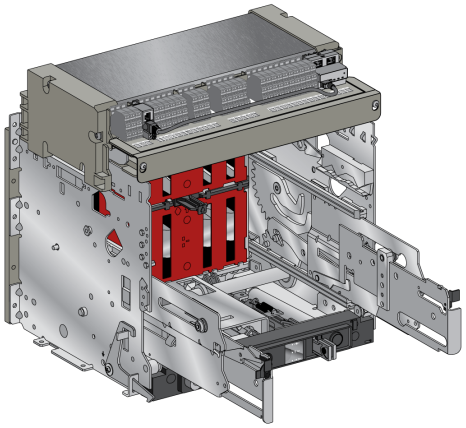
How to Maintain the Chassis

Functions

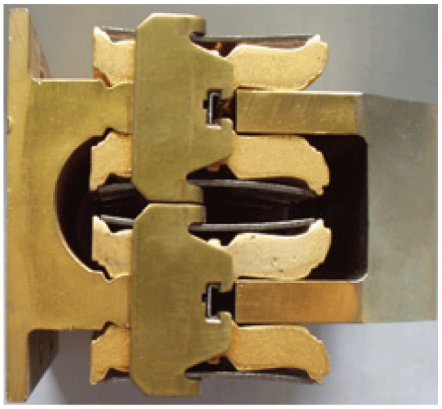
The chassis mechanism is used to rack the device in and out.

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.

Chassis and system of racking in and out



Clusters and disconnecting contacts



Degradation Factors

The factors which can cause degradation of the chassis are the following:

- Dusty environment
- Shocks
- Corrosive atmosphere
- Idle for long periods of time
- Incorrect operation

Potential Hazards

Performing regular maintenance on the chassis can help to avoid the potential hazards and consequences listed in the following table.

Hazard	**Consequence**	
	Personal injury	**Equipment damage**
Safety shutter malfunction	Electric shock	–
Device remains jammed in connected position.	–	Jammed operation of the device in the chassis (racking-in and racking-out)

Preventive Action

The following table lists the preventive maintenance procedures to be performed to maintain the chassis.

Maintenance program	**Preventive action**	**Procedure**
Basic end-user preventive maintenance	Check device racking operation.	Chassis NII_1_1
Standard end-user preventive maintenance	Check operation of safety shutters.	Chassis NIII_2_3

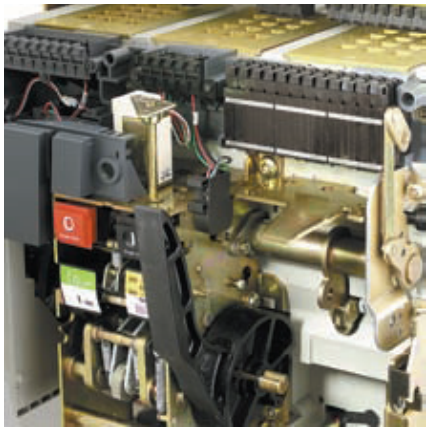
Maintenance program	Preventive action	Procedure
	Clean chassis and check presence of grease on chassis.	Chassis NIII_2_1
	Check disconnecting contact clusters.	Chassis NIII_2_2
Manufacturer preventive maintenance	Check connection/disconnection torque.	Contact your Schneider Electric field service representative.
	Clean and regrease chassis of MasterPact NT/NW drawout devices.	

For more information, refer to Preventive Maintenance Programs, page 32.

How to Maintain the Charging Mechanism

Functions

The charging mechanism is used to close the main contacts.



Degradation Factors

The factors which can cause degradation of the charging mechanism are the following:

- Dusty or dirty environment
- Shocks
- Corrosive atmosphere
- Idle for long periods of time

Potential Hazards

Performing regular maintenance on the charging mechanism can help to avoid the potential hazards and consequences listed in the following table.

Hazard	**Consequence**	
	Personal injury	**Equipment damage**
Charging mechanism is jammed.	–	Jammed mechanism

Preventive Action

The following table lists the preventive maintenance procedures to be performed to maintain the charging mechanism.

Maintenance program	**Preventive action**	**Procedure**
Basic end-user preventive maintenance	Operate the device manually and electrically.	Mechanism NII_1_1
	Charge the device electrically with MCH gear motor.	Mechanism NII_1_2
	Check the complete closing of the device poles.	Mechanism NII_1_3
Standard end-user preventive maintenance	Check the MCH gear motor charging time at 0.85 Un.	Mechanism NIII_2_1
	Check the general condition of the mechanism.	Mechanism NIII_2_2
Manufacturer preventive maintenance	Check opening and closing forces.	Contact your Schneider Electric field service representative.
	Clean and regrease the mechanism.	

For more information, refer to Preventive Maintenance Programs, page 32.

How to Maintain MicroLogic Control Unit

Functions

The control unit permanently monitors the electrical network and generates trip orders when electrical faults are detected.

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

Schneider Electric recommends that the field service representative replaces the MicroLogic control unit and associated optional M2C modules every 15 years. Each time the MicroLogic control unit is replaced, the performer, the rating plug, and the sensor plug must be replaced by the Schneider Electric field service representative.

Degradation Factors

The factors which can cause degradation of the control unit and electronic components are the following:

- Shocks
- Vibration
- Humidity
- High ambient temperature
- Corrosive atmosphere

Potential Hazards

Performing regular maintenance on the control unit can help to avoid the potential hazards and consequences listed in the following table.

Hazard	**Consequence**	
	Personal injury	**Equipment damage**
High short-circuit current and no tripping order	–	Degradation of the breaking unit

Preventive Action

The following table lists the preventive maintenance procedures to be performed to maintain the control unit.

Maintenance program	**Preventive action**	**Procedure**
Basic end-user preventive maintenance	Check the general condition of the device.	Device NII_1_1
Standard end-user preventive maintenance	Check overcurrent protection.	Device NIII_2_1
Manufacturer preventive maintenance	Perform aging diagnostic to evaluate when to preventively replace the MicroLogic control unit.	Contact your Schneider Electric field service representative.

For more information, refer to Preventive Maintenance Programs, page 32.

How to Maintain the Communication System

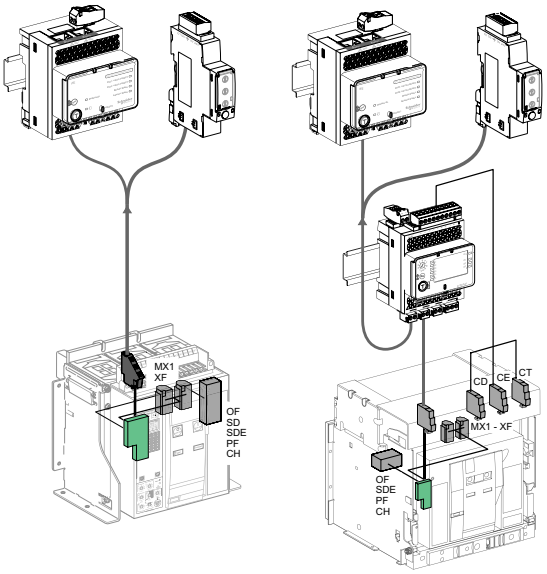
Functions

The communication system allows data transmission between the device and the remote controller. It can be used to remotely operate (open/close) the device.

Maintenance, production, management, and other departments can use this function to manage energy and assets, and monitor the quality of the electrical network.

In MasterPact NT/NW circuit breakers, the device data can be accessed by using an IFE or IFM communication interface and an appropriate software tool such as EcoStruxure Power Commission software.

MasterPact NT/NW devices with communication interface:



Degradation Factors

The factors which can cause degradation of the communication system are the following:

- Vibration
- Electro-magnetic field disturbances
- Equipment and software breakdown
- Modification of communication system architecture

Potential Hazards

Performing regular maintenance on the communication system can help to avoid the potential hazards and consequences listed in the following table.

Hazard	**Consequence**	
	Personal injury	**Equipment damage**
Incorrect or no operation (critical to safety) as a result of misleading information	Death or serious injury	–
Communication loss	–	Inappropriate functioning of devices, communication interfaces or modules on communication network

Hazard	Consequence	
	Personal injury	**Equipment damage**
Incorrect decision taken as a result of misleading information (status, metering, health)	–	Inappropriate functioning of devices, communication interfaces or modules on communication network
Incorrect system management leading to financial losses	–	Inappropriate functioning of devices, communication interfaces or modules on communication network

Preventive Action

The following table lists the preventive maintenance procedures to be performed to maintain the communication system.

Maintenance program	Preventive action	Procedure
Manufacturer preventive maintenance	Check data transmission via communication bus	Contact your Schneider Electric field service representative.

For more information, refer to Preventive Maintenance Programs, page 32.

How to Maintain Auxiliary Circuits

Functions

Auxiliary circuits are made of two parts, an electrical or mechanical accessory with the associated wiring:

- Voltage releases (XF, MX, MN)
- Gear motor (MCH)
- Indication contacts (OF, CE, CT, CD, SDE, PF)

Auxiliary wiring links devices and transmits the following information:

- Orders to the control devices
- Status-condition information

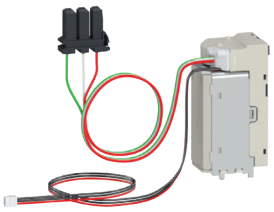
Voltage Releases

The voltage releases (XF, MX, MN) can be standard or with communicating function (XF, MX).

The XF closing voltage release closes the circuit breaker instantaneously when powered if the spring mechanism is charged.

The MX opening voltage release opens the circuit breaker instantaneously when powered.

The MN undervoltage release instantaneously opens the circuit breaker when its supply voltage drops to a value between 35% and 70% of its rated voltage.



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.

It is recommended that you replace voltage releases every 15 years.

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 spring charging handle serves as a backup if the auxiliary voltage is interrupted.

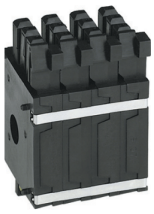
Given the mechanical forces exerted to charge the mechanism, periodic checks on the operation of the MCH gear motor and the charging time are required to help ensure the device closing function.

Indication Contacts

Contacts indicate the following information:

- OF: position of the main contacts (opened or closed)
- 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.



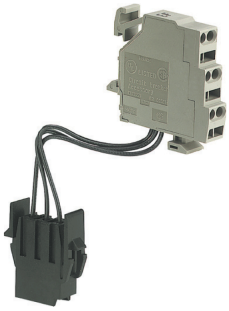
Improper contact performance can be caused by vibrations, corrosion, or abnormal temperature rises.

Preventive maintenance consists in regularly checking that contacts conduct or isolate correctly, depending on their position.

Auxiliary Wiring

Auxiliary wiring is used to transmit the following information:

- Orders to the various control devices
- Status-condition information



Incorrect connections or damaged insulation can cause unintended 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.

Degradation Factors

The factors which can cause degradation of the auxiliaries are the following:

- High ambient temperature
- Humidity
- Corrosive atmosphere
- Vibration

Potential Hazards

Performing regular maintenance on the auxiliaries can help to avoid the potential hazards and consequences listed in the following table.

Hazard	**Consequence**	
	Personal injury	**Equipment damage**
Loose wiring	Electric shock	–
Loss of local control (open/close), such as emergency stop	Death or serious injury	–
Loss of remote control (open/close)	–	Unwanted operation
Misleading information	–	Unwanted operation

Preventive Action

The following table lists the preventive maintenance procedures to be performed to maintain the control unit.

Maintenance program	Preventive action	Procedure
Basic end-user preventive maintenance	Check auxiliary wiring and insulation.	Auxiliaries NII_1_1
Standard end-user preventive maintenance	Check operation of indication contacts (OF, PF).	Auxiliaries NIII_2_1
	Check closing operation with XF closing voltage release at 0.85 Un.	Auxiliaries NIII_2_2
	Check opening operation with MX opening voltage release at 0.70 Un.	Auxiliaries NIII_2_3
	Check closing and opening operations with MN undervoltage release.	Auxiliaries NIII_2_4
	Check time delay of MNR delayed undervoltage release.	Auxiliaries NIII_2_5
Manufacturer preventive maintenance	Check opening time of MX opening voltage release.	Contact your Schneider Electric field service representative.
	Check closing time of XF closing voltage release.	
	Check opening time of MN undervoltage release.	
	Check the service life of the voltage releases XF, MX, MN.	

For more information, refer to Preventive Maintenance Programs, page 32.

How to Maintain Mechanical Interlocking Systems

Functions

A source changeover system, either manual or automatic (ATS), enhances the continuity of service of an electrical distribution system.

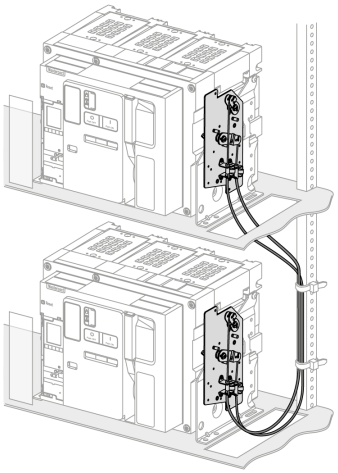
Mechanical interlocking between the devices in the source changeover system prevents the closing of two devices simultaneously.

The use of mechanical interlocking for source-changeover systems using cables or connecting rods is compulsory for Automatic Transfer Switch (ATS) applications.

A mechanical interlocking system is made of the following parts depending on the type of MasterPact NT/NW devices:

- An interlocking plate on the side of each MasterPact NT/NW device.
- A set of cables or connecting rods linking the MasterPact NT/NW devices.

The figure below illustrates a mechanical interlocking system by cable for source changeover between two MasterPact NW devices:



Degradation Factors

The factors which can cause degradation of the mechanical interlocking system are the following:

- Dusty or dirty environment
- Vibration

Potential Hazards

Performing regular maintenance on the mechanical interlocking system can help to avoid the potential hazards and consequences listed in the following table.

Hazard	**Consequence**	
	Personal injury	**Equipment damage**
Inappropriate or no operation of the source changeover system	Death or serious injury	–

Preventive Action

The following table lists the preventive maintenance procedures to be performed to maintain the mechanical interlocking system.

Maintenance program	Preventive action	Procedure
Basic end-user preventive maintenance	Operate interlocking systems	Mechanical Interlocking NII_1_1
Manufacturer preventive maintenance	Operate mechanical interlocking by cable.	Contact your Schneider Electric field service representative.
	Operate mechanical interlocking by rod.	

For more information, refer to Preventive Maintenance Programs, page 32.

Preventive Maintenance Programs

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.
- Turn off all power supplying this equipment 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.
- Beware of potential hazards and carefully inspect the work area for tools and objects that may have been left inside the equipment.

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

Basic End-User Preventive Maintenance Program

Definition

The Basic end-user preventive maintenance program can be carried out by:

- Trained and qualified end-user personnel.
- Trained and qualified maintenance services provider personnel.
- Schneider Electric field service representatives.

The Basic end-user preventive maintenance program comprises:

- Limited visual inspection.
- Function checks.
- Replacement by standard exchange of certain assemblies.

The Basic end-user preventive maintenance program must be performed every year in the case of normal operating conditions. Refer to the recommended frequency for the Basic end-user maintenance program for other cases, page 14.

Procedures

The Basic end-user procedures are described in detail in *MasterPact NT/NW - Basic and Standard End-User Maintenance Procedures for IEC Devices*, page 7.

Part	Procedure title	Procedure name
Device	Check the general condition of the device	Device NII_1_1
Mechanism	Operate the device manually and electrically	Mechanism NII_1_1
	Charge the device electrically with MCH gear motor	Mechanism NII_1_2
	Check the complete closing of device poles	Mechanism NII_1_3
Auxiliaries	Check auxiliary wiring and insulation	Auxiliaries NII_1_1
Control unit	Check device tripping and operation of SDE fault-trip indication contacts	Control Unit NII_1_1
	Check ground-fault or earth-leakage protection function	Control Unit NII_1_2
Device locking	Operate device keylocks	Device Locking NII_1_1
	Operate device padlocks	Device Locking NII_1_2
Chassis	Check device racking operation	Chassis NII_1_1
	Check IBPO racking interlock between racking handle and opening pushbutton (MasterPact NW)	Chassis NII_1_2
Chassis locking	Operate chassis keylocking system	Chassis Locking NII_1_1
	Operate chassis padlocking system	Chassis Locking NII_1_2
Mechanical interlocking	Operate chassis interlocking systems	Mechanical Interlocking NII_1_1

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 NT/NW - Basic and Standard End-User Maintenance Procedures for IEC Devices*, page 7.

Time Required

The average total time required for experienced, trained, and qualified personnel to perform this maintenance program is as follows:

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

Standard End-User Preventive Maintenance Program

Definition

The Standard end-user preventive maintenance program can be carried out by:

- Trained and qualified maintenance services provider personnel.
- Schneider Electric field service representatives.

The Standard end-user preventive maintenance program includes the Basic end-user preventive maintenance program, page 33.

The Standard end-user preventive maintenance program comprises:

- Extended visual inspection.
- Extended function checks.
- Part and system servicing (cleaning, greasing).
- Part replacement (based on time intervals or number of units of use).

The Standard end-user preventive maintenance program must be performed every two years in the case of normal operating conditions. Refer to the recommended frequency for the Standard end-user maintenance program for other cases, page 14.

Procedures

The Standard end-user procedures are described in detail in *MasterPact NT/NW - Basic and Standard End-User Maintenance Procedures for IEC Devices*, page 7.

Part	Procedure title	Procedure name
Mechanism	Check the MCH gear motor charging time at 0.85 Un	Mechanism NIII_2_1
	Check the general condition of the mechanism	Mechanism NIII_2_2
	Check the number of device operating cycles	Mechanism NIII_2_3
Breaking unit (arc chutes + contacts)	Check the condition of the breaking unit	Breaking Unit NIII_2_1
	Check mounting of arc chutes and filter cleanliness	Breaking Unit NIII_2_2
Auxiliaries	Check operation of indication contacts (OF, PF)	Auxiliaries NIII_2_1
	Check closing operation with XF closing voltage release at 0.85 Un	Auxiliaries NIII_2_2
	Check opening operation with MX opening voltage release at 0.70 Un	Auxiliaries NIII_2_3
	Check closing and opening operations with MN undervoltage release	Auxiliaries NIII_2_4
	Check time delay of MNR delayed undervoltage release	Auxiliaries NIII_2_5
Control unit	Check overcurrent protection	Control Unit NIII_2_1
	Save protection settings, reports, and event logs (MicroLogic P and H)	Control Unit NIII_2_3
Chassis	Clean chassis and check presence of grease on chassis	Chassis NIII_2_1
	Check disconnecting contact clusters	Chassis NIII_2_2
	Check operation of safety shutters	Chassis NIII_2_3
	Check operation of CD, CT, CE position contacts and EF auxiliary contacts	Chassis NIII_2_4
Power connections	Check connection system	Power Connections NIII_2_1

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 NT/NW - Basic and Standard End-User Maintenance Procedures for IEC Devices*, page 7.

Time Required

In addition to the Basic end-user maintenance program, the average time required for experienced, trained, and qualified maintenance personnel to perform this maintenance program is as follows:

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

Manufacturer Preventive Maintenance Program

Definition

The Manufacturer preventive maintenance program must be done exclusively by Schneider Electric field service representatives.

The Manufacturer preventive maintenance program includes the Basic and Standard end-user preventive maintenance programs, page 35.

The Manufacturer preventive maintenance program comprises:

- Complete function checks.
- Condition checks (test-based).
- Complete part and system servicing (cleaning, greasing).
- Control unit replacement (diagnostic-based).

The Manufacturer preventive maintenance program must be performed every five years in the case of normal operating conditions and user application with low criticality. Refer to the recommended frequency for the Manufacturer maintenance program for other cases, page 14.

Procedures

Part	Procedure title
Device	Measure insulation resistance
Mechanism	Check opening and closing forces
	Clean and regrease the mechanism
Breaking unit	Measure the contact resistance for each pole
Auxiliaries	Preventively replace XF, MX, MN voltage releases (1)
	Check opening time of MX opening voltage release
	Check closing time of XF closing voltage release
	Check opening time of MN undervoltage release
Control unit	Save protection settings, event histories (MicroLogic P and H) and create reports
	Check continuity of the tripping chain by primary injection
	Check integrated instantaneous protection (DIN/DINF) tripping
	Check operation of MicroLogic thumbwheels
	Preventively replace MicroLogic control unit and electrronic modules (2)
Chassis	Check connection/disconnection torque
	Clean and regrease chassis of MasterPact drawout devices
Communication system	Check operation of the breaker communication module (BCM)
	Check operation of the chassis communication module (CCM)
	Check data transmission via communication bus
Mechanical interlocking	Operate mechanical interlocking by cable
	Operate mechanical interlocking by rod

(1) As part of the preventive maintenance plan, Schneider Electric recommends replacing the voltage releases after 15 years of operation.

(2) As part of the preventive maintenance plan, Schneider Electric recommends that the field service representative replaces the MicroLogic control unit and associated M2C modules after 15 years of operation. Each time the MicroLogic control unit is replaced, the performer, and the rating and sensor plugs must be replaced by the field service representative.

Time Required

The average total time required for a Schneider Electric field service representative to perform this maintenance program including the Standard one, is as follows:

- From 1.5 hours to 2 hours depending on the frame size, for a fixed device with all accessories installed.
- From 2 hours to 3 hours depending on the frame size, for a drawout device with all accessories installed.

Schneider Electric Expert Diagnostics Program Used by Field Service Representatives

Performing Diagnostics of MasterPact Devices with Schneider Electric

Schneider Electric offers a large portfolio of manufacturer diagnostic services for electrical distribution equipment.

Enhanced Manufacturer Maintenance by Schneider Electric is condition-based maintenance where inspection and/or testing, analysis, and the ensuing maintenance actions are conducted on site. Testing, analysis, and ensuing recommended maintenance actions for low voltage (LV) circuit breakers and switch-disconnectors, for example MasterPact NT/NW devices, are provided by the following diagnostics programs:

- ProDiag Trip Unit
- ProDiag Breaker
- ProDiag Clusters

The ProDiag diagnostics programs deliver a comprehensive report with data collected during testing, along with expert recommendations based on analytics. This enables you to anticipate downtime and improve the availability of your installation.

Contact your Schneider Electric field service representative for more information.

ProDiag Trip Unit

Designed by Schneider Electric, ProDiag Trip Unit is used to perform diagnostics of circuit breaker control unit tripping performance.

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 creating high incident energy levels.

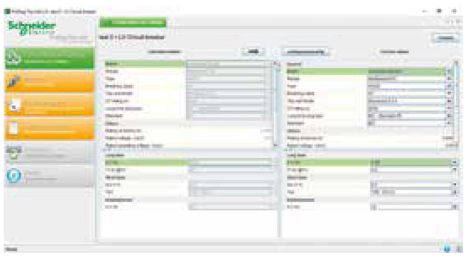
ProDiag Trip Unit can help to mitigate the risks of potential failure of LV circuit breaker control unit performance by:

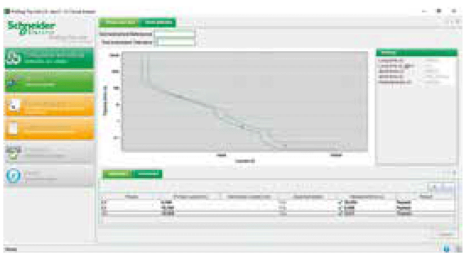
- Detection of tripping time drifts.
- Verification of LV circuit breaker and control unit features according to electrical network characteristics (breaking capacity, discrimination).
- Analysis of the history of alarms and events.

Non-performing LV circuit breaker control unit causes unwanted effects such as:

- Unintended trips (power outage).
- Downstream industrial equipment inefficiencies.
- Breakdowns.
- Longer short-circuits (overheating and internal fires).
- Circuit breaker and switchgear destruction, or even complete destruction of the electrical room.

ProDiag Trip Unit helps the end user to discover and understand LV circuit breaker control unit performance and criticality. Diagnosis is conducted on de-energized LV circuit breaker and only by Schneider Electric field service representatives.





Regular diagnosis of LV circuit breaker control unit tripping performance is delivered with theComplete Manufacturer Maintenance program. This solution brings the end user the following benefits:

- Help ensure the protection of downstream LV electrical distribution equipment, goods, and people operating them.
- Enhance reliability, mitigating unintended shutdown risks and operating costs.
- Extend the equipment lifespan, optimizing the total cost of ownership.

ProDiag Breaker

Designed by Schneider Electric, ProDiag Breaker diagnostics evaluate the performance of opening, closing, and spring charging operations.

A quick and reliable opening of LV circuit breaker is a strategic function for evaluating the complete operating chain. The fault detection rate and reaction speed stops short-circuits from creating high incident energy level.

ProDiag Breaker is used to mitigate the risk of LV circuit breaker electro-kinematic incident. ProDiag Breaker identifies the symptoms of undetected incident or degradation of the equipment that can cause unwanted effects like:

- Stress on internal moving parts.
- Accelerated wear of internal moving parts.
- Overheating and/or internal fires.
- Circuit breaker and switchgear destruction.
- Electrical room complete destruction.

ProDiag Breaker is conducted on de-energized LV circuit breaker and only by Schneider Electric field service representatives.

Regular diagnosis of electric and kinematic performance of LV circuit breakers is delivered with the Advanced Manufacturer Maintenance program. This solution brings the end user the following benefits:

- Alert in the early stages of above described phenomena not detected during regular preventive maintenance.
- Help ensure the protection of downstream LV electrical distribution equipment, goods, and people operating them.
- Enhance reliability, mitigating unexpected shutdown risks and operating costs.
- Extend the equipment lifespan, optimizing the total cost of ownership.

ProDiag Clusters

Designed by Schneider Electric, ProDiag Clusters is used to diagnose early stages of connection cluster deterioration not detected during regular preventive maintenance. This deterioration can result from one or more of the following factors:

- Severe environmental conditions
- User application with high criticality

- Accelerated aging process caused by racking-out and racking-in operations
- Electrical stress
- Uneven maintenance

Device Aging

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
- Interrupted currents

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 around the switchboard 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
Aging of plastic insulation. Deterioration of the mechanical characteristics of plastic parts (insulation, case) for which deterioration speed is increased with temperature rise.	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

Influence	Appearance	Consequences
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 annual average ambient temperature Ta are defined in the following table:

Annual average ambient temperature Ta	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, page 12.	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, page 12.	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 Ta	Typical service life of the device (electronic components excluded)
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: • of steel springs when temperature > 100 °C (212 °F) • of stainless steel springs when temperature > 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, page 12.	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, page 12. • Inspect for condensation.	• Provide ventilation for the switchboard. • Install a device with a higher rating.
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, page 12. • Measurement of insulation resistance (dielectric strength) 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, page 12. • 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, page 12.	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, page 12. • 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/Eddy 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, potential heat generation is approximately 10 % higher, corresponding to 5 % more current.	Carry out more frequent periodic checks, page 12.	Standard filtering with an inductor to reduce harmonics
> 50 %	–	Carry out more frequent periodic checks, page 12.	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

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 level	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, page 20.	Make sure that the switchboard remains closed.
High level	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, page 20.	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

Corrosive atmosphere	Influence	Appearance	Consequences	Thresholds per class in ppm (1)
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.	No particular recommendation
3C3	Immediate vicinity of industrial pollution **Example:** paper mills, water treatment, chemicals, synthetic fibers, smelting plants	Significant level	• Major impact on device service life, particularly concerning temperature rise. • No impact on electronic components with varnished boards.	Implement the standard program.	No particular recommendation
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, page 12. • Change the grease on the disconnecting contacts by Condat Pyratex EP2 fluorinated grease.	• Install the switchgear in a room offering protection from the pollution • Use fixed rather than drawout devices

Influence of Vibration on Aging

Vibration

Influence	Appearance	Consequences
Premature deterioration of contact surfaces (clusters and main contacts)	Not identifiable	Increased device temperature rise
Loosening 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

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, page 12.	No particular recommendation
0.5 g to 0.7 g	Significant increase in incidents	• Carry out more frequent periodic checks, page 12. • Check in particular the tightness of connections.	Install switchgear on a rubber mounting bushing
≥ 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.

Example: Influence of operating cycles on the service life for a MasterPact NT/NW 2000 A device.

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	6 years
(1) Service life is defined for endurance of 10,000 cycles and an interrupted current of less than 0.4 In	

Influence of Interrupted Currents on Aging

Interrupted Currents

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 currents 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

Operating Limits for MasterPact NT/NW IEC Devices

Operating Limits of MasterPact NT Devices

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

Type of MasterPact NT	Maximum number of cycles with periodic preventive maintenance
NT H1, H2, L1	12,500

Operating Limits of MasterPact NT Parts

These tables show the maximum possible number of operating cycles before the parts below must be replaced during the device service life.

Type of MasterPact NT	Maximum number of cycles before replacement of the part	
	Arc chute (at In)	Main contacts (at In) (1)
NT 06–16 440 V H1, H2	6,000	6,000
NT 06–16 690 V H1, H2	3,000	3,000
NT 06–16 440 V L1	3,000	3,000
NT 06–16 690 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.		

Device	Maximum number of cycles before replacement of the part			
	XF/MX/MN voltage releases	MCH gear motor	Connecting-rod springs, interlocking mechanisms	Interlocking cables
MasterPact NT	12,500	5,000	12,500	3,000

Operating Limits of MasterPact NW Devices

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

Type of MasterPact NW	Maximum number of cycles with periodic preventive maintenance
NW 08–16 N1, H1, H2, L1	25,000
NW 20 N1, H1, H2, H3, L1	20,000
NW 25–40 H1, H2, H3	20,000
NW 40b–63 H1, H2	10,000

Operating Limits of MasterPact NW 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 NW	Maximum number of cycles before replacement of the part		
	Arc chute (at In)	Main contacts (at In) (1)	Connecting-rod springs, interlocking mechanisms
NW 08–16 N1, H1, H2	10,000	10,000	12,500
NW 08–16 16 L1	3,000		

Type of MasterPact NW	Maximum number of cycles before replacement of the part		
	Arc chute (at In)	Main contacts (at In) (1)	Connecting-rod springs, interlocking mechanisms
NW2 20 440 V N1, H1, H2	8,000	8,000	10,000
NW 20 690 V N1, H1, H2	6,000	6,000	
NW 20 440 V H3	2,000	8,000	
NW 20 690 V H3		6,000	
NW 20 L1	3,000	10,000	
NW 25–40 440 V H1, H2	5,000	5,000	
NW 25–40 690 V H1, H2	2,500	2500	
NW 25–40 440 V H3	1,250	5,000	
NW 25–40 690 V H3		2,500	
NW 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.			

Device	Maximum number of cycles before replacement of the part		
	XF/MX/MN voltage releases	MCH gear motor	Interlocking cables
MasterPact NW	12,500	8,000	3,000

Related Documents for MasterPact NT/NW IEC Devices

Title of documentation	Reference number
MasterPact NT/NW Catalogue	LVPED208008EN
MasterPact NT/NW - Circuit Breakers and Switch-Disconnectors Maintenance Guide	LVPED508016EN
MasterPact NT - Circuit Breakers and Switch-Disconnectors – User Guide	51201116AA
MasterPact NW - Circuit Breakers and Switch-Disconnectors - User Guide	04443720AA
MasterPact NW – DC Circuit Breakers and Switch-Disconnectors - User Guide	04444163A
MicroLogic Control Units 2.0, 5.0 and 6.0 - User Guide	04443722AA
MicroLogic Control Units 2.0 A, 5.0 A, 6.0 A, 7.0 A 2.0 E, 5.0 E, 6.0 E – User Guide	04443724AA
MicroLogic Control Units 5.0 P, 6.0 P and 7.0 P – User Guide	04443726AA
MicroLogic Control units 5.0 H, 6.0 H and 7.0 H – User Guide	04443728AA
Enerlin'X IO - Input/Output Application Module for One IEC Circuit Breaker - User Guide	DOCA0055EN
Enerlin'X IFE -Ethernet Switchboard Server -User Guide	DOCA0084EN
Enerlin'X IFE -Ethernet Interface for One Circuit Breaker - User Guide	DOCA0142EN
Enerlin'X FDM128 -Ethernet Display for Eight Devices -User Guide	DOCA0037EN
MasterPact NT/NW, ComPact NS, and PowerPact P-, R-Frame – Service Interface – User Guide	DOCA0170EN
MasterPact NT - Fixed and Drawout Circuit Breaker or Switch-Disconnector -Instruction Sheet	51201003AA
MasterPact NW -Fixed and Drawout Circuit Breaker or Switch-Disconnector -Instruction Sheet	51156118AA
MasterPact NT -CDM Operation Counter - Instruction Sheet	51156135AA
MasterPact NW - CDM Operation Counter -Instruction Sheet	51201006AA
MasterPact NT/NW -Auxiliary Terminals - Instruction Sheet	51156122AA
MasterPact NT/NW -MN-MX-XF Voltage Releases - Instruction Sheet	51156123AA
MasterPact NT/NW -MN-MX-XF Communicating Voltage Releases with Diagnostic Function -Instruction Sheet	51201007AA
MasterPact NT -MCH Gear Motor - Instruction Sheet	51201009AA
MasterPact NW - MCH Gear Motor - Instruction Sheet	51156128AA
MasterPact NT -Arc Chute - Instruction Sheet	GHD10835AA
MasterPact NW - Arc Chute -Instruction Sheet	
MasterPact NW - SDE2 Fault-Trip Indication Contact / RES Remote Reset - Instruction Sheet	51156121AA
MasterPact NW - RES Remote Reset - Instruction Sheet	51156125AA
MasterPact NT -VCPO OFF-Position Locking and BPFE Support - Instruction Sheet	51201018AA
MasterPact NW -VCPO OFF-Position Locking and BPFE Support -Instruction Sheet	51156137AA
MasterPact NT/NW -Position Contacts (Connected / Disconnected / Test) -Instruction Sheet	51156129AA
MasterPact NW -EF Combined Connected/Closed Contact Installation Manual	4443729AA
MasterPact NT -Safety Shutters - Installation Manual	51201011AA
MasterPact NW - Safety Shutters - Installation Manual	51156130AA
MasterPact NW - Safety Shutter Position Indication and Locking -Installation Manual	04442873AA
MasterPact NT - Disconnected Position Locking - Installation Manual	51201013AA
MasterPact NW - Disconnected Position Locking - Installation Manual	51156132AA
MasterPact NT, NW, Compact NS630b-1600 – Interlocking 2 Sources by Cable – Installation Manual	51156138AA
MasterPact NT, NW, Compact NS630b-1600 – Interlocking 2 Sources by Rod – Installation Manual	51156139AA
MasterPact NT, NW- Cable-Type Door Interlock – Installation Manual	04443731AA
MasterPact NW - Mechanical Interlocking for 3 Sources - Instruction Sheet	51156126AA
MasterPact NW - Mechanical Interlocking for 2 Sources and 1 Replacement - Installation Manual	51156124AA

Title of documentation	Reference number
MasterPact NW - Mechanical Interlocking for 2 Sources and 1 Coupling - Installation Manual	51156127AA
MasterPact NT/NW - PF Ready-To-Close Contact - Installation Manual	51156120AA
Full-Function Test Kit Software Version 1.60 User Manual	48049-183-06
Hand-Held Test Kit (HHTK) Instruction Bulletin	48049-184-03

Troubleshooting and Solutions

Problem	Probable causes	Solutions
Circuit breaker cannot be closed locally or remotely.	Circuit breaker padlocked or keylocked in the "open" position.	• Disable the locking function.
	Circuit breaker interlocked mechanically in a source changeover system.	• Check the position of the other circuit breaker in the changeover system. • Modify the situation to release the interlock.
	Circuit breaker not completely connected.	Terminate racking in (connection) of the circuit breaker.
	The reset button signalling a fault trip has not been reset.	• Clear the fault. • Push the reset button on the front of the circuit breaker.
	Stored energy mechanism not charged.	• Charge the mechanism manually. • If it is equipped with an MCH gear motor, check the supply of power to the motor. If the problem persists, replace the gear motor (MCH).
	MX opening voltage release permanently supplied with power.	There is an opening order. Determine the origin of the order. The order must be cancelled before the circuit breaker can be closed
	MN undervoltage release not supplied with power.	• There is an opening order. Determine the origin of the order. • Check the voltage and the supply circuit (U > 0.85 Un). If the problem persists, replace the MN undervoltage release.
	XF closing voltage release continuously supplied with power, but circuit breaker not "ready to close" (XF not wired in series with PF contact).	Cut the supply of power to the XF closing voltage release, then send the closing order again via the XF, but only if the circuit breaker is "ready to close".
	Permanent trip order in the presence of a MicroLogic P or H control unit with minimum voltage and minimum frequency protection in Trip mode and the control unit powered.	Disable these protection functions on the MicroLogic P or H control unit.
Circuit breaker cannot be closed remotely but can be opened locally using the closing pushbutton.	Closing order not executed by the XF closing voltage release.	Check the voltage and the supply circuit (0.85 - 1.1 Un). If the problem persists, replace the XF closing voltage release.
Unexpected tripping without activation of the reset button signalling a fault trip.	MN undervoltage release supply voltage too low.	Check the voltage and the supply circuit (U > 0.85 Un).
	Load-shedding order sent to the MX opening voltage release by another device.	Check the overall load on the distribution system. If necessary, modify the settings of devices in the installation.
	Unnecessary opening order from the MX opening voltage release.	Determine the origin of the order.
Unexpected tripping with activation of the reset button signalling a fault trip.	A fault is present: • Overload • Earth fault • Short-circuit detected by the control unit.	• Determine and clear the causes of the fault. • Check the condition of the circuit breaker before putting it back into service.
Instantaneous opening after each attempt to close the circuit breaker with activation of the reset button signalling a fault trip.	Thermal memory.	• See the user manual of the control unit. • Press the reset button.
	Transient overcurrent when closing.	• Modify the distribution system or the control unit settings. • Check the condition of the circuit breaker before putting it back into service.

Problem	Probable causes	Solutions
		• Press the reset button.
	Closing on a short-circuit.	• Clear the fault. • Check the condition of the circuit breaker before putting it back into service. • Press the reset button.
Circuit breaker cannot be opened remotely, but can be opened locally.	Opening order not executed by the MX opening voltage release.	Check the voltage and the supply circuit (0.7 - 1.1 Un). If the problem persists, replace the MX opening voltage release.
	Opening order not executed by the MN undervoltage release.	Drop in voltage insufficient or residual voltage (> 0.35 Un) across the terminals of the undervoltage release. If the problem persists, replace the MN undervoltage release.
Circuit breaker cannot be opened locally.	Operating mechanism malfunction or welded contacts.	Contact a Schneider Electric service centre.
Circuit breaker cannot be reset locally but not remotely.	Insufficient supply voltage for the MCH gear motor.	Check the voltage and the supply circuit (0.7 - 1.1 Un). If the problem persists, replace the MCH gear motor.
Nuisance tripping of the circuit breaker with activation of the reset button signalling a fault trip.	Reset button not pushed-in completely.	Push the button in completely.
Impossible to insert the crank in connected, test or disconnected position.	A padlock or keylock is present on the chassis or a door interlock is present.	Disable the locking function.
Impossible to turn the crank.	The reset button has not been pressed.	Press the reset button.
Circuit breaker cannot be removed from chassis.	Circuit breaker not in disconnected position.	Turn the crank until the circuit breaker is in disconnected position and the reset button out.
	The rails are not completely out.	Pull the rails out all the way.
Circuit breaker cannot be connected (racked in).	Chassis/circuit breaker mismatch protection.	Check that the chassis corresponds with the circuit breaker.
	The safety shutters are locked.	Remove the locks.
	The disconnecting contact clusters are incorrectly positioned.	Reposition the clusters.
	Chassis locked in disconnected position.	Disable the chassis locking function.
	The reset button has not been pressed, preventing the rotation of the crank.	Press the reset button.
	The circuit breaker has not been sufficiently inserted in the chassis.	Insert the circuit breaker completely so that it is engaged in the racking mechanism.
Circuit breaker cannot be locked in disconnected position.	The circuit breaker is not in the right position.	Check the circuit breaker position by making sure the reset button is out.
	The crank is still in the chassis.	Remove the crank and store it.
Circuit breaker cannot be locked in connected, test or disconnected position.	Check that locking in any position is enabled.	Contact a Schneider Electric service centre.
	The circuit breaker is not in the right position.	Check the circuit breaker position by making sure the reset button is out.
	The crank is still in the chassis.	Remove the crank and store it.
The crank cannot be inserted to connect or disconnect the circuit breaker.	The rails are not completely in.	Push the rails all the way in.
The right-hand rail (chassis alone) or the circuit breaker cannot be drawn out.	The crank is still in the chassis.	Remove the crank and store it.

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