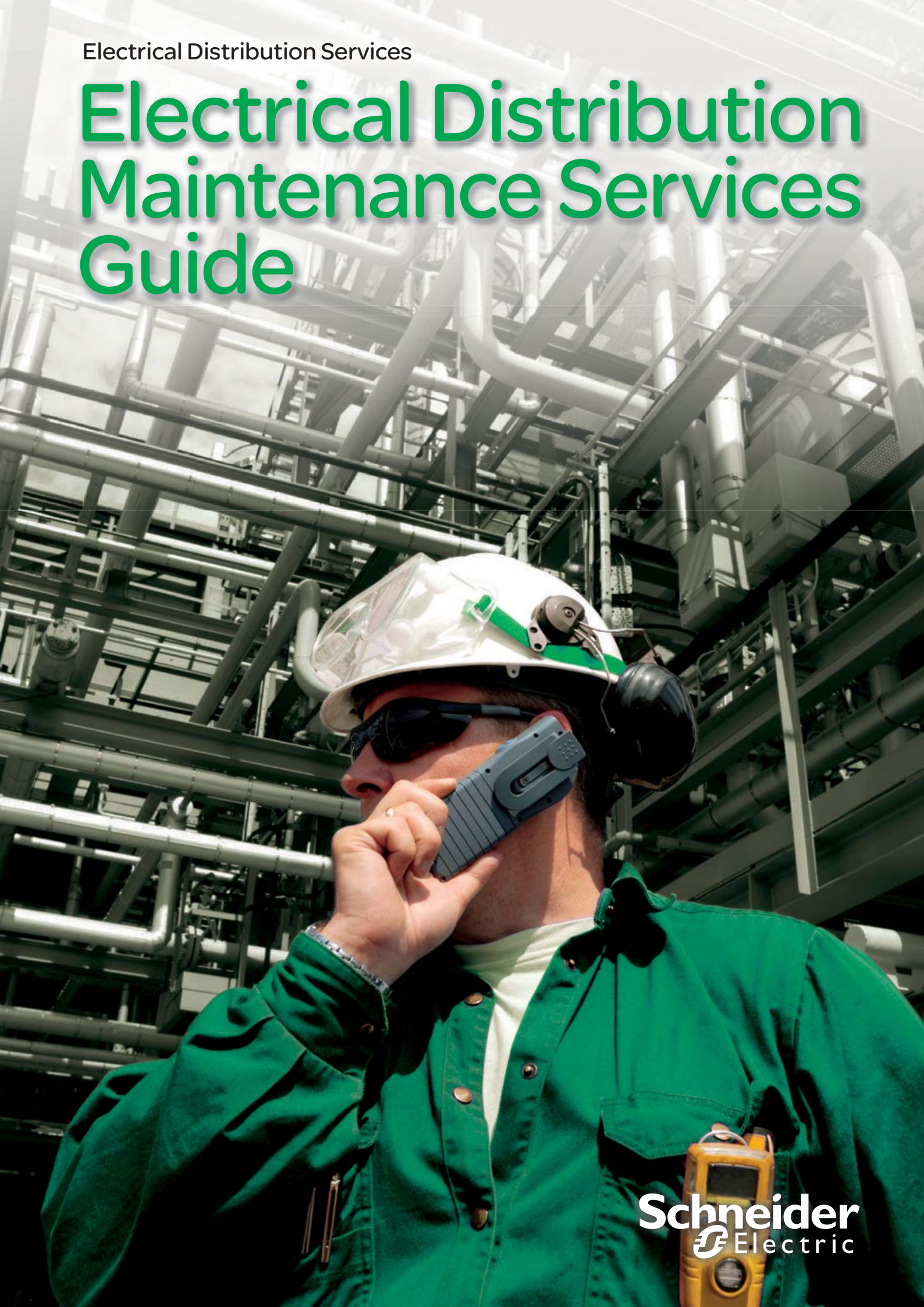
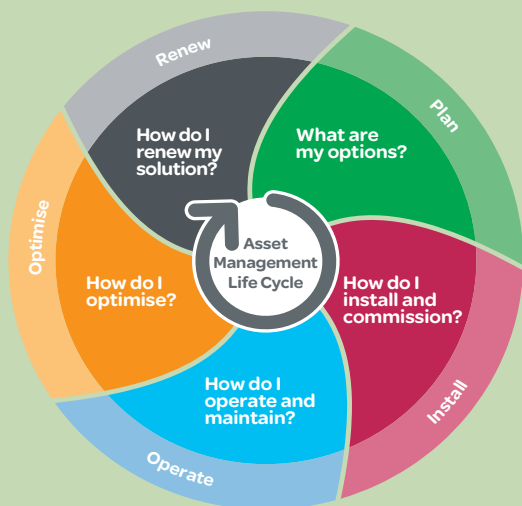


Electrical Distribution Services

Electrical Distribution Maintenance Services Guide



Schneider
Electric



The ultimate in life cycle support for all your installations

The ultimate in life cycle support for all your installations Schneider Electric's professional engineers and qualified field service representatives are committed to providing you with innovative solutions, best-in-class customer service, advanced technical support, and exceptional quality in everything we do.

You can count on Schneider Electric Field Services to help manage the life cycle of your electrical distribution equipment.

As global energy management specialists, we have extensive knowledge and experience in electrical distribution maintenance.

This Maintenance Services Guide offers more than just an overview of Schneider Electric's maintenance services solutions, it also contains valuable information and suggestions concerning best maintenance practices and recommended electrical maintenance activities.

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History

Since the early days of the industry, businesses have wanted equipment to operate as well as possible. Most of the equipment failures they experienced were a result of abuse. Maintenance would be only performed only when it was no longer possible to operate the equipment. That was called reactive maintenance. Referring to reactive maintenance as “maintenance,” however, is a misnomer. That's really just repair.

Maintenance means keep it running, not repair!

It wasn't until 1950 in Japan that a new concept of maintenance arose. It consisted of following the manufacturers' recommendations about how to take care of equipment at predetermined intervals of time or usage, with checks intended to reduce the probability of failure or deterioration in system operation. That new trend was called preventive maintenance.

Maintenance is a function devoted to keeping industry running as well as possible and making equipment reliable, productive, and safe at an optimal cost. It has historically been thought of as a necessary expense of doing business. Preventive maintenance alone, however, could not fully address this universal need.

Equipment manufacturers continually invest in innovative new tools and technologies to diagnose the wear and tear or failure of critical parts in their equipment.

They engage in each of the following:

- Record and analyse system parameters.
- Detect drift from the initial state.
- Anticipate the reactive action required to ensure equipment safety and continuity of service.
- Schedule action for convenient times.

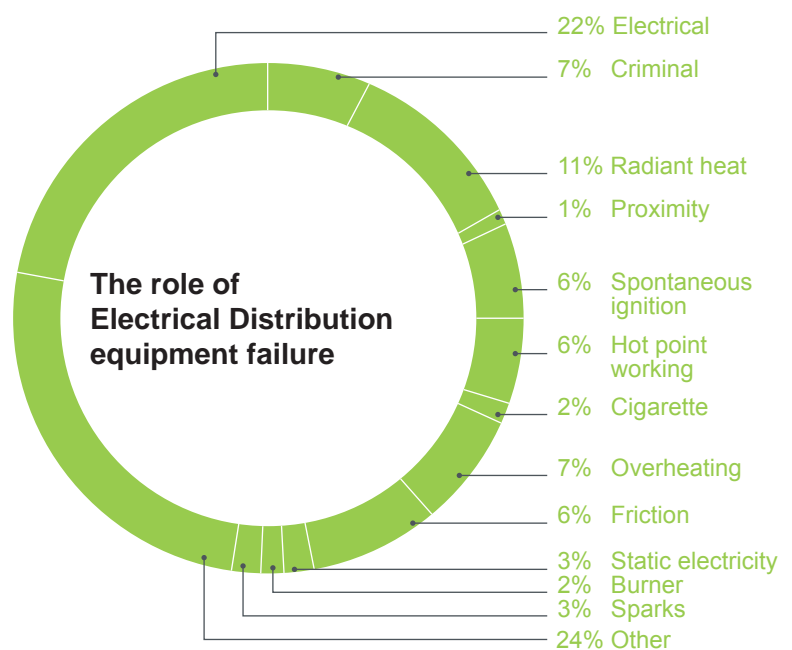
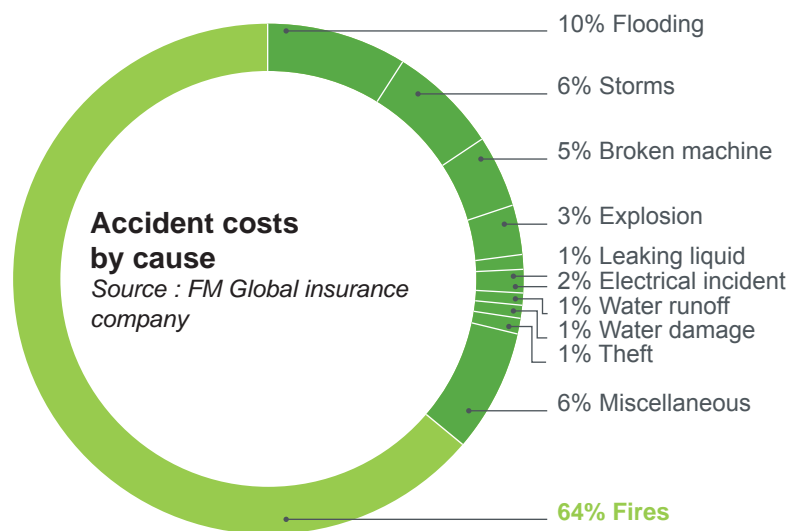
When included within the preventive maintenance, we name it on-site condition maintenance.

Condition monitoring using advanced sensor and instrumentation technologies analysed to detect significant trends is called “Predictive maintenance”. These solid, modern maintenance techniques and practical approaches have the potential to become a key competitive advantage in your businesses. This requires establishing new habits and defining modern and up-to-date maintenance plans. This guide was created to help you work towards that goal.

Keeping MV/LV equipment performing optimally is challenging.

You need to adopt the best maintenance practices in order to increase safety and minimise downtime while working with limited budgetary and maintenance resources.

What are the major causes of accident-related costs and the role of electrical equipment failure?





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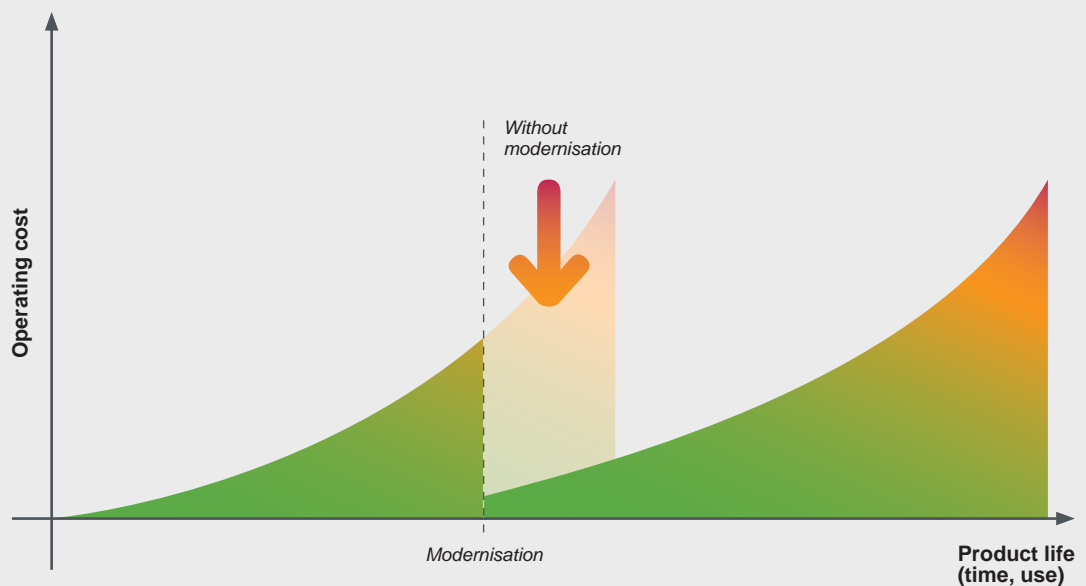
This guide is designed for maintenance managers responsible for the health and performance of ED installations. It can help you discover, understand, adopt, and manage the benefits of maintenance activity according to equipment manufacturer recommendations, as well as acknowledge the risks of failing to do so.

The first step is to define a maintenance strategy according to these main objectives:

- Ensure the availability of the equipment to function as required, at optimum cost.
- Take account of safety and any other mandatory requirements associated with equipment.
- Take account of any environmental impact.
- Ensure equipment endurance and product and service quality provided while managing cost.

This guide can also aide business managers and other buyers of maintenance services, who are ultimately responsible for the commissioning and budgeting of maintenance activity, and optimising ED equipment costs. Costs depend directly on ED equipment criticality, environmental conditions, and ageing, including spare parts.

The final goal for your business is to make equipment run at higher capacities for longer, thereby delivering the most from your investments.



2.1 - Why maintain ED equipment?

There are five unbeatable, universal benefits that result from carrying out ED equipment maintenance.

1. People safety and ED equipment protection

Plant managers are paid to ensure the sustainable development of their businesses. They are ultimately responsible for adopting all measures technically and economically available to minimise the risk of unwanted events. These events might cause loss of assets, but also having at risk plant operators' lives.

Some of your ED equipment is designed to minimise the risk and severity of your employees' accidents or processes breakdown, such as circuit-breakers, fuse-contactors, etc. The first priority of maintenance is to ensure this role is performed.

2. Service continuity (uptime) when you need it the most

Preventive maintenance maximises your uptime. Thanks to scheduled equipment outage, less disruption to activities and less stress is generated.

It takes less time to perform preventive maintenance than emergency repair while mitigating the risk of emergency shutdown.

What is the financial impact to the customer of 1 hour's production shutdown?

(Source: Contingency Planning Research & Schneider Electric)

Application	Loss(*) in €
Health establishment	Human lives...
Stock market transactions	6,500,000
Credit card sales	2,600,000
Petrochemical	100,000
Plane ticket booking system	90,000
Mobile phone network	40,000
Automobile	30,000
Pharmaceutical	30,000
Food processing	20,000
Cement	15,000

() Direct and indirect costs of non availability*

3. Energy-efficient ED equipment

Research shows that unmaintained devices are not as energy efficient as well maintained equipment. Over time, normal wear and tear causes stress to components that can result in diminishing device energy efficiency. Less wear and tear on the equipment means less wasted energy while it is running. Simple maintenance can be performed during off-peak business periods.

4. Efficient spare parts management

Spare parts alone can add up to half of the total maintenance costs. These costs can be cut by substituting reactive maintenance with preventive maintenance, in order to reduce the number of faults on complex parts and/or systems. As a result, more money and time can be spent on improving your production process.

5. Optimized Total Cost of Ownership (TCO)

Customers want to keep their ED equipment running well for as long as possible, considering the significant costs of any ED equipment acquisition (CapEx).

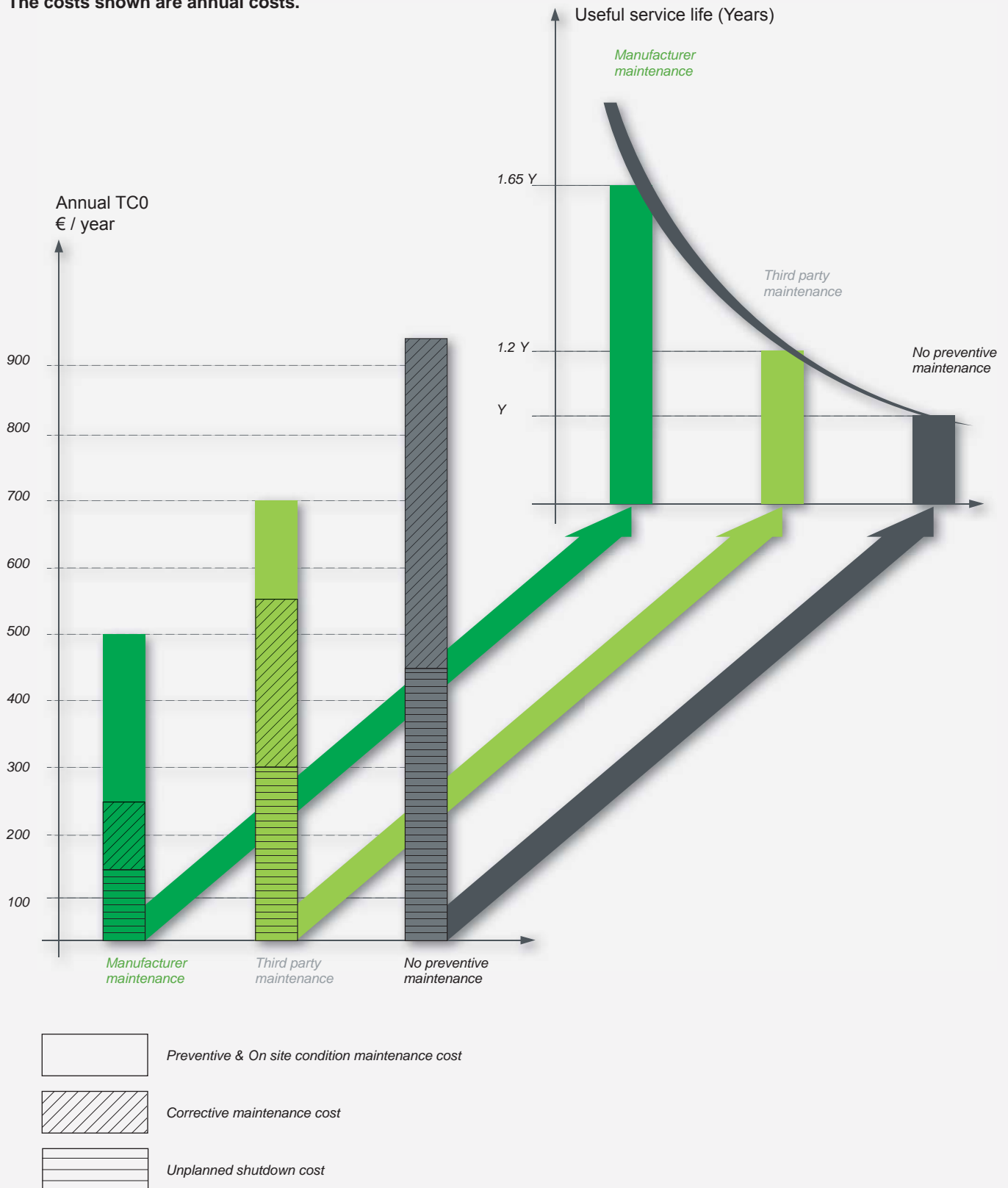
Moreover business operations must be kept running as well as possible at an optimum cost. Without maintenance, industries suffer emergency shutdown situations (reactive maintenance). These urgencies can cause both spare parts and labour to be sold at a premium, in addition to process shutdown costs (OpEx).

Modern and up-to-date maintenance techniques become a key competitive advantage thanks to early detection, identifying problems before they become a major repair. Knowing when a scheduled shutdown will occur allows you to set staffing levels accordingly.

In summary, carrying out maintenance is a unique opportunity to reduce your Total Cost of Ownership (CaPex + OpEx) and create more value for your business. It must be professionally executed by highly qualified/skilled technical operators.

What is the impact of a maintenance strategy on the Total Cost of Ownership (TCO) of electrical equipment?

Example of complete costs for a MV switch protection cubicle:
The costs shown are annual costs.



Hence, for Manufacturer Maintenance:

- Annual TCO is lower since the useful service life of the equipment is longer.
- Predictive & On site condition maintenance reduce reactive maintenance and unplanned shutdown cost resulting from equipment failure by improving reliability and maximizing service continuity.

2.2 - Reactive maintenance

Equipment intervention to restore the required function of a faulty item.

The result can be:

- Palliative or temporary, to allow a faulty item to perform its required function for a limited interval and until a repair is carried out.
- Curative, to allow a faulty item to perform its required function as per original performance. Often, a deep diagnosis of equipment is required for fault recognition, localization, cause identification, and the appropriate solution. A final function check-out is conducted to verify that the item is able to perform the required function as required.

ED equipment manufacturers services and their diagnostics solutions are the best positioned to deliver the best and cost efficient corrective solution thanks to:

- Expertise on manufacturer equipment for the optimal condition, hence, extending the life of the equipment (for more details see chapters 3.1 / 3.2, page 19).
- Know-how in particular techniques, procedures, test equipment technologies, equipment assembly and manufacturing process, that may affect equipment performance after intervention (ie. switchgear for adjustments of spare parts).
- Direct access to supply original spare parts for both active and discontinued MV and LV equipments.

2.3 - Preventive maintenance

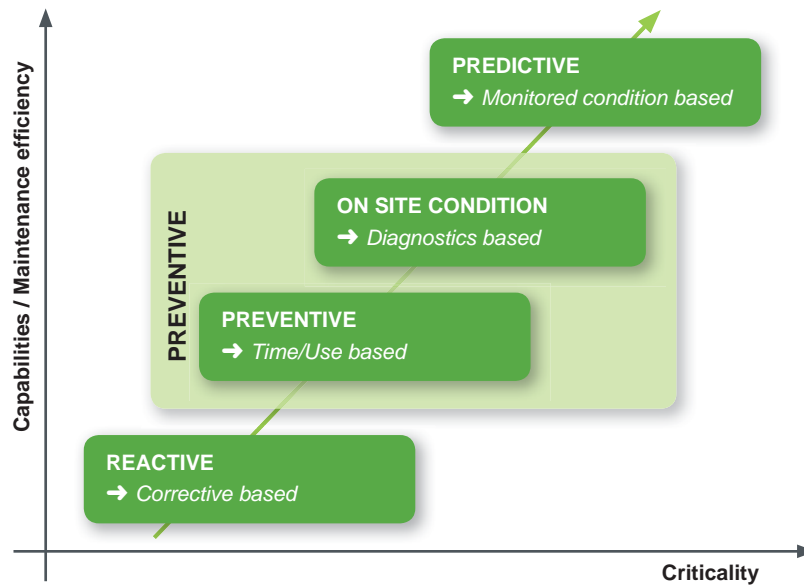
This is the combination of activities consisting of regular inspections, work on mechanisms, and part replacement on your ED equipment. Its goal is to avoid any possible failure (to a certain or maximum possible extent) and its costly corrective intervention (palliative or curative), but not at optimized cost.

Preventive maintenance can be categorized in three levels according to its complexity:

- **Exclusive maintenance activities**
Conducted by equipment manufacturer services as it impacts ED equipment performances.
 - Cleaning / checking / greasing of the operating mechanism.
 - Cleaning / checking / greasing of the closing and opening springs.
- **Advanced maintenance activities**
Conducted by equipment manufacturer services or certified partner with demonstrated qualification.
 - Cleaning /checking / greasing of the moving withdrawable parts
 - Inspection of busbars (tightening, chalking, cracking, signs of heating)
- **Light maintenance activities**
Conducted by trained customer employee on manufacturer's preventive maintenance guides.
 - General state: visual checking, cleanliness, insulator condition, oxidation, no corrosion of supporting structure.
 - Inspection of state of the auxiliaries contact (on/off, rack in, rack off, etc.).

Preventive maintenance is usually conducted during a scheduled shutdown to minimize its impact on business operations, and to respect the principle of periodic maintenance. This is, when interventions are scheduled and conducted based on time intervals and/or the number of units in use, but without any previous equipment condition investigation.

Maturity curve



Maintenance operator's Competences Levels (EN 13306)

- **Level 5:** Manufacturer services or Master technician in several techniques/technologies/processes with an industrial (logistic/technical) support equipment when on-site troubleshooting is not feasible. Recall action is requested to return the equipment to the factory for deep inspection and repair.
- **Level 4:** Manufacturer services Master technician in:
 - particular technique / technology of **specialized support equipment**,
 - particular ED equipment **assembly / manufacturing** process.
- **Level 3:** Manufacturer services or Qualified technician to use **complex tools** / measures / setting devices / activities thanks to **advanced** training modules.
- **Level 2:** Manufacturer services or Qualified customer employee with **basic** training modules to conduct **simple** operations according to manufacturer's maintenance guides.
- **Level 1:** Manufacturer services or Customer employee with **minimal** training in the electrical field.

2.4 - On site condition maintenance

The next level of maintenance maturity is the completion of preventive maintenance with on site periodic diagnostic interventions when available. The aim is to identify the symptoms of an undetected malfunction or degradation of ED equipment before the fault happens.

Its goal is to keep the equipment as close to its optimum condition as possible (excluding the need to repair the device and eliminating all failures) and schedule, during the most convenient time, a complete corrective intervention plan to regain its original performance level, if needed.

Its applications involve the more critical assets where failure significantly impacts uptime, asset longevity, safety, product quality, or involves major reactive intervention costs. This level of maintenance is an easy-to-implement and cost-efficient solution.

ED equipment manufacturers diagnostic solutions are best positioned to deliver a unique performance because of the following:

- Inspection, testing, and analysis are conducted with customized test kits and software, securing efficient and reliable data management.
- Availability of an historical equipment operating technical database to diagnose whether equipment maintains its original performance level.
- Field service representatives' expertise about equipment to secure the best recommendations and instructions for ED performance and optimal condition, thereby extending equipment life.
- Experience from an extensive ED equipment installed base under the most extreme operating conditions.
- Information about obsolescence dates of manufacturer equipment and original spare parts availability in order to anticipate future evolutions such as extensions, upgrades, retrofits (i.e., ECOFIT™ by Schneider Electric).



*For ECOFIT solutions
see our catalogue
SERED111047EN*

The next step is to integrate smart monitoring systems for real-time tracking of an electrical distribution installation, the performance of its critical devices, and sensible parts condition data.

When also following the principles of predictive maintenance, the plant manager gains a complete picture of equipment condition, a comprehensive risk assessment, and greater peace of mind when making critical decisions.

2.5 - Predictive maintenance

Predictive maintenance is the equipment condition monitoring using advanced sensor and instrumentation technologies, and its repetitive analysis. It represents the application of the Just-in-Time principle to the preventive maintenance function. It is a way to reduce (but not eliminate) periodic maintenance activities that requires annual shutdowns to a strict minimum.

Maintenance interventions are forecasted and launched when programmed alarms (online monitoring of selected parameters of equipment's core items), indicate that a predefined wear threshold has been reached. Sensors therefore need to be installed in devices, switchboards, and installations.

This is supported by a maintenance information system (Enterprise Asset Management), optionally integrated with plant ERP, for planning the most convenient intervention time and derived actions, such as spare parts, field services, etc.

2.6 - Frequency of intervention

ED equipment manufacturers recommend a schedule for maintenance activities to extend ED equipment performance over time. Frequencies under normal/healthy operation (minor equipment criticality and optimal environmental conditions) can be generally defined as follows:

Maintenance	Minimal frequency (1) (every)	Who		
		Manufacturer	Certified Partner	End user
Exclusive	4 years	✓		
Advanced	2 years	✓	✓	
Light	1 year	✓	✓	✓

(1) Recommended under normal operating conditions (minor equipment criticality and optimal environmental conditions). However, this recommended frequency should be increased according to: a) the level of criticality (low, major, critical) b) the severity of environment conditions (i.e. corrosive, naval, offshore) following recommendations of Manufacturer's services. (see table p.15)

Nonetheless, it is **strongly recommended to increase the frequency of interventions, in abnormal or unhealthy operating conditions** such as the situations listed below (alone or combined):

Harsh environments

Environments with extreme temperatures, significant temperature changes, high humidity levels, and high dust concentration, each, speeds ED equipment ageing individually and even more so in combination.

This leads to a higher risk of ED equipment malfunction. The more regularly inspections are conducted, the better the chance of mitigating this risk.

Maintenance	Normal environment conditions	Severe environment conditions
Temperature	Average annual temperature < 25°C outside the switchboard (TA)	Average annual temperature between 35°C - 45°C around the switchboard (see IEC 60439-1)
Percent load	< 80% of In 24/24 hours	> 80% of In 8/24 hours or 24/24 hours
Relative Humidity	< 70%	> 80%
Corrosive atmosphere (IEC60721-3-3)	Device installed in environment category 3C1 or 3C2	Device installed in environment category 3C3 or 3C4 without any particular protection
Salt environment	No salt mist	Installation < 10 km from seaside and device without any particular protection
Dust	Low Level. Device protected in switchboard equipped with filters or ventilated IP54 enclosure	High Level. Device not protected
Vibration	Permanent vibration < 0.2g	Continuous vibration between 0.2g and 0.5g

Intensive exploitation conditions

Exploitation conditions are the working operating conditions to which the equipment is subjected within the ED installation. This includes, for example, frequency of shunting or no shunting, charging and load rate, power and supply quality, and factors that define overall equipment stress levels.

ED equipment manufacturers warrant electrical and mechanical endurance for a number of accumulated operations depending on exploitation and environmental operating conditions. When equipment exceeds the operating limits defined by the manufacturer, an accurate and regular diagnostic is recommended.

ED equipment obsolescence and unavailability of spare parts

The only solution to extend the Electrical Distribution (ED) equipment life cycle when at the end of its Discontinued phase, is to carry out intense maintenance while planning for modernisation.

ED equipment levels of criticality

To ensure the highest possible level of installation reliability and optimise equipment service life, it is advisable to create a maintenance management plan.

For each piece of equipment, the plan indicates the following:

- The most suitable type of maintenance.
- The specified frequency of maintenance.

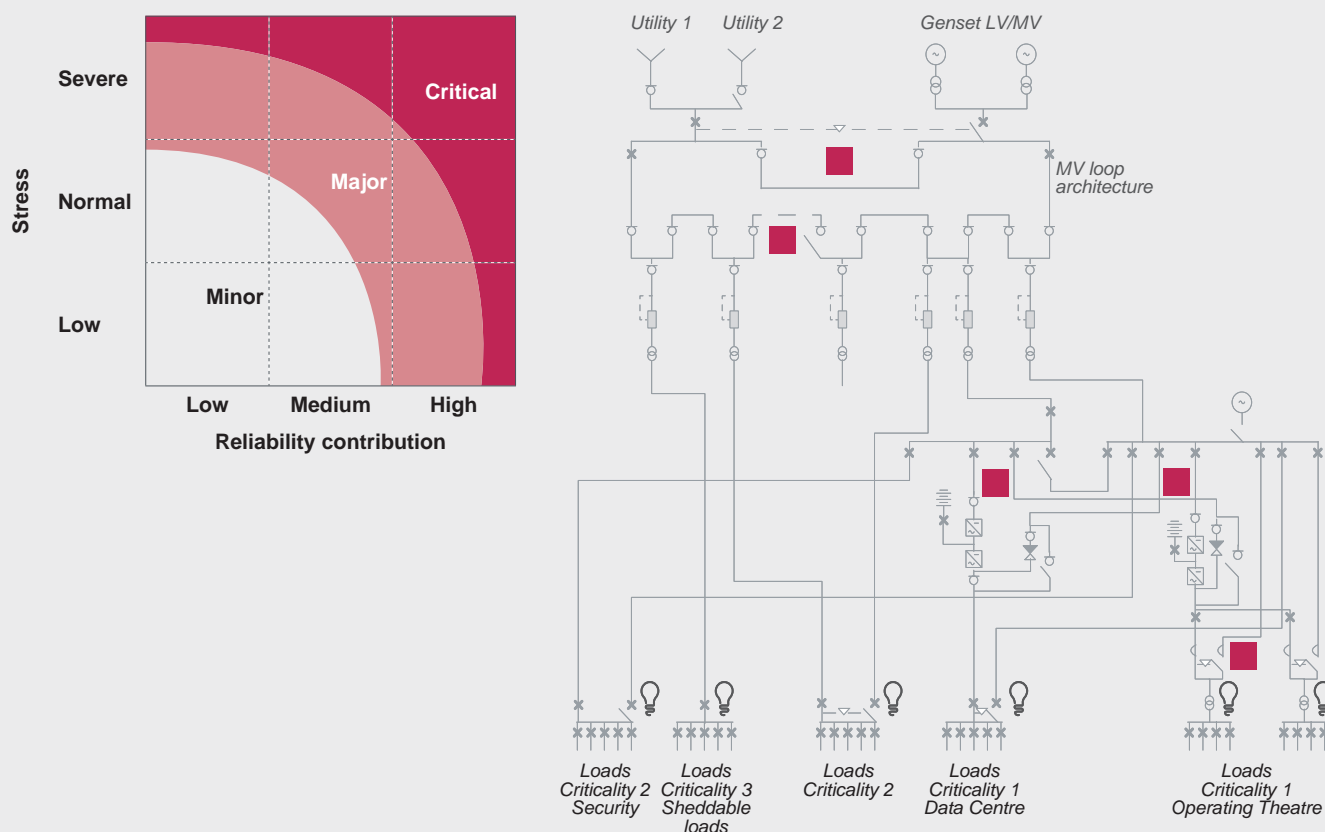
The plan is based on two criteria:

- The criticality of each device in the installation.
- The device operating conditions.

The criticality of an ED equipment depends on two factors:

- Exploitation conditions categorized by the stress level (low, normal, severe) to which the ED equipment is subjected.
- The level of contribution (low, medium, high) of the ED equipment toward the reliability of the installation, measured by shutdowns, production losses, corrective intervention costs, process ramp-up costs, etc. An empirical estimate may be sufficient for simple cases, but it is necessary to undertake a reliability analysis of the installation for more complex architectures involving backup sources, transfer mechanisms, etc.

Consequently, for a given device, maintenance may vary substantially in terms of both necessary maintenance activities and their frequency.



Following manufacturer's service recommendations, the frequency of interventions (Advanced or Exclusive) should be increased according to:

- Level of criticality (Minor, Major, Critical).
- Environment conditions (normal or severe).

		For equipments under environment (corrosive, humidity, heat, dust)	
		Normal	Severe
For equipments with a level of criticality	Minor		Advanced every 1 year Exclusive every 3 years
	Major	Advanced every 1 year Exclusive every 3 years	Advanced every 1 year Exclusive every 2 years
	Critical	Advanced every 1 year Exclusive every 2 years	Advanced every 1 year Exclusive every 1 year

ED equipment ageing

The older or closer to its obsolescence date ED equipment becomes, the higher the risk of shutdown.

Adjustments done during interventions become increasingly complex due to the lack of some spare parts, which lengthens intervention times.

2.7 - Spare Parts

Every piece of equipment has an associated risk of failure.

While you can minimise risk by choosing high-quality ED equipment and performing regular maintenance, that risk can never be entirely eliminated.

By having access to original spare parts at the right time according to the ED equipment manufacturer's recommendations, you can ensure that your equipment is returned to service in the shortest possible time, avoiding lost revenue and safeguarding your assets and business. (See more p. 20).



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Level of intervention	People	Methods	Tools	Spare Parts	Services coverage	Maintenance execution	Examples of actions
EXCLUSIVE	Master technician in several technologies / processes with industrial support equipment when factory repair is requested	Recall action when identification and on-site troubleshooting is not possible. Return to the factory for deep inspection and repair	Industrial (logistic / technical) support available when a recall is required	Equipment / moving parts will generally be returned to the factory for thorough inspection and repair. Parts assortment / availability is secured for a full repair		Manufacturer's factory or workshop	General overhaul/review with dismantling of whole equipment Replace obsolete/worn-out equipment
	Master technician in: • particular technique / technology of a specialist support equipment • ED equipment assembly / manufacturing process that may affect equipment performance after intervention (ie. switchgear for adjustments of spare parts)	Important and complex Corrective / Preventive / Diagnostic activities, with very heavy equipment disassembly, described in manufacturer's maintenance guides (activities / operations procedures)	Proprietary / specialist support equipment / test tools / software (enriched with original equipment manufacturing technical data). Recommended for intervention when applicable (see ProDiag tools table p. 25)	Complex components KITS for upgrading functionality that needs Heavy later adjustments as Latching box, Dumper, Pressure switch Exclusive availability to Schneider Electric services for next intervention		On-site	Technical upgrading. Change of function performance. Change of use. ED equipment diagnosis
ADVANCED	Technician qualified to use complex tools/measures/ setting devices thanks to advanced training modules in use of complex manufacturer's maintenance guides	Complex Corrective/ Preventive activities, with heavy equipment disassembly, described in manufacturer's maintenance guides	Standard support equipment (market metering tools) complex to use	Complex components that needs light later adjustment such as Mechanical links, Bearings, Auxiliary contacts Available/ dispatched to Schneider Electric /Partner for next preventive intervention	ED Equipment Manufacturer services	On-site	Replacement of manufacturer's original parts. Complex general adjustments, realignment. Identification and troubleshooting
	LIGHT	Technician accredited in basic training modules in use of simple manufacturer' s maintenance guides	Simple Corrective/ Preventive activities, with light equipment disassembly, described in manufacturer's maintenance guides	Built-in or external Mechanical Tools, easy to use		Simple components to be exchanged as Motors, Coils, Relays Available / dispatched to customer for next preventive intervention	On-site
		Certified customer employee according to the manufacturer maintenance instructions	Basic knowledge in the Electrical field	No special tool is requested	Consumables as Fuses, Bulbs, Plug-in, sockets equipments easily removable Available / dispatched to customer for next preventive intervention	End-User/Non certified partner	On-site

3.1 - Highly qualified personnel



Schneider Electric Field Service Representatives (FSRs)

are characterised by in-depth knowledge of:

- Equipment maintenance at functional, technical, and life cycle levels
- Use of technologies like patented design principles: breaking technologies, rotating arc, etc.
- Equipment integration into its environment: understanding of electrical phenomena, power networks, etc.
- Safety rules for everyone involved, the equipment, and the overall electrical network because of permanent yearly training about equipment upgrades, new equipment, and best practices.

Service centers

These house the main resources for carrying out manufacturer maintenance work:

- The Services sales team is the customer's correspondent for defining work to be conducted and for following contracts.
- Our FSRs visit customer sites to carry out manufacturer maintenance on all Schneider Electric ED equipment.
- Service assistants schedule the work of FSRs and manage contract administration.

Expert Centres

These house the most skilled and involved technicians who carry out manufacturer's maintenance work at several levels:

- Preparing major work that may include equipment refurbishment.
- Solving network-related problems (harmonics, discrimination etc.).

3.2 - Customised maintenance procedures and methods



Schneider Electric FSRs are committed to high-quality approaches and have detailed maintenance procedures (planning, prevention plans, installed base readings, safety, executing work, reporting, recommendations, etc.) for all equipment ranges.

As a result of decades of our experience, **Schneider Electric has defined dedicated maintenance service offers for each of its ED devices.**

These maintenance service offers are constantly evolving as a result of the integration of new solutions, functionality, and technologies. Feedback about our equipment in its operating environment enables us to improve our methods and procedures (particularly through actions relating to diagnostic work and conditional maintenance).

This Maintenance Services Guide defines all maintenance activities - from installation safety preparation and starting maintenance jobs to final verification that the ED equipment works as expected - for each type of intervention. Some of these activities, however, are related to particular ED equipment spare parts that are reserved exclusively for manufacturer's FSRs, i.e., for manufacturer's maintenance activities declared as Exclusive Maintenance.

This is to secure compliance with the rigorous procedures required when replacing such parts. These complex procedures may affect ED equipment performance after intervention (e.g., circuit breakers, switchgear). They require:

- Dismantling/reassembly of sensitive components.
- Unique knowledge of technologies used (patented design principles: breaking, rotating arc, etc.).
- Qualification in final assembly/operation of ED equipment.

Services teams housed in Expert Centres are responsible for planning annual service operations. Expert Centres possess the competencies to:

- Define Tailored Maintenance Service Plans under the format of short-, medium-, or long-term contracts named Advantage Service Plans.
- Schedule orders of On-Demand Preventive or On site condition Maintenance services (one shot/multiple intervention plan).
- Schedule orders of Reactive services (unplanned emergency shutdowns).



For Advantage Services Plans see our brochure 998- 1234034_A_GMA-GB

3.3 - Access to manufacturer original spare parts

Schneider Electric supplies original spare parts for both active and discontinued MV and LV equipment.

Schneider Electric can provide assistance with identifying the spare parts required for your electrical distribution equipment.

Schneider Electric's spare parts management policy identifies three major phases in the life of electrical distribution equipment:

Active

1

Electrical distribution equipment is part of Schneider Electric's commercialised offer. The spare parts offer defined in the equipment catalogue is available.

Discontinued

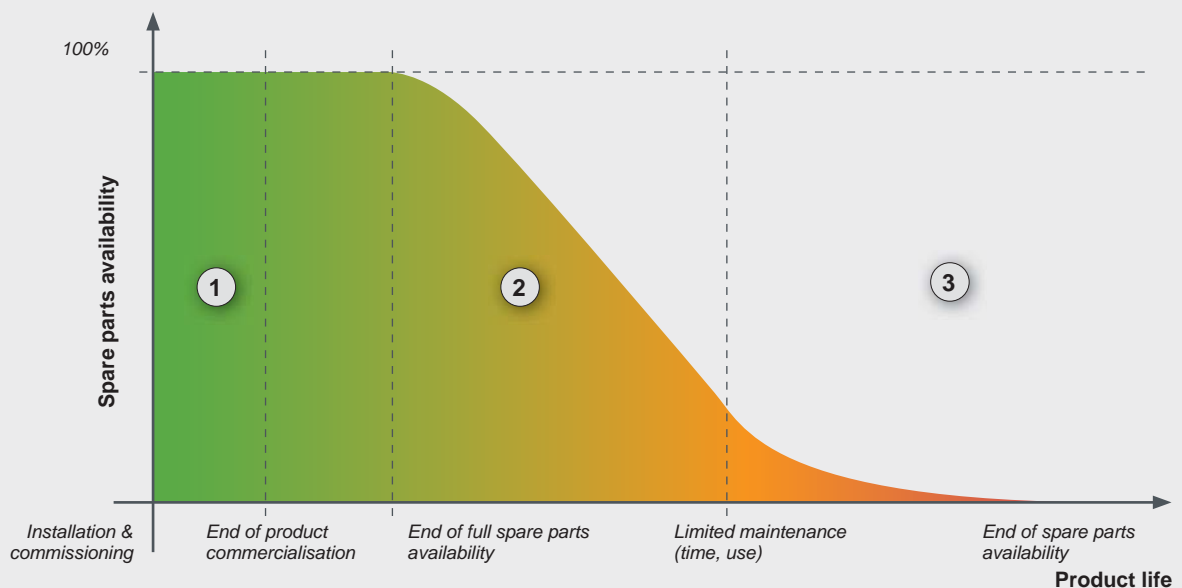
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The equipment cannot be used for new projects (end of commercialisation). However, the service for the existing installed base is secured. The spare parts offer remains available for a period of 10 years for LV and 12 years for MV ED equipment. This is the optimum time for solution modernization to be considered.

Limited maintenance

3

Unless specific agreements exist, any spare parts for maintenance and repair are no longer available.



Storage conditions

Spare parts must be stored in a dry and ventilated room, protected from rain, water, dust, and chemical agents.

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

If stored in severe conditions (e.g., high temperature, corrosive atmosphere), it is necessary to check spare parts regularly to ensure correct device operation when needed (i.e., electronic devices need to be checked regularly, and battery and clocks need to be energized every 1-2 years).



“Secure” Spare Parts

These are most often replaced in order to avoid unexpected shutdowns/corrective interventions. “Secure” Spare Parts failures are unpredictable and usually inexpensive. However, consequences of their failure could impact running processes. Therefore, we strongly recommend stocking them at the customer's premises.

Whether as part of a tailored kit or in a central store, it's reassuring to know that “Secure” spare parts are available to you 24/7.

“Prevent” Spare Parts

“Prevent” spare parts are those that are recognized as degraded during preventive maintenance FSR intervention. “Prevent” spare parts installation is conducted during Exclusive or Advanced maintenance by qualified expert because they may affect ED equipment performance. These spare parts wear and tear is difficult to be predicted out of Schneider Electric preventive maintenance interventions. It is recommended to stock them in customer's premises for faster and cost effective interventions.

“Life Extension” Spare Parts

These are the core parts necessary to extend the life of your equipment. Schneider Electric FSRs will support you in scheduling their supply in accordance with ED equipment maintenance plans.

	Secure	Prevent	Life Extension
Reactive	✓		
Preventive		✓	
On site condition			✓

Spare parts categories most often used per each type of maintenance

Schneider can help you to optimize your spare parts stocks

According to the ED equipment criticality in your process and its operating environment, Schneider Electric can advise you regarding which spare parts to stock.



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[Schneider Electric proprietary and standard diagnostic tools]

Schneider Electric offers a large portfolio of proprietary diagnostic services for your electrical distribution equipment. This offer is complemented by standard technologies and tools like IR thermography.

Industries and businesses eligible to enrich their maintenance management plans to minimise or eliminate process shutdown risks at an optimum cost include the following:

Electro-intensive industries:

- Electric utilities.
- Mining and minerals.
- Metals.
- Oil and gas.
- Marine.
- Chemical.
- Pharmaceuticals.

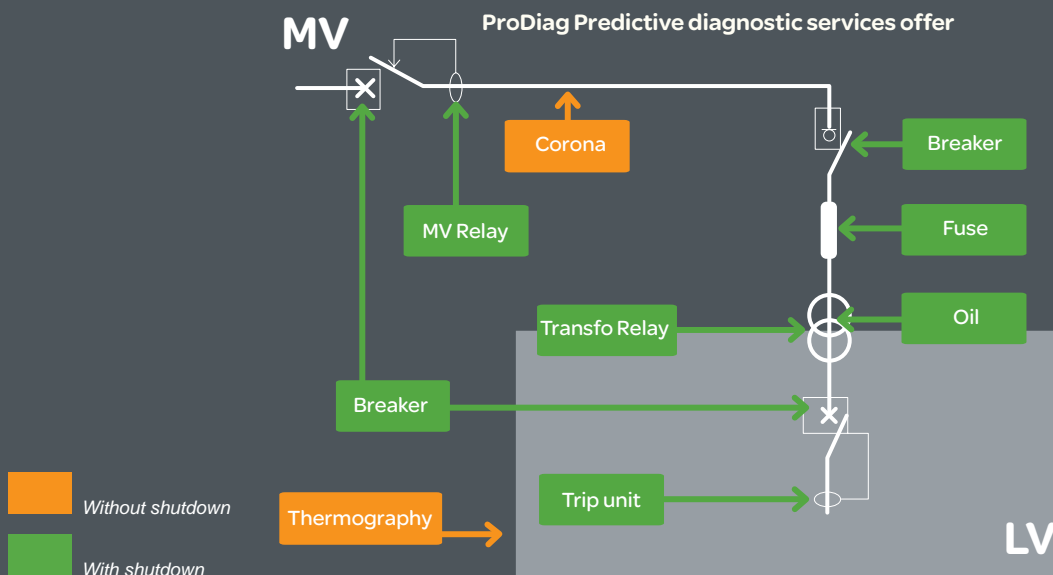
Electro-sensitive businesses:

- Healthcare.
- Food and beverage.
- Public transport.
- Data centers.

Equipped with vast experience acquired over more than 30 years in services, Schneider Electric has developed proprietary tools to diagnose failures and estimate the expected life of potentially faulty parts or systems in LV and MV ED equipment.

By augmenting preventive maintenance plans with diagnostic tools, customers mitigate the risk of future shutdowns. The technical prowess of these tools allows equipment to be qualified, including new generations of equipment that integrate advanced functions.

See the panorama below about Schneider Electric's diagnostic service offers.



ProDiag proprietary diagnostic tools applicable to Schneider Electric equipment

	Breaker(2)	Trip Unit(2)	MV Relay	Corona (2)	Fuse (2)	Transfo Relay(2)	Oil	Thermography
Medium Voltage								
MV Switch cubicle				✓				
MV Circuit Breaker / Switch cubicle	✓			✓				
MV Fuses/Contactor cubicle	✓			✓	✓			
MV Fuses/Switch cubicle				✓	✓			
MV Metering cubicle				✓	✓			
MV Ring main unit (RMU)				✓	✓			
Protection Relays								
MV Protection Relays			✓ (1)					
Transformers								
Distribution Transformer						✓	✓	
Power Transformer						✓	✓	
Low Voltage								
LV Circuit breaker	✓	✓						✓
LV Switchboard								✓
LV Capacitors bank								✓

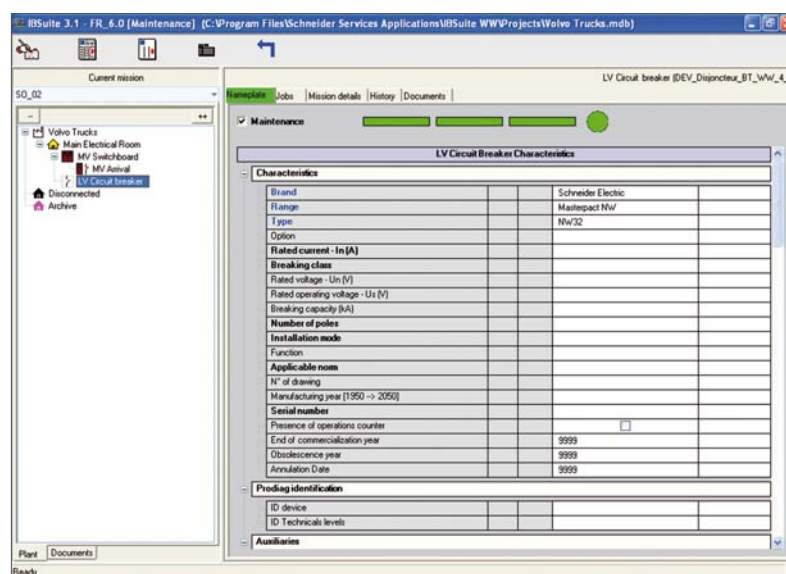
(1) Integration within Schneider Electric IBSuite (Professional Installed Base Services Software) is under development

(2) Integrated inside Schneider Electric IBSuite (Professional Installed Base Services Software)

Integrated within Schneider Electric IBSuite (Professional Installed Base Services Software)

Schneider Electric IBSuite is a professional Installed Base Services Software. It is a proprietary application to:

- Track installations of customer premises and all their particular characteristics.
- Propose corresponding maintenance activities according to equipment characteristics and remind about previous intervention recommendations.
- Record intervention history, corresponding reporting, and recommendations associated with each installation.
- Integrate expert diagnostic applications with operating process and automatic data uploading measured from test analyzers.
- Consolidate unique reports for all devices maintained during an intervention.





ProDiag Breaker

Customer needs

A quick and reliably opening LV/MV circuit breaker is now a strategic function for evaluating the full operating chain.

Its fault detection rate and reaction speed stops short circuits from developing. Regular diagnosis of the complete operating chain performance in accordance with the manufacturer's recommendations is necessary to secure ED equipment protection and service continuity.

LV/MV ED equipment used to run the ProDiag Breaker diagnostic service are LV and MV circuit-breakers that have not received any maintenance intervention in the last four years (under normal operating conditions, and less if operating in severe environments).

The aim of ProDiag Breaker (hardware-software proprietary solution) is to mitigate the risks of circuit-breaker full operating chain kinematic drifts and contacts simultaneity causing of unwanted effects. The result of extra low/high speed opening/closing/spring-loading of operating mechanisms can create stress on internal moving parts with consequent accelerated wear and tear, overheating and/or resulting internal fires, total destruction of the circuit-breaker and switchgear, even the complete destruction of the electrical room.

Customer benefits

ProDiag Breaker helps customers visualise, discover, and understand circuit breaker performance and equipment wear and tear as compared to original performance.

This solution monitors the opening, closing, spring-loading operations, and deviations (de-energized circuit breakers) in order to anticipate future failures.

Thanks to ProDiag Breaker, customer can implement, manage, and enrich their maintenance plans. Schneider Electric FSRs conclude their on-site intervention with an exhaustive report on ED equipment conformity. If ED equipment is non-conforming, the Schneider Electric FSRs will suggest the corrective action (including spare parts to be replaced) required to ensure circuit-breaker safety and service continuity.

Customer should enrich their preventive maintenance plans with this corrective action for the most convenient time for each ED device.

Preventive maintenance, including regular diagnostics, is what we call On site condition maintenance. It helps customers implement, manage, plan, and smooth annual maintenance budgets, and minimize the total cost of ownership.



"Unique value for customer vs standard market tools"

Measurements (kinematic drifts parameters) of Schneider Electric circuit breakers on a customer site are taken by kinematic sensors and transmitted to the Schneider Electric FSRs' ProDiag Breaker software. They are compared to a database of proprietary measurements of original circuit breaker data collected from Schneider Electric factories.

The aim is to determine whether recorded measurements are within the acceptable range, at the limit, or outside it, as criteria for declaring the circuit breakers conforming/non-conforming.

As an ED equipment manufacturer, Schneider Electric is uniquely positioned to develop and invest in specific testing tools (kinematic sensors for each range) and a testing methodology (measuring points) for collecting reliable measures of kinematic drift parameters. This is the ProDiag Breaker solution.

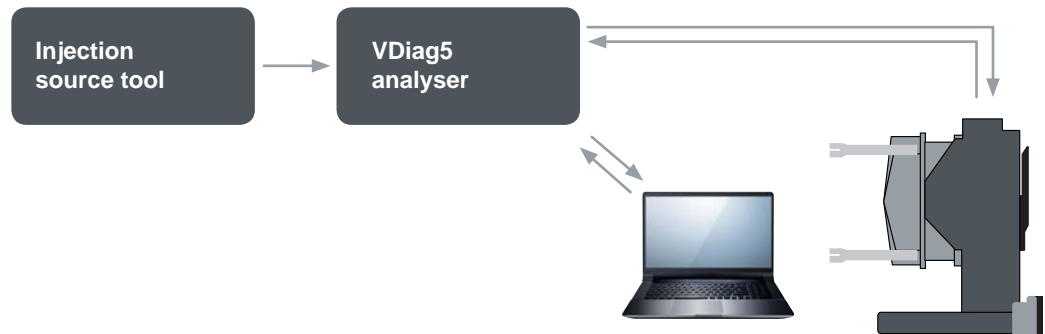


> ProDiag Breaker

ProDiag Breaker software can measure, record, and analyse a larger number of parameters than standard tools on the market: closing/opening over-travel to confirm the closing/opening on save position, acceleration/deceleration of moving parts through dumper system control to reduce equipment wear and tear, etc.

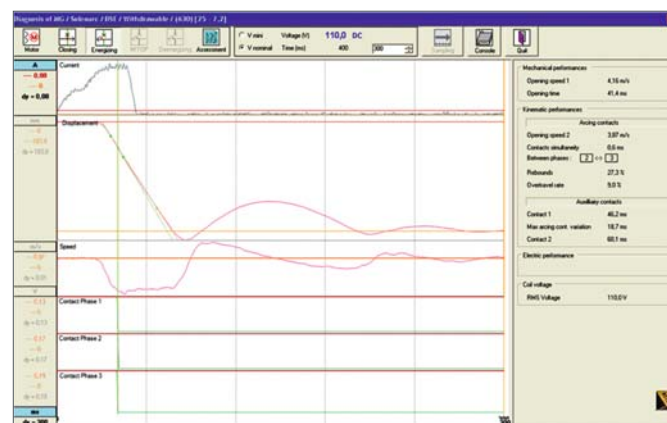
The result is best-in-class circuit breaker diagnosis.

Schneider Electric scope: Main Schneider Electric equipment (consult us).

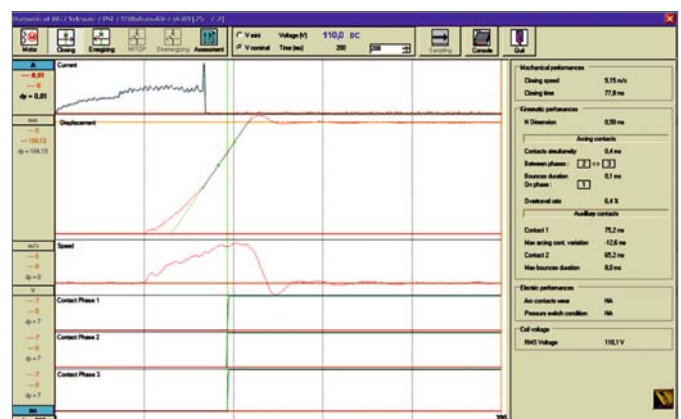


Measurements taken on de-energized equipment:

1. Charging time of control mechanism
2. Opening and closing times
3. Opening and closing speeds
4. Simultaneity of contacts at opening and closing
5. Check safety to close (overtravel and stabilisation)
6. Check safety to open (overtravel and stabilisation)
7. Wear of arcing contacts
8. Contact and insulator resistance
9. Check / adjustment of condition of the damper and / or stop device



Analyse of closing function



Analyse of opening function



ProDiag Trip Unit Customer needs

Accurate tripping time operation in accordance with control unit settings defined for an electrical installation is now a strategic function for evaluating protection performance. Fault detection and tripping speed reaction stops short circuits from developing.

Regular diagnosis of LV circuit breaker control unit tripping performance according to manufacturer recommendations is required to secure LV ED equipment protection and service continuity, which are important for customers.

The ProDiag Trip Unit service solution can be used on LV Circuit Breaker Trip units that have not received any maintenance intervention in the last four years (under normal operating conditions, and less if operating in severe environments or depending on their criticality in the installation).

Designed by Schneider Electric, the purpose of ProDiag Trip Unit (a hardware-software proprietary solution) is to mitigate the risks of poor LV circuit breaker trip unit performance on tripping time drifts, etc., causing unwanted effects. Such problems can lead to unexpected power failures, downstream industrial equipment inefficiencies, potential breakdowns, or even longer short circuits with resulting internal fires, circuit breaker and switchgear destruction, or even complete destruction of the electrical room.

Customer benefits

The ProDiag Trip Unit helps customer visualise, discover, and understand LV circuit breaker control unit performance and criticality. Tripping times are highlighted on the original equipment tripping curve and give a clear indication in a customer report of whether they fall within the specified parameters.

Thanks to the ProDiag Trip Unit, customers can implement, manage, and enrich their maintenance plans. Schneider Electric FSRs conclude their on-site intervention with an exhaustive report about ED equipment conformity. If ED equipment is declared nonconforming, Schneider Electric FSR suggest the corrective actions (including spare parts to be replaced) required to ensure circuit breaker safety and service continuity.

Customer can augment their preventive maintenance plans with a corrective interventions plan during the most convenient time for each ED device. ProDiag helps customers implement, manage, plan, and smooth annual maintenance budgets and minimise total cost of ownership.

ProDiag Trip Unit



> ProDiag Trip Unit "Unique value for customer vs standard market tools"

Manual and automatic measurements (tripping times, primary current based on secondary injection current) from Schneider Electric circuit breaker control units with on-site customer settings are recorded with a proprietary injection test kit.

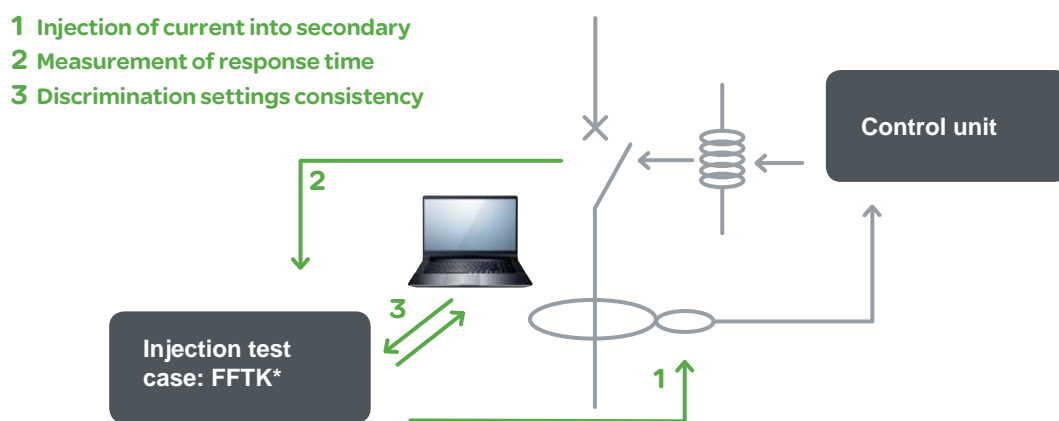
These values are recorded by the Schneider Electric FSRs using ProDiag Trip Unit software that already integrates all tripping curves and a settings database of the original equipment (Schneider Electric circuit breaker control units, i.e., ST, STR, Micrologic, etc.) according to the settings (discrimination parameters) defined for the circuit breaker within the electrical installation under diagnosis.

The goal is to determine whether recorded measurements are within the acceptable range, at the limit, or fall outside it, as criteria for LV circuit breaker control unit conformity.

As equipment manufacturer, Schneider Electric is uniquely positioned to develop and invest in specific testing tools, proprietary software, and a testing methodology for collecting reliable control unit measurements. This is the ProDiag Trip Unit solution.

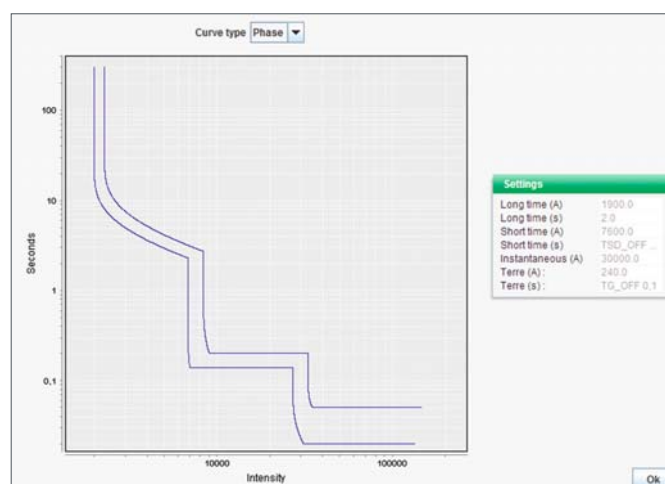
In addition, ProDiag Trip Unit checks the discrimination settings consistency between upstream and/or downstream devices. The goal is to deliver best-in-class circuit breaker control unit diagnostics.

Schneider Electric scope: ST, STR, Micrologic (consult us).



*Full Function Test Kit

ProDiag Trip Unit



Masterpact NW20 tripping curve

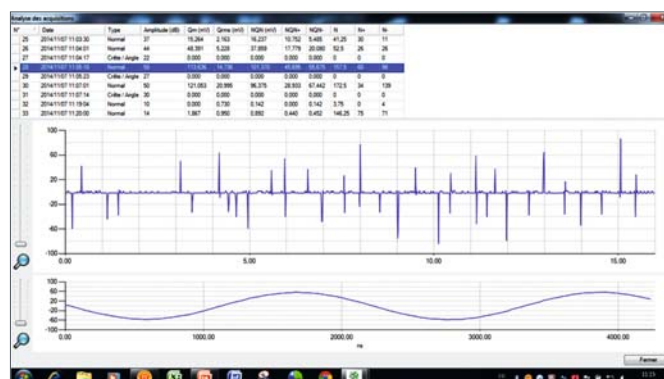
Electrical power installations must often operate under conditions of heavy condensation. Condensation and electrical stress are the major causes of partial discharges responsible for abnormal, accelerated ageing of insulating parts in MV equipment. Insulating parts deliver a strategic function evaluated through surface/internal partial discharge detection.

Designed by Schneider Electric, the purpose of ProDiag Corona (a proprietary, hardware-software solution) is to mitigate the risks of MV equipment's insulating parts' accelerated wear and tear or ageing causing unwanted effects.

Customer benefits

Thanks to ProDiag Corona, customers can implement, manage, and enrich their maintenance plans.

If the ED equipment is declared non-conforming, Schneider Electric will suggest a corrective interventions plan. Corrective plans include the spare parts to be replaced and recommendations concerning the electrical room (ventilation, air filtration) in order to regain the original performance in terms of safety and service continuity.



30

> ProDiag Corona "Unique value for customer vs standard market tools"

Measurements (partial discharges) on Schneider Electric MV equipment on customer sites are taken using a Voltage Indicator System (VIS) and XDP2 measuring tool. Measured data are registered by Schneider Electric FSR into the ProDiag Corona software.

Thanks to their equipment architecture knowledge, in case of partial discharge phenomenon, the FSR can easily detect its location. The aim is to determine whether the recorded measurements are within the acceptable range, at the limit, or fall outside it, as criteria for ED equipment conformity.

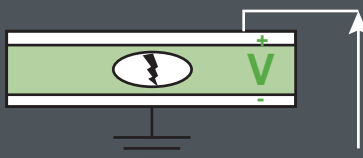
As an ED equipment manufacturer, Schneider Electric is uniquely positioned to develop and invest in specific tests tools, proprietary software, and testing methodology to collect reliable measurements from surface/internal partial discharges.

ProDiag Corona solution can measure, record, and analyse a large number of parameters that allow a better understanding of partial discharge phenomena. The result is best-in-class MV equipment diagnostics.

Schneider Electric scope: Schneider Electric equipment (consult us).

3 different types of partial discharge

1. Internal discharge



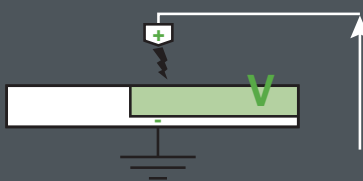
Dielectric breakdown
Internal breakdown

2. Surface discharge



Dielectric breakdown
Surface breakdown

3. Corona discharge



Dielectric breakdown
Surface breakdown

ProDiag Corona



> ProDiag Fuse

Customer needs

Electrical power installations protected by MV switchgear with fuse protection should be regularly checked (for correct assembly, electrical parameters, etc.) to confirm that their characteristics correspond to the original specification. Regular diagnosis of fuse performance (electrical parameters, resistance) according to the manufacturer's recommendations is necessary to secure the ED installation and its service continuity, which are important for customers.

The ProDiag Fuse diagnostic solution can be used on MV switchgear protected by fuses that have not received any maintenance intervention in the last four years (under normal operating conditions, and less if operating in severe environments or depending on their criticality in the installation).

The purpose of ProDiag Fuse (a proprietary hardware-software solution) is to mitigate the risks on MV switchgear and equipment by fuses of faults or drifts causing unwanted effects. The result of fuse premature ageing caused by thermal or electrical over-stressing of the high-voltage system is the destruction of filaments that can lead to thermal runaway, partial damage, complete destruction of MV switchgear and equipment, or even destruction of the electrical room.

Customer benefits

ProDiag Fuse helps customers visualise, discover, and understand MV switchgear fuse ageing and wear and tear as compared to the original fuse manufacturers' technical specification.

ProDiag Fuse monitors the performance of MV switchgear fuses.

Thanks to ProDiag Fuse, maintenance managers can implement, manage, and enrich their maintenance plans. Schneider Electric FSRs conclude their on-site interventions with an exhaustive report on the MV switchgear fuses conformity/non-conformity. If a MV fuse is declared non-conforming, Schneider Electric suggests a corrective plan that includes fuse replacement to regain original performance in safety and service continuity.

Customers can augment their preventive maintenance plans with this corrective action at the most convenient time for each ED device.

"Unique value for customer vs standard market tools"

Electrical parameter measurements (resistance, etc.) on MV switchgear fuses at customer sites are taken by a test tool and transmitted to the Schneider Electric FSRs' ProDiag Fuse software. Data are compared to those of a fuse manufacturers' technical database.

The aim is to determine whether recorded measurements are within the acceptable range, at the limit, or fall outside it, as criteria for MV switchgear fuse conformity.

As an ED equipment manufacturer, Schneider Electric is uniquely positioned to develop and invest in specific tests tools, proprietary software, and testing methodology to collect reliable measurements from MV switchgears fuses.

Schneider Electric scope: Schneider Electric fuses and main market fuses players.

ProDiag Fuse



> ProDiag Transfo Relay

Customer needs

Electro-intensive installations are equipped with oil distribution transformers. These are monitored by sensors activating a relay ordering transformer disconnection, hence protecting it.

The purpose of the relay is to protect the transformer and the downstream ED equipment. This relay unit should be regularly checked to confirm that it is working according to its original specification. The transformer protection relay offers a safety function for the transformer and downstream ED equipment in case of unwanted events.

Regular diagnosis of its performance (oil temperature, gas release, pressure metering) according to the manufacturer's recommendations is necessary to secure transformer protection and service continuity, which are important for customers.

Customer benefits

The ProDiag Transfo Relay (a proprietary hardware-software solution) mitigates the risks of transformer malfunctions causing unwanted effects. The usual symptoms of oil transformer malfunctions are oil temperature, pressure drifts, gas release, etc. The relay's purpose is to detect these drifts to avoid transformer inefficiency, overheating, fire, or destruction of the transformer and downstream ED equipment, or even the complete destruction of the electrical room.

Thanks to the ProDiag Transfo Relay, customers can visualise, discover, and understand) transformer ageing and wear and tear as compared to the original transformer technical specification. The ProDiag Transfo Relay monitors the performance of the transformer protection relay. It helps customers implement, manage, and enrich their maintenance plans.

Schneider Electric FSRs concludes their on-site intervention with an exhaustive report on transformer protection relay conformity and non-conformity. If a transformer protection relay is declared non-conforming, the Schneider Electric FSR proposes a corrective action plan. The corrective action plan can recommend the replacement of the relay to restore the transformer's original performance in terms of safety and service continuity.

Customers can enrich their preventive maintenance plans with this corrective interventions plan action at the most convenient time.

"Unique value for customer vs standard market tools"

Electrical parameter measurements (oil temperature, pressure, release of gases) of on-site transformer protection relays are transmitted by Schneider Electric FSRs' into ProDiag Transfo Relay software. Schneider Electric FSRs will determine whether the recorded measurements are within or outside the acceptable range, following criteria for transformer protection relay conformity.

As an ED equipment manufacturer, Schneider Electric is uniquely positioned to develop and invest in specific tests tools, proprietary software, and testing methodology (reporting) to collect reliable measurements from transformer protection relays.

ProDiag Transfo Relay measures a larger number of parameters than standard market tools. For example, standard market tools test only the protection chain by switching the relay's free contacts. ProDiag Transfo Relay is the only market tool that diagnoses the accuracy of protection relay sensors as well as their calibration (temperature probe, pressure switch, and reed).

Schneider Electric scope: DGPT2, DMCR, RIS relays and third-party products.

> ProDiag Transfo Relay



Customer needs

Electro-intensive installations are equipped with oil distribution transformers or medium power transformers. Annual analysis of the oil's dielectric characteristics (more often in severe environments: corrosive, offshore, marine) according to the manufacturer's recommendations offers peace-of-mind. It secures its performance maintaining its performance according to the original specification, enhancing transformer safety and that of the downstream ED equipment, extending its lifespan, and securing its service continuity, which are important for customers.

Customer benefits

ProDiag Oil monitors the oil's dielectric characteristics, helping customers visualise, discover, and understand oil transformer ageing and wear as compared to the original technical specification, as well as adopt, manage, and enrich their maintenance plans.

The outcome is an exhaustive report about the oil transformer diagnosis, depending on the service contracted. If needed, Schneider Electric FSRs will suggest corrective actions that might consist of maintenance, repair, or replacement of the oil transformer to restore its original performance in safety and service continuity.

Customers can enrich their preventive maintenance plans with this corrective action at the most convenient time for each transformer to smooth out their annual maintenance budgets. They can reduce Total Cost of Ownership as ProDiag Oil can mitigate the risks of oil transformer malfunctions causing unwanted effects.

One symptom of transformer malfunction is degradation of the dielectric oil. Its consequences can be transformer energy inefficiency (risk of overheating), electrical arcing, fire, destruction of the transformer and downstream ED equipment, or even complete destruction of the electrical room.

"Unique value for customer vs standard market tools"

The transformer's oil is sampled at the customer site and sent to a Schneider Electric Laboratory or Certified Partner Lab for analysis. Later it is compared with a database of proprietary measurements of original oil distribution transformers collected from Schneider Electric factories.

The purpose is to determine whether sample measurements are within the acceptable range, at or outside the limit, as criteria for oil transformer conformity and recommended expert actions. It is available in two packs:

- Pack 2+: Characterize the level of quality of the liquid dielectric (breakdown voltage, water content, acidity, color index, appearance) and internal fault properties through DGA (dissolved gases analysis).
- Pack 3: Check the solid insulation performance including Pack2+ and measurement of furan derivatives, specially recommended for power transformers. It measures a larger number of parameters than the standard market labs (relative permittivity, interfacial tension, kinematic viscosity, PCB contamination, etc.).

While others are able to conduct these tests, Schneider Electric provides distinctive added value with its:

- Know-how in interpreting analysis results by predicting eventual product failures thanks to our experience in transformer manufacturing, maintenance, and repair
- Unique competence to develop and invest in specific testing tools and methodology to conduct oil transformer diagnosis
- Support for customer implementation of effective remedial solutions.

Schneider Electric scope: All Dielectric liquid Distribution & Power Transformer.



ProDiag Thermography

Customer needs

Electro-intensive installations seek diagnostic solutions to revamp their maintenance plan that do not require de-energizing (shutdown) their processes. There is a widely known technology for identifying hot spots along the installation, free of shielding where an IR imaging camera can be applied.

The ED equipment where the InfraRed (IR) Thermography diagnosis service can be applied includes any LV device suspected of suffering from overheating that has not received any maintenance interventions in the last year under normal operating conditions (in accordance with the manufacturer's recommendations), or less time if located in severe environments (corrosive, offshore, marine) and according to its level of criticality in the installation.

The aim of IR Thermography is to mitigate the risks of LV ED equipment malfunctions causing unwanted effects. The origins of these thermal malfunctions can include bad connections, harmonics, overloads, unbalancing, etc. Its consequences can lead to a risk of overheating, fire, destruction of ED equipment, or even complete destruction of the electrical room.

Customer benefits

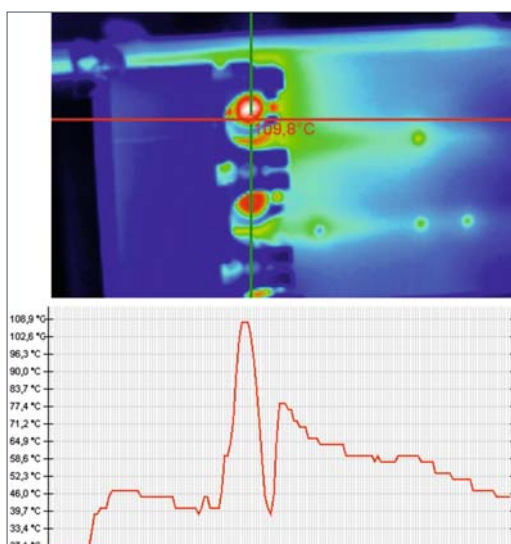
IR Thermography allows customers to visualise, discover, and understand installation-critical hot spots, providing an image of what is happening in the form of a temperature gradient. These images allow installation hot spots to be identified and addressed.

With IR Thermography, customers can implement, manage, and enrich their maintenance plans. A predictive IR Thermography service delivers an exhaustive report on installation hot spots. This report, presented by Schneider Electric FSRs, suggests corrective actions. The corrective plan might consist of several check-ups, cleaning, greasing of contacts, an improving performance in terms of safety and service continuity.

"Unique value for customer vs standard market tools"

IR thermography is a standard market diagnostic tool that is part of Schneider Electric's diagnostic tools portfolio. The purpose is to determine whether thermal measurements are within the acceptable range, or at or outside the limits. They are compared to ED equipment technical specifications and/or historical manufacturers' technical data base as criteria for LV conformity and recommended expert actions.

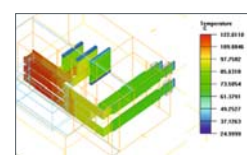
ProDiag Thermography



Downstream switchgear connection



Polyfast Statement after disconnection





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5.1 - Medium Voltage



Fuse - Contactor Cubicle

Fuse - Contactor Cubicle / Main recommended maintenance activities

Preventive maintenance activities	Minimal Frequency ⁽¹⁾ / Performance Level									
	Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10
LV Compartment										
Checking of connexions	●	●	●	●	●	●	●	●	●	●
Checking of wiring	●	●	●	●	●	●	●	●	●	●
Contactor										
Inspection of enclosure (chalking, cracking, signs of heating)	●	●	●	●	●	●	●	●	●	●
Inspection of connections (tightening, chalking, signs of heating)	●	●	●	●	●	●	●	●	●	●
Inspection / check of auxiliaries contacts (signaling contacts, coils, wiring)	●	●	●	●	●	●	●	●	●	●
Inspection / checking / adjustment of latching system				●				●		
Inspection / adjustment of coil contact insertion				●				●		
Checking wearing and simultaneity of arcing contacts				●				●		
Tests										
Mechanical (manual on/off)	●	●	●	●	●	●	●	●	●	●
Electrical (remote on/off)	●	●	●	●	●	●	●	●	●	●
Busbar compartment (power off)										
Cleaning of busbars				●				●		
Inspection of busbars (tightening, chalking, cracking, signs of heating)				●				●		
Inspection of isolators (tightening, chalking, cracking, signs of heating)				●				●		
Cables compartment										
Inspection of cables (tightening ,chalking, cracking, signs of heating)	●	●	●	●	●	●	●	●	●	●
Inspection of isolators (tightening ,chalking, cracking, signs of heating)	●	●	●	●	●	●	●	●	●	●
Cleaning / greasing of earthing switch	●	●	●	●	●	●	●	●	●	●
Contactor compartment										
Inspection of ground and interlock disconnecter operating mechanism	●	●	●	●	●	●	●	●	●	●
Inspection of functional interlocks (connection, disconnection, grounding switches)	●	●	●	●	●	●	●	●	●	●
Inspection of locks	●	●	●	●	●	●	●	●	●	●
Inspection of connections (tightening, chalking, signs of heating)	●	●	●	●	●	●	●	●	●	●
Inspection of shutter (signs of corrosion, arcing)	●	●	●	●	●	●	●	●	●	●
Cleaning / greasing of shutter locking system	●	●	●	●	●	●	●	●	●	●
Fuses										
Inspection of fuse (chalking, color, cracking, corrosion)	●	●	●	●	●	●	●	●	●	●
Inspection of fuse fixing	●	●	●	●	●	●	●	●	●	●
Inspection of fuse signaling microswitch	●	●	●	●	●	●	●	●	●	●
Inspection of fuse signaling striker	●	●	●	●	●	●	●	●	●	●
CT / VT										
Cleaning / inspection of isolators (tightening, chalking, cracking, signs of heating)	●	●	●	●	●	●	●	●	●	●
Cleaning / inspection of TPs (tightening, chalking, cracking, signs of heating)	●	●	●	●	●	●	●	●	●	●
Schneider Electric Proprietary Diagnosis services offers										
Diagnosis to detect drifts from the initial state and significant trends, to anticipate on the corrective action (future failures) required to ensure equipment safety and continuity of service, and plan the action for the most convenient time for customer operations. More info in chapter 4 of this guide										
ProDiag Breaker Monitors opening / closing / spring-loading operations drifts				●				●		
Checking / adjusting of condition of the damper and / or stop device				●				●		
Checking of opening / closing times and speeds				●				●		
Checking of charging time				●				●		
Checking of contact synchronization				●				●		
Checking of safety to close (overtravel and stabilisation)				●				●		
Checking of safety to open (overtravel and stabilisation)				●				●		
ProDiag Corona Surface/internal partial discharges detection.				●				●		
ProDiag Fuse Mesurement of fuses internal impedance / comparison with manufacturer's data				●				●		
Spare Parts										
Secure: Parts commonly used in corrective maintenance interventions										
Relay, LV Fuse	Light maintenance									
Auxilliary Contact	Light maintenance									
Tripping coil	Light maintenance									
Prevent: Parts whose conditon are checked in preventive maintenance interventions										
Earthing switch clusters	Advanced maintenance									
Pressure switch (gas version)	Advanced maintenance									
Electromagnetic coil	Exclusive maintenance									

(1) Recommended under optimal operating conditions. However this recommended frequency should be increased according to

a) the level of criticality (low, major, critical) and b) the severity of environment conditions (ie corrosive, naval, offshore) following the prescriptions of manufacturer's services (see table p. 15)

Schneider Electric ranges covered by this Maintenance guide: MCset, PIX , SM6, Fluokit, VM6, Fluair, DNF, Alliance.
Does not supersede the information provided in the product user guide.

Exclusive maintenance conducted by ED equipment manufacturer only
Advanced maintenance, preferably conducted by ED equipment manufacturer or manufacturer certified partner
Light maintenance, conducted by ED equipment manufacturer or customer competent technician

[Recommended maintenance activities]

Circuit Breaker Switch Cubicle

Circuit Breaker - Switch Cubicle / Main recommended maintenance activities

Preventive maintenance activities	Minimal Frequency ⁽¹⁾ / Performance Level									
	Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10
LV Compartment										
Inspection of auxiliaries equipments	●	●	●	●	●	●	●	●	●	●
Inspection of wiring connections (tightening, fixing)	●	●	●	●	●	●	●	●	●	●
Cubicle										
Cleaning cubicle / internal equipment	●	●	●	●	●	●	●	●	●	●
Inspection of the position indicators and signalling micro switches	●	●	●	●	●	●	●	●	●	●
Inspection of locking + interlocking mechanism function		●		●		●		●		●
Inspection of withdrawal mechanism		●		●		●		●		●
Inspection of the shutters		●		●		●		●		●
Cleaning / checking switch line operating mechanism				●				●		
Cleaning / checking of isolators (tightening ,chalking,cracking , signs of heating)				●				●		
Cleaning / checking of earthing switch operating mechanism				●				●		
Cleaning / checking / greasing of earthing switch plugs				●				●		
Cleaning / checking / greasing of shutter locking system				●				●		
Cables compartment										
Inspection of cables (chalking, signs of heating)	●	●	●	●	●	●	●	●	●	●
Inspection of wiring connections (tightening, fixing)	●	●	●	●	●	●	●	●	●	●
CT / VT compartment										
Cleaning / inspection of isolators (chalking,cracking , signs of heating)				●				●		
Cleaning / inspection of TPs (tightening ,chalking,cracking , signs of heating)				●				●		
Busbar compartment										
Inspection of busbars (tightening ,chalking,cracking, signs of heating)		●		●		●		●		●
Inspection of isolator switches (tightening ,chalking,cracking, signs of heating)		●		●		●		●		●
Circuit breaker										
General state: visual checking, cleanliness, insulator condition, oxidation, no corrosion of supporting structure	●	●	●	●	●	●	●	●	●	●
Checking of number of operation	●	●	●	●	●	●	●	●	●	●
Cleaning of resin bodies	●	●	●	●	●	●	●	●	●	●
Inspection of state of the auxiliaries contact (on/off , rack in ,rack off etc.)	●	●	●	●	●	●	●	●	●	●
Inspection of fonctionnal and safety interlock on device	●	●	●	●	●	●	●	●	●	●
Cleaning / checking / greasing of the power contacts (plugs , sliding contact , light greasing)				●				●		
Measurement of main contact resistance (microhmmeter)				●				●		
Cleaning /checking / greasing of the moving withdrawable parts		●		●		●		●		●
Checking of coupling rods		●		●		●		●		●
Cleaning / checking / greasing of the operating mechanism				●				●		
Cleaning / checking / greasing of the latching mechanism				●				●		
Cleaning / checking / greasing of the closing and opening springs				●				●		
Cleaning / checking / greasing of the motor and reduce				●				●		
Cleaning / checking / greasing of all linkages		●		●		●		●		●
Check LV electrical wiring connections		●		●		●		●		●
Tests										
Mechanical (manual on/off)	●	●	●	●	●	●	●	●	●	●
Electrical (remote on/off)	●	●	●	●	●	●	●	●	●	●
Associated protection										
Inspection of protection relay (setting , tripping functions)				●				●		
Inspection of upstream / downstream selectivity				●				●		
Schneider Electric Proprietary Diagnosis services offers										
Diagnosis to detect drifts from the initial state and significant trends, to anticipate on the corrective action (future failures) required to ensure equipment safety and continuity of service, and plan the action for the most convenient time for customer operations. More info in chapter 4 of this guide										
ProDiag Breaker Monitors opening / closing / spring-loading operations drifts				●				●		
Checking / adjusting of condition of the damper and / or stop device				●				●		
Checking of opening / closing times and speeds				●				●		
Checking of charging time				●				●		
Checking of contact synchronization				●				●		
Checking of safety to close (overtravel and stabilisation)				●				●		
Checking of safety to open (overtravel and stabilisation)				●				●		
ProDiag Corona Surface/internal partial discharges detection.				●				●		
Spare Parts										
Secure: Parts commonly used in corrective maintenance interventions										
Relay, LV Fuse	Light maintenance									
Auxilliary Contact	Light maintenance									
Tripping coil	Light maintenance									
Mitop for switch	Light maintenance									
Undervoltage coil	Advanced maintenance									
Motor	Advanced maintenance									
Prevent: Parts whose conditon are checked in preventive maintenance interventions										
Gear motor				Exclusive maintenance						
Operating mechanism				Exclusive maintenance						
Life extension: Parts to extend the life of the equipment										
Capacitive insulator	Advanced maintenance									
Earthing cluster	Advanced maintenance									

(1) Recommended under optimal operating conditions. However this recommended frequency should be increased according to a) the level of criticality (low, major, critical) and b) the severity of environment conditions (ie corrosive, naval, offshore) following the prescriptions of manufacturer's services (see table p. 15)

Schneider Electric ranges covered by this Maintenance guide: Fluair, MCset, PIX, F400, Alliance, DNF, SM6, Fluokit, VM6. Does not supersede the information provided in the product user guide.

Exclusive maintenance conducted by ED equipment manufacturer only
Advanced maintenance, preferably conducted by ED equipment manufacturer or manufacturer certified partner
Light maintenance, conducted by ED equipment manufacturer or customer competent technician



Preventive maintenance activities	Minimal Frequency ⁽¹⁾ / Performance Level									
	Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10
LV Compartment										
Checking of connexions	●	●	●	●	●	●	●	●	●	●
Checking of wiring	●	●	●	●	●	●	●	●	●	●
Cables compartment										
Inspection of cables (tightening, chalking, cracking , signs of heating)	●	●	●	●	●	●	●	●	●	●
Inspection of isolators (tightening, chalking, cracking , signs of heating)	●	●	●	●	●	●	●	●	●	●
Cleaning / checking / greasing of the earthing switch connection contacts				●				●		
Equipment compartment										
Cleaning / checking of active part and enclosure (chalking, cracking, signs of heating)	●	●	●	●	●	●	●	●	●	●
Cleaning / checking of isolators (chalking, signs of heating)	●	●	●	●	●	●	●	●	●	●
Checking of lock and inter-lock system	●	●	●	●	●	●	●	●	●	●
Checking of auxiliaries contacts position indicator	●	●	●	●	●	●	●	●	●	●
Cleaning / Checking of operating mechanism				●				●		
Cleaning / checking of the earthing switch operating mechanism				●				●		
Busbar compartment (power off)										
Inspection of busbars (signs of heating)				●				●		
Inspection of isolator switches (chalking, signs of heating)				●				●		
CT / VT (optional)										
Cleaning / inspection of isolators (tightening ,chalking,cracking , signs of heating)				●				●		
Cleaning / inspection of TPs (tightening ,chalking,cracking , signs of heating)				●				●		
Tests										
Mechanical (manual on/off)	●	●	●	●	●	●	●	●	●	●
Electrical (remote on/off)	●	●	●	●	●	●	●	●	●	●
Schneider Electric Proprietary Diagnosis services offers										
Diagnosis to detect drifts from the initial state and significant trends, to anticipate on the corrective action (future failures) required to ensure equipment safety and continuity of service, and plan the action for the most convenient time for customer operations. More info in chapter 4 of this guide										
ProDiag Corona Surface/internal partial discharges detection.				●				●		
Spare Parts										
Secure: Parts commonly used in corrective maintenance interventions										
Relay, LV Fuse	Light maintenance									
Auxilliary Contact	Light maintenance									
Tripping coil	Light maintenance									
Mitop for switch	Light maintenance									
Undervoltage coil	Advanced maintenance									
Motor	Advanced maintenance									
Prevent: Parts whose conditon are checked in preventive maintenance interventions										
Gear motor				Exclusive maintenance						
Operating mechanism				Exclusive maintenance						
Life extension: Parts to extend the life of the equipment										
Capacitive insulator	Advanced maintenance									
Earthing cluster	Advanced maintenance									

(1) Recommended under optimal operating conditions. However this recommended frequency should be increased according to a) the level of criticality (low, major, critical) and b) the severity of environment conditions (ie corrosive, naval, offshore) following the prescriptions of manufacturer's services (see table p. 15)

Switch Cubicle / Main recommended maintenance activities

Exclusive maintenance conducted by ED equipment manufacturer only
Advanced maintenance, preferably conducted by ED equipment manufacturer or manufacturer certified partner
Light maintenance, conducted by ED equipment manufacturer or customer competent technician



Schneider Electric ranges covered by this Maintenance guide: SM6, Fluokit, VM6.
Does not supersede the information provided in the product user guide.

[Recommended maintenance activities]

Fuse Switch Cubicle

Fuse Switch Cubicle / Main recommended maintenance activities

Preventive maintenance activities	Minimal Frequency ⁽¹⁾ / Performance Level									
	Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10
LV Compartment										
Inspection of connections	●	●	●	●	●	●	●	●	●	●
Inspection of wiring	●	●	●	●	●	●	●	●	●	●
Cables compartment										
Inspection of cables (tightening, chalking, cracking , signs of heating)	●	●	●	●	●	●	●	●	●	●
Inspection of isolators (tightening, chalking, cracking , signs of heating)	●	●	●	●	●	●	●	●	●	●
Cleaning / checking / greasing of the earthing switch connection contacts				●				●		
Equipment compartment										
Cleaning / checking of active part and enclosure (chalking, cracking, signs of heating)	●	●	●	●	●	●	●	●	●	●
Cleaning / checking of isolators (chalking, signs of heating)	●	●	●	●	●	●	●	●	●	●
Checking of lock and inter-lock system	●	●	●	●	●	●	●	●	●	●
Checking of auxiliaries contacts position indicator	●	●	●	●	●	●	●	●	●	●
Cleaning / Checking of operating mechanism				●				●		
Cleaning / checking of the earthing switch operating mechanism				●				●		
Fuses										
Inspection of fuse (chalking, color, cracking, corrosion)	●	●	●	●	●	●	●	●	●	●
Inspection of fuse fixing	●	●	●	●	●	●	●	●	●	●
Inspection of fuse signaling microswitch	●	●	●	●	●	●	●	●	●	●
Inspection of fuse striker	●	●	●	●	●	●	●	●	●	●
Busbar compartment (power off)										
Inspection of busbars (signs of heating)				●				●		
Inspection of isolator switches (chalking, signs of heating)				●				●		
CT / VT										
Cleaning / inspection of isolators (tightening ,chalking,cracking , signs of heating)				●				●		
Cleaning / inspection of TPs (tightening ,chalking,cracking , signs of heating)				●				●		
Tests										
Mechanical (manual on/off)	●	●	●	●	●	●	●	●	●	●
Electrical (remote on/off)	●	●	●	●	●	●	●	●	●	●
Schneider Electric Proprietary Diagnosis services offers										
Diagnosis to detect drifts from the initial state and significant trends, to anticipate on the corrective action (future failures) required to ensure equipment safety and continuity of service, and plan the action for the most convenient time for customer operations. More info in chapter 4 of this guide										
ProDiag Corona Surface/internal partial discharges detection.				●				●		
ProDiag Fuse. Mesurement of fuses internal impedance / comparison with manufacturer's data				●				●		
Spare Parts										
Secure: Parts commonly used in corrective maintenance interventions										
Relay, LV Fuse	Light maintenance									
Auxilliary Contact	Light maintenance									
Tripping coil	Light maintenance									
Mitop for switch	Light maintenance									
Undervoltage coil	Advanced maintenance									
Motor	Advanced maintenance									
Prevent: Parts whose conditon are checked in preventive maintenance interventions										
Gear motor				Exclusive maintenance						
Operating mechanism				Exclusive maintenance						
Life extension: Parts to extend the life of the equipment										
Capacitive insulator	Advanced maintenance									
Earthing and fuses cluster	Advanced maintenance									
MV Fuse (ProFusion maintenance)	Advanced maintenance									

(1) Recommended under optimal operating conditions. However this recommended frequency should be increased according to
a) the level of criticality (low, major, critical) and b) the severity of environment conditions (ie corrosive, naval, offshore) following the prescriptions of manufacturer's services (see table p. 15)

Exclusive maintenance conducted by ED equipment manufacturer only
Advanced maintenance, preferably conducted by ED equipment manufacturer or manufacturer certified partner
Light maintenance, conducted by ED equipment manufacturer or customer competent technician

Schneider Electric ranges covered by this Maintenance guide: SM6, Fluokit, VM6.
Does not supersede the information provided in the product user guide.

[Recommended maintenance activities]

Metering Cubicle

Metering Cubicle / Main recommended maintenance activities

Preventive maintenance activities	Minimal Frequency ⁽¹⁾ / Performance Level									
	Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10
LV Compartment										
Inspection of connections	●	●	●	●	●	●	●	●	●	●
Inspection of wiring	●	●	●	●	●	●	●	●	●	●
Equipment compartment										
Cleaning / checking of active part and enclosure (chalking, cracking, signs of heating)	●	●	●	●	●	●	●	●	●	●
Cleaning / checking of isolators (chalking, signs of heating)	●	●	●	●	●	●	●	●	●	●
Checking of lock and inter-lock system	●	●	●	●	●	●	●	●	●	●
Checking of auxiliaries contacts position indicator	●	●	●	●	●	●	●	●	●	●
Cleaning / Checking of operating mechanism				●				●		
Cleaning / checking of the earthing switch operating mechanism				●				●		
Fuses										
Inspection of fuse (chalking, color, cracking, corrosion)	●	●	●	●	●	●	●	●	●	●
Inspection of fuse fixing	●	●	●	●	●	●	●	●	●	●
Inspection of fuse signaling microswitch	●	●	●	●	●	●	●	●	●	●
Inspection of fuse striker	●	●	●	●	●	●	●	●	●	●
Busbar compartment (power off)										
Inspection of busbars (signs of heating)				●				●		
Inspection of isolator switches (chalking, signs of heating)				●				●		
CT / VT										
Cleaning / inspection of isolators (tightening ,chalking,cracking , signs of heating)				●				●		
Cleaning / inspection of TPs (tightening ,chalking,cracking , signs of heating)				●				●		
Tests										
Mechanical (manual on/off)	●	●	●	●	●	●	●	●	●	●
Electrical (remote on/off)	●	●	●	●	●	●	●	●	●	●
Schneider Electric Proprietary Diagnosis services offers										
Diagnosis to detect drifts from the initial state and significant trends, to anticipate on the corrective action (future failures) required to ensure equipment safety and continuity of service, and plan the action for the most convenient time for customer operations. More info in chapter 4 of this guide										
ProDiag Corona Surface/internal partial discharges detection				●				●		
ProDiag Fuse. Mesurement of fuses internal impedance / comparison with manufacturer's data				●				●		
Spare Parts										
Secure: Parts commonly used in corrective maintenance interventions										
Auxilliary Contact	Light maintenance									
Prevent: Parts whose conditon are checked in preventive maintenance interventions										
Operating mechanism				Exclusive maintenance						
Life extension: Parts to extend the life of the equipment										
Capacitive insulator	Advanced maintenance									
Earthing and fuses cluster	Advanced maintenance									
MV Fuse (ProDiag Fuse maintenance)	Advanced maintenance									

(1) Recommended under optimal operating conditions. However this recommended frequency should be increased according to
a) the level of criticality (low, major, critical) and b) the severity of environment conditions (ie corrosive, naval, offshore) following the prescriptions of manufacturer's services (see table p. 15)

Schneider Electric ranges covered by this Maintenance guide: SM6, Fluokit, VM6.
Does not supersede the information provided in the product user guide.

Exclusive maintenance conducted by ED equipment manufacturer only
Advanced maintenance, preferably conducted by ED equipment manufacturer or manufacturer certified partner
Light maintenance, conducted by ED equipment manufacturer or customer competent technician

[Recommended maintenance activities]

MV Ring Main Unit

Preventive maintenance activities	Minimal Frequency ⁽¹⁾ / Performance Level									
	Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10
Equipment compartment										
Cleaning / checking of active part and enclosure (chalking, cracking, signs of heating)	●	●	●	●	●	●	●	●	●	●
Checking of lock and inter-lock system	●	●	●	●	●	●	●	●	●	●
Checking of auxiliaries contacts position indicator	●	●	●	●	●	●	●	●	●	●
Cleaning / Checking of operating mechanism				●				●		
Cleaning / checking of the earthing switch operating mechanism				●				●		
Cables compartment										
Inspection of cables (chalking, signs of heating)	●	●	●	●	●	●	●	●	●	●
Inspection of cable connections (tightening, fixing)	●	●	●	●	●	●	●	●	●	●
Fuses compartment										
Inspection (visual) of the fuse (chalking, color, cracking, corrosion)	●	●	●	●	●	●	●	●	●	●
Cleaning of fuse	●	●	●	●	●	●	●	●	●	●
Checking of fuse signaling indicator	●	●	●	●	●	●	●	●	●	●
Inspection of fuse fixing	●	●	●	●	●	●	●	●	●	●
Cleaning / checking fuse contact plugs				●				●		
Inspection of fuse striker				●				●		
Tests										
Mechanical (manual on/off)	●	●	●	●	●	●	●	●	●	●
Electrical (remote on/off)	●	●	●	●	●	●	●	●	●	●
Associated protection										
Associated protection (see Protection Relay)				●				●		
Schneider Electric Proprietary Diagnosis services offers										
Diagnosis to detect drifts from the initial state and significant trends, to anticipate on the corrective action (future failures) required to ensure equipment safety and continuity of service, and plan the action for the most convenient time for customer operations. More info in chapter 4 of this guide										
ProDiag Corona Surface/internal partial discharges detection				●				●		
ProDiag Fuse. Mesurement of fuses internal impedance / comparison with manufacturer's data				●				●		
Spare Parts										
Secure: Parts commonly used in corrective maintenance interventions										
Relay, LV Fuse	Light maintenance									
Auxilliary Contact	Light maintenance									
Tripping coil	Light maintenance									
Mitop for switch	Light maintenance									
Undervoltage coil	Advanced maintenance									
Motor	Advanced maintenance									
Prevent: Parts whose conditon are checked in preventive maintenance interventions										
Gear motor				Exclusive maintenance						
Operating mechanism				Exclusive maintenance						
Life extension: Parts to extend the life of the equipment										
Fuse equipment	Advanced maintenance									

(1) Recommended under optimal operating conditions. However this recommended frequency should be increased according to
a) the level of criticality (low, major, critical) and b) the severity of environment conditions (ie corrosive, naval, offshore) following the prescriptions of manufacturer's services (see table p. 15)

MV Ring Main Unit / Main recommended maintenance activities

Exclusive maintenance conducted by ED equipment manufacturer only
Advanced maintenance, preferably conducted by ED equipment manufacturer or manufacturer certified partner
Light maintenance, conducted by ED equipment manufacturer or customer competent technician

Schneider Electric ranges covered by this Maintenance guide: RM6, Ringmaster, FBX.
Does not supersede the information provided in the product user guide.

5.2 - Protection Relays

Protection relays

Preventive maintenance activities	Minimal Frequency ⁽¹⁾ / Performance Level									
	Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10
Inspection of protection measured values, alarms, battery status through HMI	●	●	●	●	●	●	●	●	●	●
Inspection of connexions	●	●	●	●	●	●	●	●	●	●
Inspection of cabling	●	●	●	●	●	●	●	●	●	●
Checking of tightness of test / connection units					●					●
Inspection of tripping circuits		●		●		●		●		●
Checking of tripping curves				●				●		
Inspection of protection settings				●				●		
Downstream / upstream blocking or permissive scheme				●				●		
On demand										
Checking / updating of electrical network settings	* According to manufacturer's instructions									
Equipment upgrade	* According to manufacturer's instructions									
Software upgrade (digital relays)	* On change request									
Schneider Electric Proprietary Diagnosis services offers										
ProDiag MV Relay . Monitors MV relay protection function and their performance according to predefined settings .				●				●		
Inspection of tripping circuits				●				●		
Checking of tripping curves				●				●		
Inspection of protection settings				●				●		
Spare Parts										
Secure: Parts commonly used in corrective maintenance interventions										
RS485 interface / Communication module	Light maintenance									
Input / Output module	Advanced maintenance									
Sensor module	Advanced maintenance									
Prevent: Parts whose conditon are checked in preventive maintenance interventions										
Battery	Light maintenance ⁽²⁾									
Life extension: Parts to extend the life of the equipment										
Protection relay unit	Advanced maintenance									
UMI (User Man Interface)	Exclusive maintenance									

(1) Recommended under optimal operating conditions. However this recommended frequency should be increased according to
a) the level of criticality (low, major, critical) and b) the severity of environment conditions (ie corrosive, naval, offshore) following the prescriptions of manufacturer's services (see table p. 15)
(2) Lithium batteries are recommended to be replaced every 5 years depending on manufacturer Brand / Range / Type
It is recommended to check the corresponding User Guide

Protection Relays / Main recommended maintenance activities

Exclusive maintenance conducted by ED equipment manufacturer only
Advanced maintenance, preferably conducted by ED equipment manufacturer or manufacturer certified partner
Light maintenance, conducted by ED equipment manufacturer or customer competent technician

5.3 - Transformers

MV Distribution Transformer

MV Distribution Transformer / Main recommended maintenance activities

Preventive maintenance activities		Cast Resin	Oil	Minimal Frequency ⁽¹⁾ / Performance Level									
				Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10
Visual inspection													
Inspection of connections (heating, discharges, etc.)	✓	✓	●	●	●	●	●	●	●	●	●	●	●
Inspection of magnetic circuit appearance	✓		●	●	●	●	●	●	●	●	●	●	●
Inspection of degradation of surface coating and transformer components	✓	✓	●	●	●	●	●	●	●	●	●	●	●
Inspection of Oil level (except for integral-filling devices)		✓	●	●	●	●	●	●	●	●	●	●	●
Inspection of visual leakages (Crack for CRT)		✓	●	●	●	●	●	●	●	●	●	●	●
Checking of environmental issues (pollution / fires)	✓	✓	●	●	●	●	●	●	●	●	●	●	●
Checking of winding	✓		●	●	●	●	●	●	●	●	●	●	●
Cleaning													
Dedusting	✓	✓	●	●	●	●	●	●	●	●	●	●	●
Cleaning of transformer compartment	✓	✓	●	●	●	●	●	●	●	●	●	●	●
Cleaning of bushing (and winding for CRT)	✓	✓	●	●	●	●	●	●	●	●	●	●	●
Verifications / repairs													
Checking of transformer's protection systems	✓	✓	●	●	●	●	●	●	●	●	●	●	●
Checking of air dryer and repair if needed		✓	●	●	●	●	●	●	●	●	●	●	●
Checking of accessories (temperature probe, ...)	✓	✓	●	●	●	●	●	●	●	●	●	●	●
Leakage repair		✓	●	●	●	●	●	●	●	●	●	●	●
Tests													
Noise test	✓	✓	●	●	●	●	●	●	●	●	●	●	●
LV electrical testing	✓	✓	●	●	●	●	●	●	●	●	●	●	●
MV electrical testing (coupling, isolation resistance, ...)	✓	✓	●	●	●	●	●	●	●	●	●	●	●
Upgrading / Regulation compliance													
IP housing for electrical safety	✓		●	●	●	●	●	●	●	●	●	●	●
Installation of spike protector device (SPD)	✓		●	●	●	●	●	●	●	●	●	●	●
Installation of retention tanks		✓	●	●	●	●	●	●	●	●	●	●	●
Installation of temperature control relay	✓		●	●	●	●	●	●	●	●	●	●	●
Schneider Electric Proprietary Diagnosis services offers													
Diagnosis to detect drifts from the initial state and significant trends, to anticipate on the corrective action (future failures) required to ensure equipment safety and continuity of service, and plan the action for the most convenient time for customer operations. More info in chapter 4 of this guide													
ProDiag Oil. Monitors dielectric oil ageing / wear as symptom of any transformer dysfunction.													
Oil sampling		✓	●	●	●	●	●	●	●	●	●	●	●
Basic analyses		✓	●	●	●	●	●	●	●	●	●	●	●
PCB content analysis		✓	●	●	●	●	●	●	●	●	●	●	●
Dissolved gas / furanic analyses		✓	●	●	●	●	●	●	●	●	●	●	●
Other oil analysis		✓	●	●	●	●	●	●	●	●	●	●	●
ProRelayBox. Monitors sensors / relay performance as per manufacturer's specification													
DGPT2 / DMCR / RIS testing (alarm / tripping)		✓		●		●		●		●		●	
Endoscopy.			●	●	●	●	●	●	●	●	●	●	●
Visualize the inner parts of transformer to secure later interventions / retrofitting		✓	●	●	●	●	●	●	●	●	●	●	●
Spare Parts													
Secure: Parts commonly used in corrective maintenance interventions													
Auxiliary equipments (temperature probe, ...)			Light maintenance										
Air dryer (Silicagel)						Exclusive maintenance							
Prevent: Parts whose conditon are checked in preventive maintenance interventions													
Dessicant breather			Light maintenance										
Accessories (spike protector, cablebox, ...)			Advanced maintenance										
MV connections					Exclusive maintenance								
DGPT2 (ProDiag Transfo Relay recommendation)					Exclusive maintenance								
Life extension: Parts to extend the life of the equipment													
Gasket			Advanced maintenance										
Oil filtration. Followed of a oil diagnostic (gas, water, particules, acidity, corrosivity)					Exclusive maintenance								
Oil retrofitting. Followed of a oil diagnostic (PCB, acidity, corrosivity) or need of a dielectric with a high fire point					Exclusive maintenance								

(1) Recommended under optimal operating conditions. However this recommended frequency should be increased according to a) the level of criticality (low, major, critical) and b) the severity of environment conditions (ie corrosive, naval, offshore) following the prescriptions of manufacturer's services (see table p. 15)

Schneider Electric ranges covered by this Maintenance guide: Trihal (cast resin), Minera (Oil). Does not supersede the information provided in the product user guide.

Exclusive maintenance conducted by ED equipment manufacturer only
Advanced maintenance, preferably conducted by ED equipment manufacturer or manufacturer certified partner
Light maintenance, conducted by ED equipment manufacturer or customer competent technician

[Recommended maintenance activities]

MV Power transformer

MV Power Transformer / Main recommended maintenance activities

Preventive maintenance activities	Minimal Frequency ⁽¹⁾ / Performance Level									
	Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10
Visual inspection										
Inspection of connections (heating, discharges, etc.)	●	●	●	●	●	●	●	●	●	●
Inspection of visual leakages (Crack for CRT)	●	●	●	●	●	●	●	●	●	●
Inspection of Oil level (except for integral-filling devices)	●	●	●	●	●	●	●	●	●	●
Checking of environmental issues (pollution / fires)	●	●	●	●	●	●	●	●	●	●
Cleaning										
Dedusting	●	●	●	●	●	●	●	●	●	●
Cleaning of transformer compartment	●	●	●	●	●	●	●	●	●	●
Cleaning of Fans and motor fans testing	●	●	●	●	●	●	●	●	●	●
Cleaning of bushing (and winding for CRT)	●	●	●	●	●	●	●	●	●	●
Verifications / repairs										
Checking of auxiliary equipments	●	●	●	●	●	●	●	●	●	●
Checking of transformer's protection systems	●	●	●	●	●	●	●	●	●	●
Checking of air dryer and repair if needed	●	●	●	●	●	●	●	●	●	●
Checking of OLTC (On Load Tap Changer) and its Oil analysis	●	●	●	●	●	●	●	●	●	●
Checking of accessories (temperature probe, oil circulation indicators, ...)	●	●	●	●	●	●	●	●	●	●
OLTC complete maintenance	●	●	●	●	●	●	●	●	●	●
Leakage repair	●	●	●	●	●	●	●	●	●	●
Tests										
LV electrical compartment	●	●	●	●	●	●	●	●	●	●
Noise	●	●	●	●	●	●	●	●	●	●
MV electrical	●	●	●	●	●	●	●	●	●	●
Upgrading / Regulation compliance										
Installation of retention tanks if necessary	●	●	●	●	●	●	●	●	●	●
Installation of fire protection systems if necessary	●	●	●	●	●	●	●	●	●	●
Installation of retention tanks	●	●	●	●	●	●	●	●	●	●
Installation of temperature control relay	●	●	●	●	●	●	●	●	●	●
Schneider Electric Proprietary Diagnosis services offers										
Diagnosis to detect drifts from the initial state and significant trends, to anticipate on the corrective action (future failures) required to ensure equipment safety and continuity of service, and plan the action for the most convenient time for customer operations. More info in chapter 4 of this guide										
ProDiagOil. Monitors dielectric oil ageing / wear as symptom of any transformer dysfunction.										
Oil sampling	●	●	●	●	●	●	●	●	●	●
Basic analyses	●	●	●	●	●	●	●	●	●	●
PCB content analysis	●	●	●	●	●	●	●	●	●	●
Dissolved gas / furanic analyses	●	●	●	●	●	●	●	●	●	●
Particule content, furanic derivatives	●	●	●	●	●	●	●	●	●	●
Other oil analysis	●	●	●	●	●	●	●	●	●	●
ProRelayBox. Monitors sensors / relay performance as per manufacturer's specification										
DGPT2 / DMCR / RIS testing (alarm / tripping)	●	●	●	●	●	●	●	●	●	●
Endoscopy. Visualize the inner parts of transformer to secure later interventions / retrofitting	●	●	●	●	●	●	●	●	●	●
Spare Parts										
Secure: Parts commonly used in corrective maintenance interventions										
Auxiliary equipments (temperature probe, ...)	Light maintenance									
Air dryer (Silicagel)	●	●	●	●	●	●	●	●	●	●
Prevent spare parts: Parts whose condition are checked in preventive maintenance interventions										
Dessicant breather	Light maintenance									
Accessories (spike protector, cablebox, ...)	Advanced maintenance									
MV connections	●	●	●	●	●	●	●	●	●	●
DGPT2 (ProDiag Transfo Relay recommendation)	●	●	●	●	●	●	●	●	●	●
Life extension: Parts to extend the life of the equipment										
Gasket	Advanced maintenance									
Oil filtration. Followed of a oil diagnostic (gas, water, particules, acidity, corrosivity)	●	●	●	●	●	●	●	●	●	●
Oil retrofitting. Followed of a oil diagnostic (PCB, acidity, corrosivity) or need of a dielectric with a high fire point	●	●	●	●	●	●	●	●	●	●

(1) Recommended under optimal operating conditions. However this recommended frequency should be increased according to
a) the level of criticality (low, major, critical) and b) the severity of environment conditions (ie corrosive, naval, offshore) following the prescriptions of manufacturer's services (see table p. 15)

Schneider Electric ranges covered by this Maintenance guide: Minera MP.
Does not supersede the information provided in the product user guide.

Exclusive maintenance conducted by ED equipment manufacturer only
Advanced maintenance, preferably conducted by ED equipment manufacturer or manufacturer certified partner
Light maintenance, conducted by ED equipment manufacturer or customer competent technician

5.4 - Low Voltage

LV Circuit Breaker / Switch Disconnector

LV Circuit Breaker / Switch Disconnector / Main recommended maintenance activities

Preventive maintenance activities	Minimal Frequency ⁽¹⁾ / Performance Level									
	Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10
Circuit breaker										
Dismantle / check of breaking chambers		●		●		●		●		●
Cleaning / greasing of operating mechanism		●		●		●		●		●
Checking on the wear on contacts / arc chutes		●		●		●		●		●
Inspection of auxiliary contacts (O/C, SDE)	●	●	●	●	●	●	●	●	●	●
Chassis (withdrawable)										
Inspection / cleaning of chassis		●		●		●		●		●
Clean / grease of racking screw				●			●			
Inspection of safety devices (tripping on withdrawal, interlocks)	●	●	●	●	●	●	●	●	●	●
Device connection tests		●		●		●		●		●
Tests										
Mechanical (manual on/off)		●		●		●		●		●
Electrical (remote on/off)		●		●		●		●		●
Schneider Electric Proprietary Diagnosis services offers										
ProDiag Breaker Monitors opening / closing / spring-loading operations drifts				●				●		
Checking / adjusting of condition of the damper and / or stop device				●				●		
Checking of opening / closing times and speeds				●				●		
Checking of charging time				●				●		
Checking of contact synchronization				●				●		
Checking of safety to close (overtravel and stabilisation)				●				●		
Checking of safety to open (overtravel and stabilisation)				●				●		
ProDiag Trip Unit. Monitors circuit-breakers control unit tripping performance.				●				●		
Check tripping curves				●				●		
Check tripping chain, DIN/DINF, operation of thumbwheels, service life, save settings, log events, edit reports				●				●		
Check continuity of the tripping chain by primary injection for each phase				●				●		
Other diagnosis service offers										
ProDiag Thermography. Identifies hot spots suffering from overheating due to bad connections, harmonics, overloads		●		●		●		●		●
Recommended Spare Parts										
Secure: Parts commonly used in corrective maintenance interventions										
Auxiliary contacts	Light maintenance									
Closing / opening coil	Advanced maintenance									
Undervoltage coil	Advanced maintenance									
Prevent: Parts whose condition are checked in preventive maintenance interventions										
Clusters				Exclusive maintenance						
Operations counter	Advanced maintenance									
Life extension: Parts to extend the life of the equipment										
Adjustable delay unit	Advanced maintenance									
Automatic controller				Exclusive maintenance						
Arc Chute				Exclusive maintenance						

(1) Recommended under optimal operating conditions. However this recommended frequency should be increased according to
a) the level of criticality (low, major, critical) and b) the severity of environment conditions (ie corrosive, naval, offshore) following the prescriptions of manufacturer's services (see table p. 15)

Exclusive maintenance conducted by ED equipment manufacturer only
Advanced maintenance, preferably conducted by ED equipment manufacturer or manufacturer certified partner
Light maintenance, conducted by ED equipment manufacturer or customer competent technician



Schneider Electric ranges covered by this Maintenance guide: Masterpact NT/NW, Masterpact M
Does not supersede the information provided in the product user guide.

Preventive maintenance activities		Minimal Frequency ⁽¹⁾ / Performance Level									
		Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10
Electrical room											
Inspection of support levelness (alignment), if switchboard extension			●		●		●		●		●
Fixed part			●		●		●		●		●
Extension according to TTA/PTTA definition, if switchboard upgrade				●					●		
Software update (according to manufacturer's instructions)				●					●		
Enclosure											
Efficiency / presence of interlocking devices		●	●	●	●	●	●	●	●	●	●
Cover panel / partition: doors, form covers, automatic shutters, screws, keys		●	●	●	●	●	●	●	●	●	●
Inspection of general appearance: cleanliness, presence of humidity/oxidation		●	●	●	●	●	●	●	●	●	●
Inspection of strain		●	●	●	●	●	●	●	●	●	●
Dedusting of switchboard		●	●	●	●	●	●	●	●	●	●
Indications											
Inspection of indicators (indicator lights, mechanical indicators, etc.)		●	●	●	●	●	●	●	●	●	●
Checking signalling / measuring equipment values			●		●		●		●		●
Connections											
Inspection of heating		●	●	●	●	●	●	●	●	●	●
Inspection of power connections: busbars, terminations, busbar supports.		●	●	●	●	●	●	●	●	●	●
Inspection of downstream power connections: connecting pads, cable mechanical strength			●		●		●		●		●
Inspection of earth connections: continuity of the grounds		●	●	●	●	●	●	●	●	●	●
Inspection of clamp connections: wear / greasing		●	●	●	●	●	●	●	●	●	●
Inspection of cable connections (tightening, fixing)		●	●	●	●	●	●	●	●	●	●
Inspection of auxiliary connections		●	●	●	●	●	●	●	●	●	●
Checking of shutter moves freely		●	●	●	●	●	●	●	●	●	●
Checking of drawer locks operates correctly		●	●	●	●	●	●	●	●	●	●
Cleaning / greasing of slides			●		●		●		●		●
Checking of condition of collector		●	●	●	●	●	●	●	●	●	●
Checking of isolation		●	●	●	●	●	●	●	●	●	●
LV plug-in drawers		●	●	●	●	●	●	●	●	●	●
Inspection / cleaning of the drawer		●	●	●	●	●	●	●	●	●	●
Inspection of safety devices (tripping on withdrawal, interlocks)		●	●	●	●	●	●	●	●	●	●
Drawer connection tests		●	●	●	●	●	●	●	●	●	●
Switchgear / controlgear											
Dedusting		●	●	●	●	●	●	●	●	●	●
Inspection of opening / closing		●	●	●	●	●	●	●	●	●	●
Inspection of switchgear wearing parts: main contacts, arcing chamber.			●		●		●		●		●
Electrical environment											
Inspection of Harmonic content (depending on changes in downstream loads) * Depending on changes in downstream loads	●*										
Schneider Electric Proprietary Diagnosis services offers											
Diagnosis to detect drifts from the initial state and significant trends, to anticipate on the corrective action (future failures) required to ensure equipment safety and continuity of service, and plan the action for the most convenient time for customer operations. More info in chapter 4 of this guide											
Other diagnosis service offers											
ProDiag Thermography. Identifies hot spots suffering from overheating due to bad connections, harmonics, overloads			●		●		●		●		●
Spare Parts											
Secure: Parts commonly used in corrective maintenance interventions											
Tripping microswitch unit		Light maintenance									
Limit switch		Light maintenance									
Prevent: Parts whose conditon are checked in preventive maintenance interventions											
Mechanical reset relay		Light maintenance									
Tripping cable		Advanced maintenance									
Life extension: Parts to extend the life of the equipment											
Feedthrough connection		Advanced maintenance									

(1) Recommended under optimal operating conditions. However this recommended frequency should be increased according to
a) the level of criticality (low, major, critical) and b) the severity of environment conditions (ie corrosive, naval, offshore) following the prescriptions of manufacturer's services (see table p. 15)

Schneider Electric ranges covered by this Maintenance guide: Blockset, Masterbloc, Okken, Prisma.
Does not supersede the information provided in the product user guide.

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Advanced maintenance, preferably conducted by ED equipment manufacturer or manufacturer certified partner
Light maintenance, conducted by ED equipment manufacturer or customer competent technician



[Recommended maintenance activities]



LV Power Factor Correction

LV Power Factor Correction / Main recommended maintenance activities

Preventive maintenance activities	Minimal Frequency ⁽¹⁾ / Performance Level									
	Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10
Inspections (Power On)										
Inspection of varimetric regulator (cos phi set-up, delay, C/K, steps)	●	●	●	●	●	●	●	●	●	●
Check current (A) at the general incomer to the capacitor bank	●	●	●	●	●	●	●	●	●	●
Check current at incomer to each step with forcing of step	●	●	●	●	●	●	●	●	●	●
Check THDU, THDI (rate of voltage and current harmonic distortion)	●	●	●	●	●	●	●	●	●	●
Inspections (Power-Off and after safe "consignation")										
Check capacitors are discharged after lock-out	●	●	●	●	●	●	●	●	●	●
Clean / dust removal from ventilation system and the whole of the bank	●	●	●	●	●	●	●	●	●	●
Check condition of components (capacitors, switches, and fuses)	●	●	●	●	●	●	●	●	●	●
Check capacitance values with a capacitance meter	●	●	●	●	●	●	●	●	●	●
Schneider Electric Proprietary Diagnosis services offers										
Diagnosis to detect drifts from the initial state and significant trends, to anticipate on the corrective action (future failures) required to ensure equipment safety and continuity of service, and plan the action for the most convenient time for customer operations. More info in chapter 4 of this guide										
Other diagnosis service offers										
ProDiag Thermography. Identifies hot spots suffering from overheating due to bad connections, harmonics, overloads		●		●		●		●		●
Spare Parts										
Secure: Parts commonly used in corrective maintenance interventions										
Fans, Filters	Light maintenance									
Contactors	Light maintenance									
Capacitors	Advanced maintenance									
Modules	Advanced maintenance									
Prevent: Parts whose conditon are checked in preventive maintenance interventions										
Transformers	Light maintenance									
Circuit breakers or LV Fuses	Light maintenance									
Detuned reactors	Advanced maintenance									
Controllers	Advanced maintenance									
Life extension: Parts to extend the life of the equipment										
Modules for extensions)	Advanced maintenance									
Controller (additive features, communication)	Advanced maintenance									

(1) Recommended under optimal operating conditions. However this recommended frequency should be increased according to
a) the level of criticality (low, major, critical) and b) the severity of environment conditions (ie corrosive, naval, offshore) following the prescriptions of manufacturer's services (see table p. 15)

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Schneider Electric ranges covered by this Maintenance guide: VarSet.
Does not supersede the information provided in the product user guide.

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