

- רומן מיידמן
- חשמלאי מהנדס
- בודק סוג 3
- 050-9754620

אחזקת מתקני מתח גבוה ע"פ הוראות יצרני הציוד

נושאי ההרצאה

- אחזקה מונעת- למה וכמה?
- דרישות יצרנים עבור אחזקת לוחות מתח גבוה
- דרישות יצרן עבור ביצוע אחזקה מונעת לשנאים
- הוראות יצרן עבור בדיקה תקופתית של ממסרי הגנה
- המלצות ודגשים

אחזקה מונעת, למה?

אחזקה מונעת היא כלי חיוני לשמירה על תפקוד תקין ואורך חיים ארוך של ציוד מתח גבוה. היא מהווה גישה פרואקטיבית לטיפול בציוד, במטרה למנוע תקלות בלתי צפויות ולמזער את הסיכון להשבתות ממושכות. מדוע אחזקה מונעת כל כך חשובה?

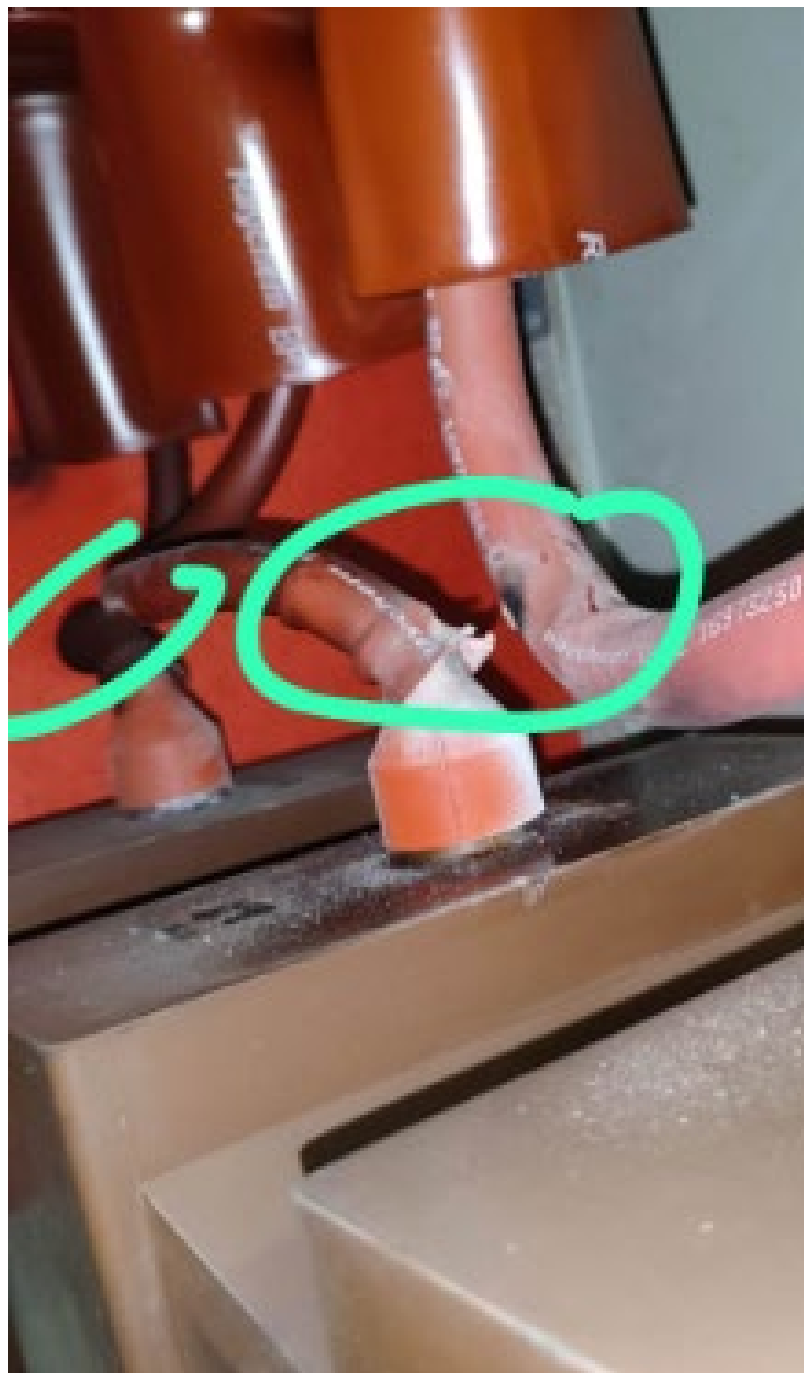
- מניעת תקלות: בדיקות ותחזוקה שוטפות מאפשרות זיהוי מוקדם של בעיות פוטנציאליות, טרם התפתחותן לתקלות משמעותיות.

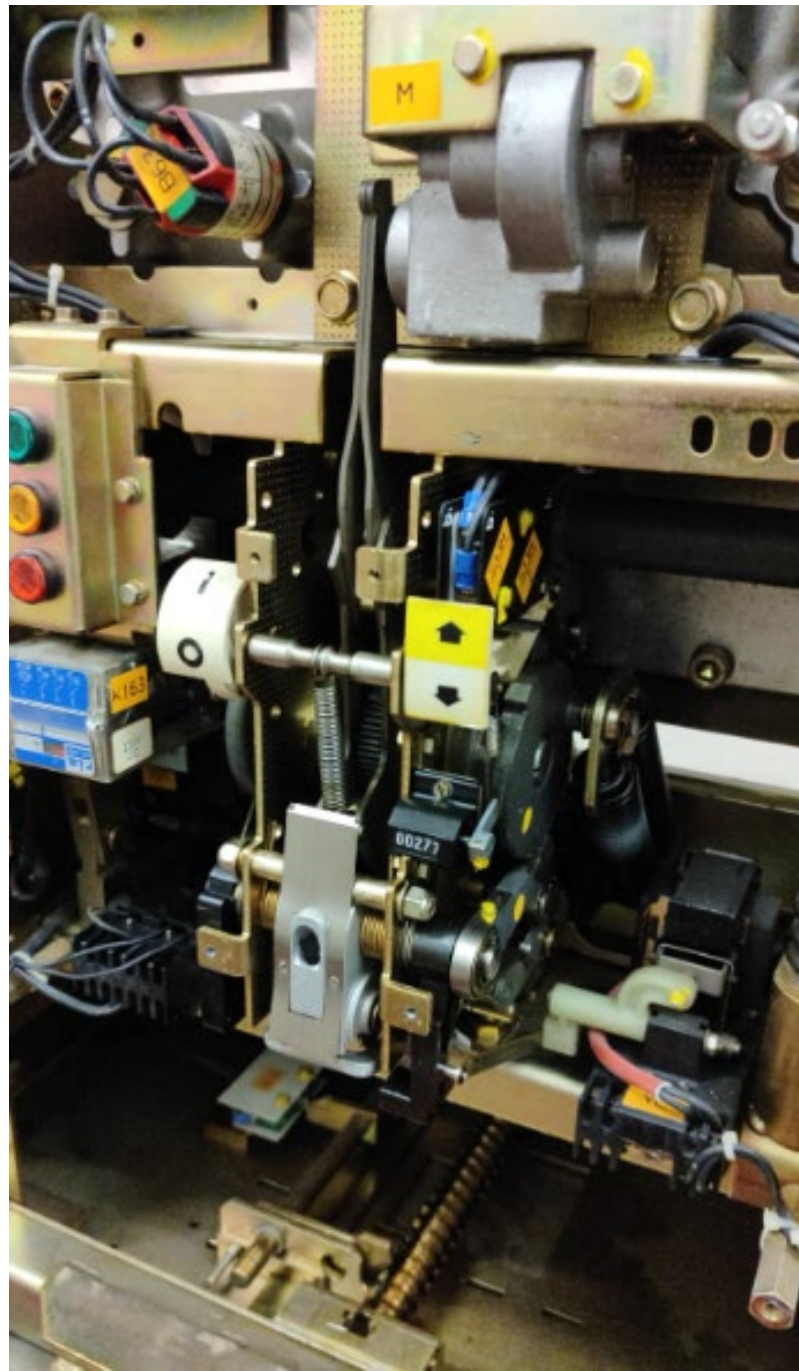
- הארכת חיי הציוד: טיפול נאות בציוד מאריך משמעותית את חיי השירות שלו, ומפחית את הצורך בהחלפות יקרות.

- שיפור האמינות: ציוד מטופל היטב פועל בצורה יציבה ואמינה יותר, ומבטיח אספקת חשמל רציפה.

- בטיחות: אחזקה מונעת מפחיתה את הסיכון לתאונות עבודה, שריפות וקצר חשמלי.

- חיסכון בעלויות: עלויות התחזוקה נמוכות משמעותית מעלויות תיקון תקלות בלתי צפויות, שעלולות להוביל להשבתות ממושכות ולנזקים נרחבים.



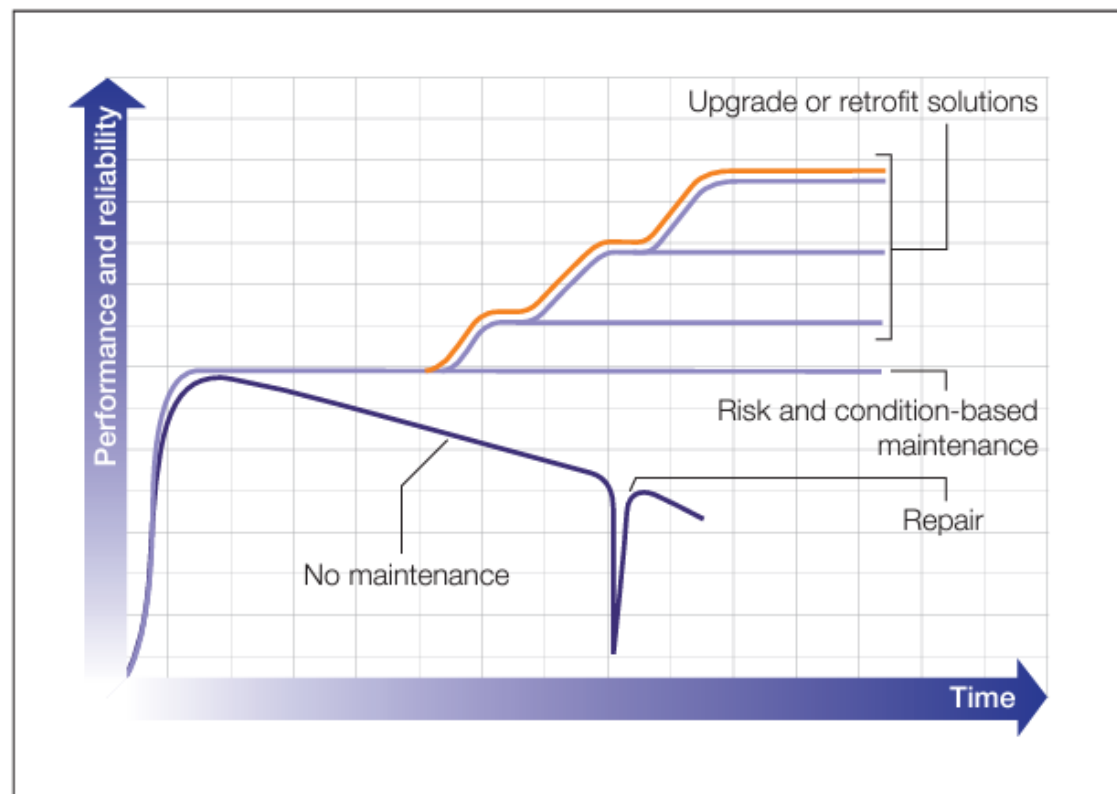


היבטים מרכזיים באחזקה מונעת של ציוד מתח גבוה:

- בדיקות תקופתיות - ביצוע בדיקות חשמליות, מכאניות ויזואליות בתדירות קבועה, על פי הוראות היצרן .
- ניתוח נתונים: איסוף וניתוח נתונים על ביצועי הציוד, כדי לזהות מגמות ולנבא תקלות עתידיות .
- תחזוקה מותאמת: התאמת תוכניות התחזוקה לסוג הציוד, תנאי העבודה וגיל הציוד .
- שימוש בחלקי חילוף מקוריים: החלפת חלקים בלויים בחלקים מקוריים, כדי לשמור על איכות הציוד .
- הכשרת אנשי צוות: הקניית ידע ומיומנויות לאנשי הצוות האחראים על האחזקה .



הקשר בין אורך החיים לתחזוקת הציוד



Switchgear working trend over time based on the maintenance adopted strategy



Trained personnel

Dedicated ABB trainings for maintenance personnel



ABB certified technician

SEE

WATCH

ACT

PERFORM

SECURE

Overall visual
Inspection

In-depth inspection
(de-energized
panel)

Cleaning,
lubrication and
functional testing
of the equipment

In-depth analysis
of the asset and
immediate
corrective actions

Special maintenance
for critical situations

הגדרת סוגי הטיפול / ביקורות ע"י היצרנים השונים

רומן מיידמן- חשמלאי מהנדס ובודק סוג 3 , 0509754620

הגדרת סוגי האחזקה הקיימים לכלל האביזרים במתקן

Maintenance levels for different equipment:



- **Circuit breaker:**

A Act

P Perform

See and Watch would require the breaker racking into test position and therefore makes sense to merge them into Act.



- **Switchgear:**

S See

W Watch

A Act

P Perform



- **Relay:**

W Watch

A Act

P Perform

See is merged into Watch for relays.

Example for Low Voltage equipment

Conditions	Device/ Year	0.5	1	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6	6.5	7	7.5	8	8.5	9	9.5	10	10.5	11	11.5	12	12.5		
Normal Severe Optimal	Circuit Breaker		A		A		P		A		A		P		A		A		P		A		A		A		P	
		A	A	P	A	A	P	A	A	P	A	A	P	A	A	P	A	A	P	A	A	P	A	A	P	A	A	P
				A			A		P		A				A		P				A			A			P	
Normal Severe Optimal	Switchgear		S		W		S		A		S		P		S		W		S		A		S		P		S	
		S	W	S	A	S	P	S	W	S	A	S	P	S	W	S	A	S	P	S	W	S	A	S	P	S	S	
				S			W		S			A			S		P			S				W		S		
Normal Severe Optimal	Relay				W		A		W		W		W		A		W		W		P				W		A	
		W	W	W	W	A	W	W	W	W	A	W	W	A	W	A	W	W	A	W	P	W	W	W	W	W	A	W
				W			A		W		W		W		W		A		W		W		W		A		P	

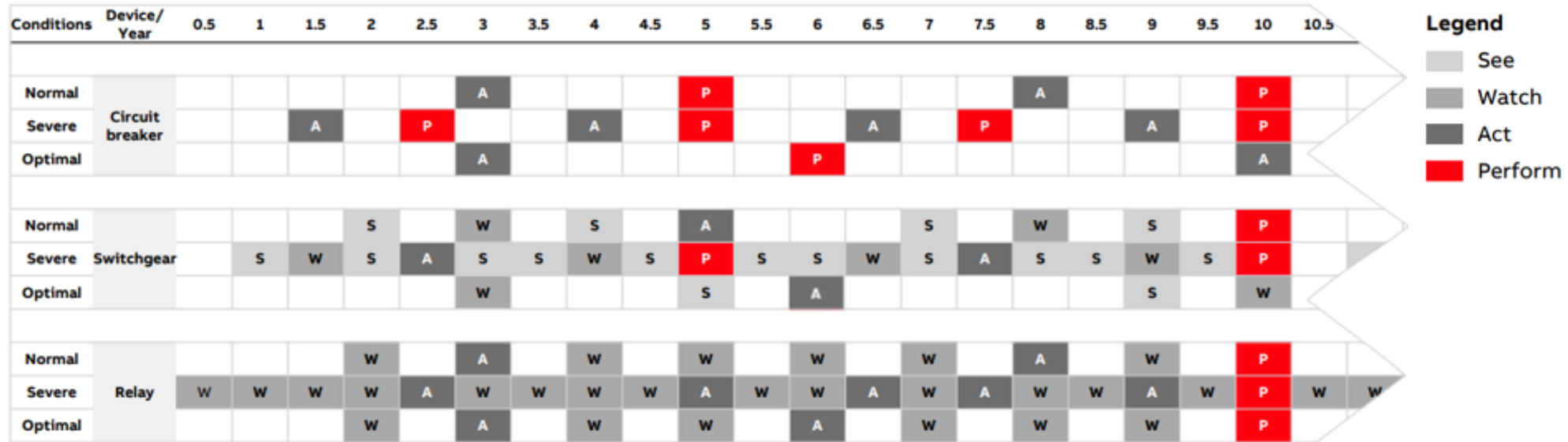
Legend

- See
- Watch
- Act
- Perform

Frequency of SWAPs intervals:

- Optimal conditions allow to extend them by 30%
- Severe ones imply reducing them by 50%

Example for Medium Voltage equipment



Frequency of SWAPs intervals:

- Optimal conditions allow to extend them by 30%
- Severe ones imply reducing them by 50%



דוגמה עבור
לוח מ"ג
תוצרת ABB

Switchgear

Level	Activity
See	Perform an overall visual inspection
	Check all indicators, meters and instruments for proper operation
	Check for undue noise and vibration that might loosen bolted connections
	Look for evidence of moisture on the switchgear surfaces
	Note presence of unusual amount of ozone odor ⁽¹⁾
	Record number of operations and loading
	Inspect auxiliary devices, wiring and terminal blocks
	Check the cleanliness and dust outside of the panel
	Check for moisture and rust presence inside the room and top of the switchboard
	Check the level of chemical presence in the substation environment
	Check the evolution of the equipment outside of the switchboard (e.g. added new generator, changed transformer, etc.)
	Insulating gas level check ⁽²⁾
Watch	Inspect cabling, terminal boxes, anti-ferroresonance circuit
	Inspect mechanical parts of the interlocks and check for humidity and corrosion
	Check the ventilation system, simple testing of centrifugal fan
	Inspect for overheating of accessible electrical and mechanical parts ⁽¹⁾
	Inspect tracking on insulating surfaces on the power cable side
	Check the voltage transformers
	Verify operation of heaters and thermostats
	Inspect line and earthing switches' kinematics and check for dirt, humidity and corrosion
Monitor the core balance current transformer performance	

Act	Clean the stationary portion of the switchgear ⁽¹⁾
	Withdraw and clean all draw-out components ⁽¹⁾
	Clean and lubricate of all parts requiring attention, identified during previous inspection
	Inspect tracking on insulating surfaces on the entire switchboard ⁽¹⁾
	Functional testing of mechanical parts of switchgear
	Measure primary circuit insulation
	Measure primary contacts resistance
Perform	Check bolted connections ⁽¹⁾
	Inspect control wiring for signs of wear and damage, if necessary replace
	Examine resistors and other devices prone to overheating
	Open all hinged doors and remove bolted panels
	Check wiring, clean contacts on relays and all necessary switches, replace all covers
	Ventilate louvers and air filters, clean or replace filters
	Functional testing on controls, interlocks and closing power rectifiers, check voltages
	Inspect, clean, functional test on current transformers, voltage transformers, and control power transformers
	Inspect secondary wiring bundles, replace if necessary
	Tighten secondary control wire connections
	Check for loose lug crimps and broken wire strands
	Inspect all power cables for tight connections
	Check bolted connections in bus bar compartment ⁽¹⁾
	Check the insulating cover of the main bus bars ⁽¹⁾
	Check the condition of pressure flaps or rupture discs
	Check the condition of arc-fault over-pressure sensors (if present)

1) Not applicable to gas insulated switchgear (GIS)

2) Applicable to gas insulated switchgear only



דוגמה עבור מפסק מ"ג תוצרת ABB

Circuit breaker

Level	Activity
Act	General inspection on:
	- Operating mechanism
	- Medium voltage parts
	- Earthing connections
	- Auxiliary supply voltage
	Check auxiliary switches
	Test interlock conditions
	General servicing of switching device
	- Clean surfaces in general
	- Clean insulating material surfaces and conductive components ⁽¹⁾
	- Clean and lubricate pawls, support shafts and bearing surfaces
	Suspect Joint maintenance (if needed)
	- Open joint and inspect connection surfaces ⁽¹⁾
	- Clean surfaces ⁽¹⁾
- Replace parts if necessary ⁽¹⁾	
- Replace contact fingers springs if necessary ⁽¹⁾	
- Tighten bolted connections ⁽¹⁾	
Functional Testing	
- Perform several switching operations under no load	
- Switch off charging motor (if fitted) and discharge the mechanism	
- Examine the condition of lubrication	
- Check the proper mechanical/electrical sequence	
Perform	Servicing of the operating mechanism
	- Switch off charging motor (if fitted) and discharge spring mechanism
	- Replace climatic and mechanical sensitive parts
	- Check operating mechanism springs
	- Check the fit and tightness of fasteners
	- Replace removed spring lock washers, split pins and other fasteners
	- Check the general condition of the operating mechanism
	- Perform comprehensive mechanical and electrical functional tests
	- Check tightness of bolted joints
	After replacements
	- Measure closing and opening time
- Measure main contacts simultaneous operation	
Timing and simultaneity of contact	
Measure primary circuits contact resistance	

1) Not applicable to gas Insulated switchgear (GIS)



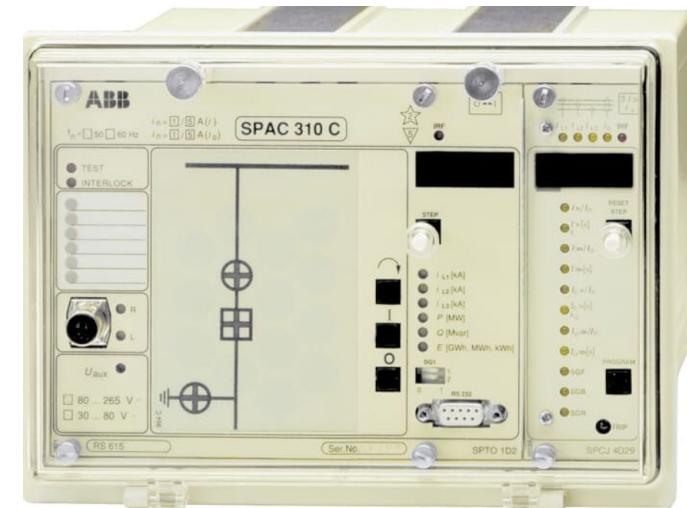
דוגמה עבור
ממסרי הגנה
תוצרת ABB

Maintenance activities

Relay

Level	Activity
Watch	Check for signs of mechanical damage on relay case
	Check for cleanliness, accumulation of dust on relay cover/case
	Check for evidence of moisture on the relay mechanical case
	Inspect wiring terminal and case for oxidation or discoloration
	Check temperature surrounding the relay
	Inspect the relay HMI:
	- Check power supply LED
	- Check display of internal relay fault indication
	- Check display of indication LEDs
	Act
Inspect secondary wiring tightness	
Initiate self-supervision check process	
Perform secondary injection test	
Perform any available test through relay	
Check circuit breaker trip operation	
Check relay settings	
Check Life Cycle status of installed base	
Check for software updates	
Perform	
	- Replacement
	- Relay Retrofit Program (RRP)
	Relay preventive maintenance program (if applicable)
	Replace power supply and output relay modules
Additional testing according to preventive maintenance concept	

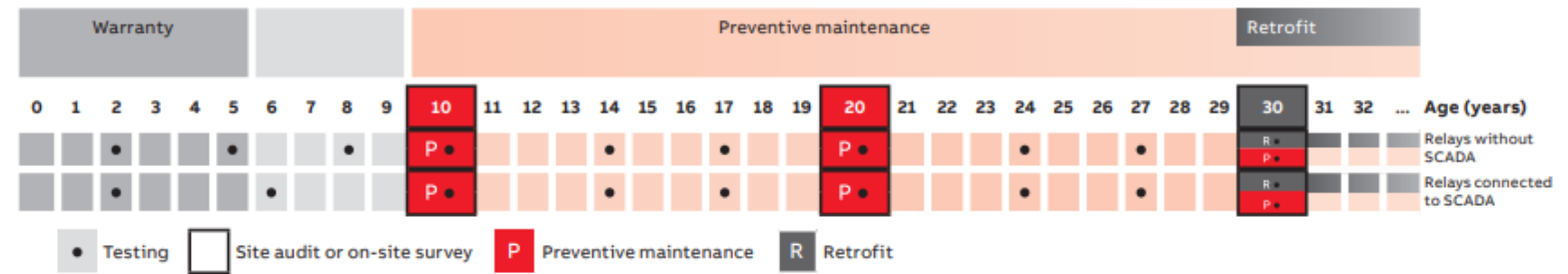
Spac 310 / Spaj 140



Maintenance and repairs

When the protection relay is operating under the conditions specified in the section "Technical data", the relay is practically maintenance-free. The relay modules include no parts or components subject to an abnormal physical or electrical wear under normal operation conditions.

Service interval recommendations for SPACOM and 500 series relays



Schneider SM6



Periodical maintenance

If needed, contact the nearest **Schneider Electric** services center.

We strongly recommend that you carry out at regular intervals (at least roughly every 2 years) a few operating cycles on the switching devices.

In harsh conditions (aggressive atmosphere, dust, temperature less than -5°C or greater than 40°C), please consult the nearest **Schneider Electric** services center.



CAUTION

Never put grease on the operating mechanism. If necessary: contact the nearest **Schneider Electric** Services Center. In normal operating conditions (temperature between -5°C and 40°C) no special maintenance is required.

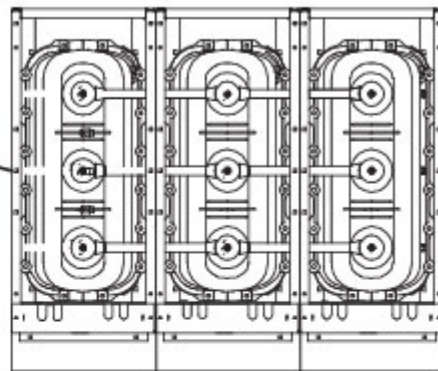
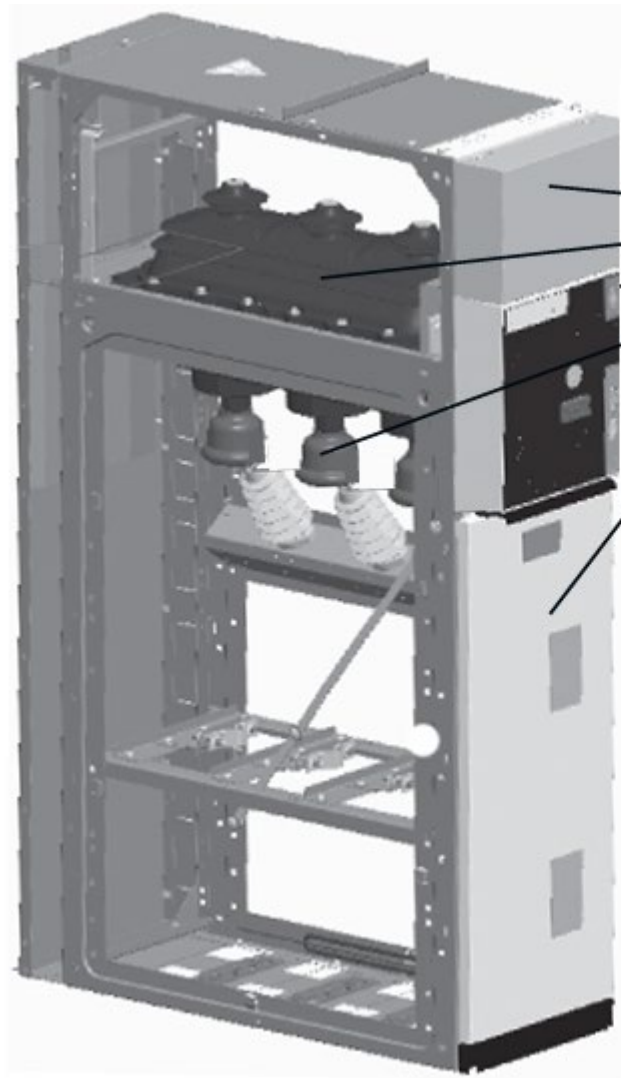
Cleaning instructions



CAUTION

We recommend that you inspect each compartment (cable, fuse, busbar) at regular intervals according to environmental conditions. If the insulating parts are dusty, to remove the dust use a clean and dry cloth.

DM101805



**CHEMICAL SOLVENT AND
ALCOHOL FORBIDDEN**



**HIGH PRESSURE CLEANING
PROCESS FORBIDDEN**

Levels of maintenance

Maintenance level (who can carry out the corrective maintenance operation)	
Level 1/2: Customer	Level 4: Schneider Service Center (advanced)
Level 3: Local LAU / =S=service center (basic)	Level 5: Factory return



Preventive maintenance	Corrective operation	Level	Normal operating conditions						Harsh operating conditions					
			Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
- Check that the LV connections aren't loose and that they don't show any traces of rust or oxidation	- Re-tighten connectors if needed. - Clean the connections if needed with a clean and dry cloth	IM 1/2		■		■		■	■	■	■	■	■	■
	- Change the damaged parts	IM 3/4												
- Verify that on the cables' terminals there aren't any piles of dust, dirt, flaws, traces of flashovers or damages	- Clean the terminals if needed with a clean cloth	IM1/2		■		■		■	■	■	■	■	■	■
	- In case of damage, contact SE													
- Make sure that the apparatus doesn't show any deformations, piles of dust, dirt, or damages	- if damages are detected on the tank, check the SF6 pressure -Clean the external components with a clean and dry cloth	IM 1/2		■		■		■	■	■	■	■	■	■
- Check mechanical operations indicated in the instructions manual "installation - operation - maintenance". Check the positioning of the status indicators (Open/Closed),	- If grease is missing or corroded ==> degrease and grease the mobile parts of the operating mechanism. - If red rust is detected on mobile parts of the operating mechanism: 1- find & treat the origin of the corrosion 2- follow up the damage 3- contact SE if the problem increases - If operating coils are damaged or stuck by rust, it has to be changed (see spare part policy)	IM 4/5		■		■		■	■	■	■	■	■	■
	- If broken or damage parts are detected, contact Schneider Electric.													
- Verify that the geared motor of the CB unit (if present) automatically loads the spring.	- Check the chain. If needed, degrease and grease it	IM 3/4												
	- Operate the mechanism manually (1 or 2 operations) and test again the controlled geared motorization - Check that the micrositches move in accordance of the main switch position.	IM 1/2		■		■		■	■	■	■	■	■	■
	- If there is red rust on the motor, it has to be changed (see spare parts policy)													

Preventive maintenance	Corrective operation	Level	Normal operating conditions						Harsh operating conditions						
			Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	
- Check that the line control geared motor (if present) automatically provides to open and to close the disconnecter.	- Check the chain. If needed, degrease and grease it	lvl 3/4													
	- Operate the mechanism manually (1 or 2 operations) and test again the controlled geared motorization	lvl 1/2		■		■		■	■	■	■	■	■	■	■
	- Check that the microsowitches move in accordance of the main switch position.														
- Voltage indicator checking	- If there is red rust on the motor, it has to be changed (see spare parts policy)														
	- Check that the Voltage indicator LED's are in the same state	lvl 1/2		■		■		■	■	■	■	■	■	■	■
	- Check the integrity of the wires connected to the bushings	lvl 3/4		■		■		■	■	■	■	■	■	■	■
- Check the SF6 pressure (manometer, pressure switch)	- [0,3 bar ; P (SF6) ; 0,2 bars] (at 20°C R.T & sea level) : Normal pressure	lvl 1/2		■		■		■	■	■	■	■	■	■	■
	- [0,2 bar ; P (SF6) ; 0,1 bars] (at 20°C R.T & sea level) : Open the circuit breaker, disconnectors and earthing lines and contact SE for intervention														
- Check the interlocks' correct operation, by executing a putting into service operation and a putting out of service operation	- [0,1 bar ; P (SF6) ; 0 bars] (at 20°C R.T & sea level) : Do not operate the RMU. Open the upstream and downstream lines and contact SE for intervention														
	- If damaged/missing components, see spare part policy	lvl 3/4						■			■				■
- Check that the operating times of the opening and closing controls of the CB unit circuit-breaker are comprehended within the correct values	- Check the fault detection relay settings	lvl 3/4													
	- Operate the op. mechanism manually (1 or 2 times) and control once again the opening and closing times.														
	- If grease is missing or corroded, degrease and grease the mobile parts of the operating mechanism								■			■			■
	- If parts are damaged, need SE intervention														
- Check that the caps are installed properly in the upper bushing on extensible compact version (if they are needed)	- Re-tighten connectors if needed.	lvl 1/2		■		■		■	■	■	■	■	■	■	■
	- Clean the connectors if needed with a clean and dry cloth														
	- Change the damaged parts	lvl 3/4													
	- Clean the terminals if needed with a clean cloth	lvl 1/2		■		■		■	■	■	■	■	■	■	■
	- In case of damage, contact SE														

Schneider RM6

standard operating conditions
maintenance summarising table



description	operation	material
panelling	cleaning	cloth
	earthing covers	cleaning

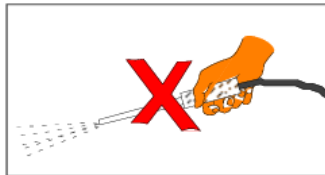
device panelling



We draw your attention to the risk of using high pressure cleaning processes.
Schneider Electric cannot therefore guarantee the reliability of equipment that have been cleaned in this manner, even if cleaning was followed by lubrication.

The main drawbacks of this process are:

- ⊘ deterioration due to jet pressure and impossibility of relubricating the inaccessible fixing points
- ⊘ risk of overheating due to presence of solvent on the contact zones.
- ⊘ elimination of special protections.



Clean using a dry cloth.

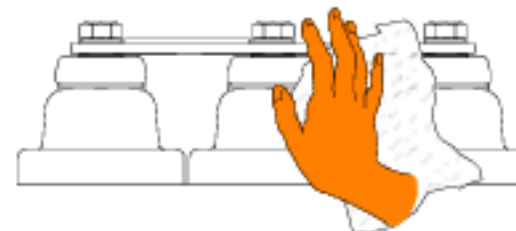


earthing covers



This operation can be performed in event of excessive soiling.

Clean using a sponge and clear water. Do not use alcohol or other solvents to clean.



maintenance cycle and operations



This device is designed to operate for 30 years or for 1000 operations in normal conditions of use as per **standard IEC 62271- 1.**

The following are recommended:

- an O/C operation every 6 years for motorised functional units and/or functional units with a latching mechanism (Q and D/B function)
- replacement of batteries is recommended every 4 years
- inspection every 5 years of the condition of the mechanisms (pollution, corrosion) and the cleanliness of the earthing covers (pollution).

Recommended inspection frequency: at least once a year

During the inspection, check the 6 following points:

1 LV compartment

symptoms: condensation, presence of humidity

check: for rust on the LV electric and electronic parts

solutions:

- dry the environment
- replace the damaged parts
- fit heating resistances (optional)

2 earthing covers

symptoms: humidity, dust

check: surface cleanliness

solutions:

- dry the environment
- clean using a clean cloth and water (no alcohol or solvent)

3 mechanical operating mechanisms

symptoms: humidity, condensation on live parts

check: for red rust on moving parts

solutions:

- find and treat the origin of condensation phenomena
- follow up the damage
- replace the operating mechanism if required (refer to reference: 07897270)

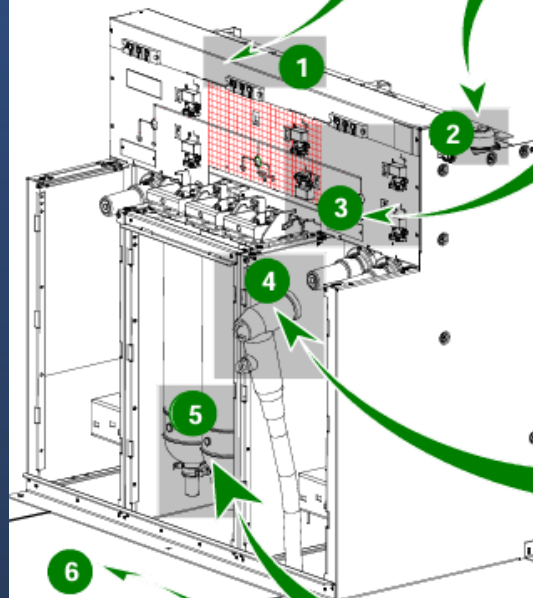
4 MV socket and cable

symptoms: presence of corona discharge or odours

check: connections (may be damaged)

solutions:

- fit new sockets



6 trench

symptoms: humidity

check: for presence of water in the trench

solutions:

- pump out water
 - drain the trench (if necessary add sand)
- In case sand is added in the trench, take care that the cables are still fixed correctly and that no additional stress is added to the bushings

5 fuse compartments

symptoms: humidity + dust

check: proper operation of the VPIS

solutions:

- clean the outside surface of the fuse compartments using a cloth and clear water



Sepam 62

DANGER

HAZARD OF ELECTRIC SHOCK, ELECTRIC ARC OR BURNS

- Only qualified personnel should maintain this equipment. Such work should be performed only after reading this entire set of instructions.
 - NEVER work alone.
 - Obey all existing safety instructions when commissioning and maintaining high-voltage equipment.
 - Beware of potential hazards and wear personal protective equipment.
- Failure to follow these instructions will result in death or serious injury.**

General

The logic inputs and outputs and the analog inputs are the parts of Sepam least covered by the self-tests. (The list of Sepam self-tests can be found in the Control and monitoring functions chapter).

They should be tested during a maintenance operation.

The recommended interval between preventive maintenance operations is 5 years.

Maintenance tests

To perform maintenance on Sepam, see Chapter 7, page 453. Carry out all the recommended commissioning tests according to the type of Sepam to be tested, except for the test specific to the differential function which is not necessary. If the MCS025 Synchro-check module is present, test its voltage inputs as well.

First test all the logic inputs and outputs involved in tripping the circuit breaker.

A test of the complete chain including the circuit breaker is also recommended.

Protection relay testing

Protection relays are tested prior to commissioning, with the dual aim of maximizing availability and minimizing the risk of malfunctioning of the assembly being commissioned. The problem consists of defining the consistency of the appropriate tests, keeping in mind that the relay is always involved as the main link in the protection chain.

Therefore, protection relays based on electromechanical and static technologies, the performances of which are not totally reproducible, must be systematically submitted to detailed testing, not only to qualify relay commissioning, but also to check that they actually are in good operating order and maintain the required level of performance.

The Sepam concept makes it possible to do away with such testing, since:

- the use of digital technology guarantees the reproducibility of the performances announced
- each of the Sepam functions has undergone full factory-qualification
- an internal self-testing system provides continuous information on the state of the electronic components and the integrity of the functions (e.g. automatic tests diagnose the level of component polarization voltages, the continuity of the analog value acquisition chain, non-alteration of RAM memory, absence of settings outside the tolerance range) and thereby guarantees a high level of availability

Sepam is therefore ready to operate without requiring any additional qualification testing that concerns it directly.

Sepam commissioning tests

The preliminary Sepam commissioning tests may be limited to a commissioning check, i.e.:

- checking of compliance with BOMs and hardware installation diagrams and rules during a preliminary general check
- checking of the compliance of the general settings and protection settings entered with the setting sheets
- checking of current or voltage input connections by secondary injection tests
- checking of logic input and output connections by simulation of input data and forcing of output status
- validation of the complete protection chain (possible customized logical functions included)
- checking of the connection of the optional MET148-2, MSA141 and MSC025 modules.

The various checks are described on the next page.

Eaton Xiria

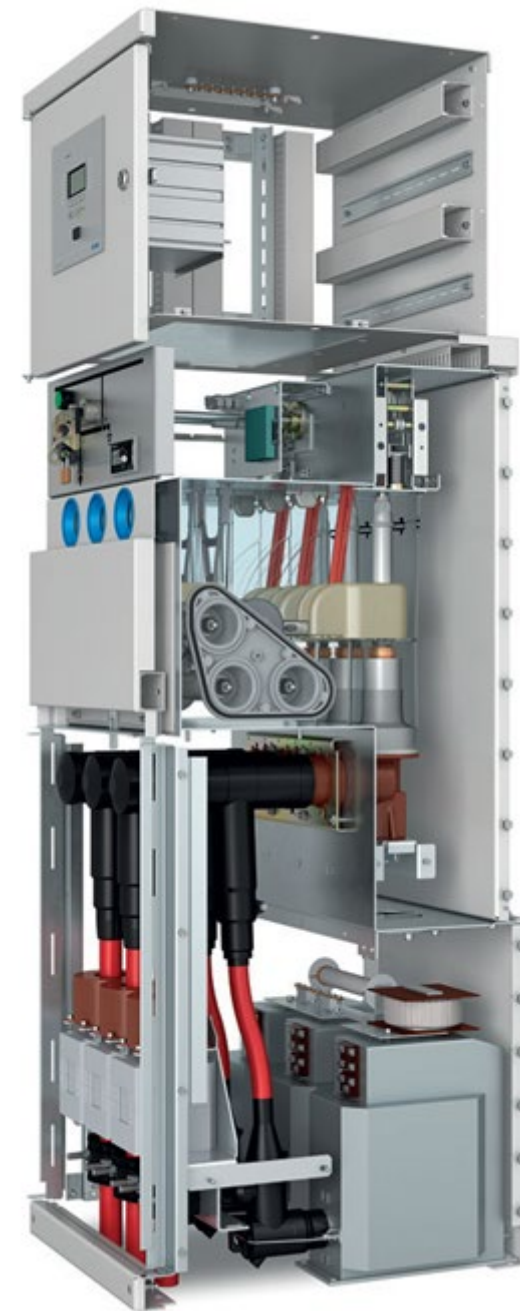
6. INSPECTION AND MAINTENANCE

6.1 Introduction

The Xiria unit is theoretically a maintenance-free system. No specific components need to be maintained. All primary, live components are maintenance-free and are housed in a sealed gas-tight enclosure. All other components have also been designed to be maintenance free.

The following components can be inspected:

- correct fixing of cable and earth connections;
- enclosure for damage and contamination;
- protection relay;
- switching functions;
- voltage detection;
- the overcurrent indicator.



6.2 Inspections

6.2.1 Inspecting cable connections

Inspect the cable connection in accordance with the following procedure:

1. Open the cable connection compartment in accordance with the procedure described in section 4.2.3.
2. Clean the compartment with a dry cloth.
3. Check the cable plug connection according to the plug supplier's instructions. Ensure that the cable does not impart any mechanical strain on the plug. The cable forces are to be absorbed by the cable support, see 'Strain relief' in section 0.
4. Check the cable support. The cables must be secure in the cable clamp blocks. Check that the bolts are still tightened to a torque of 20 Nm, see Cable assembly instructions in section 0.
5. Check the earth connections:
 - between cables and earth strip;
 - between earth strip and enclosure;
 - between earth strip and system earth;
6. Close the cable connection compartment.

6.2.2 Inspecting switching functions

Inspect the switching functions in accordance with the following procedure:

1. Check with the person responsible for the unit whether the relevant unit is disconnected and ready for inspection.
2. Verify, in consultation with the person responsible for operations, that the relevant panel is disconnected so that the inspection can be carried out safely. Satisfy yourself at the same time that the cable connected is and will remain dead.
3. Place the switch in the OFF position and the change-over switch in the earthed position, see section 4.
4. Complete all switching operations described in section 4.6 Short-form instructions. Always carefully check that the operation produces the desired result. Check the position indicators on the control panel and the actual position of the change-over switch and the vacuum interrupter through the viewing windows, see section 4.2.2.
5. If an operation has not produced the required result according to the position indicators or when the actual position of the change-over switch is checked, shut down the unit and inform Eaton.

6.2.3 Inspection of the moisture absorbing agent

Check the operation of the moisture absorbing agent in the unit with a color indicator. This is located behind the centre viewing window of the right-hand panel (see Figure 6-1). The indicator should be pale blue in color.

Under normal operating conditions the moisture level inside the Xiria unit is <15% due to the Silica Gel bag placed inside before the enclosure is sealed.

When the moisture indicator turns to pink instead of blue the moisture level inside the switchgear unit is more than 40%.

The type testing of the Xiria unit has been carried out with the enclosure flaps open under normal atmospheric humidity conditions of > 50-60%.

When a too high level of humidity is detected by a pink colored indicator (e.g. at annual inspection), then the unit can still be safely switched but arrangements should be made for the unit to be taken out of service.

A first visual inspection can be made to check for damages to the outside of the enclosure, but where there is no visible damage detected, Eaton can assist in a further investigation into the loss of integrity of the enclosure and possible rectification.

6.2.4 Testing voltage detection

Refer to Appendix 2 of this manual for inspection and maintenance of the voltage detection system.

6.2.5 Inspecting the protection relay

Refer to the manual provided by the relay manufacturer for inspection and maintenance of the protection relay.

6.2.6 Inspecting the overcurrent indicator

Refer to Appendix 4 of this manual for inspection and maintenance of the overcurrent indicator system.



Woodward WIC1



6.10 Maintenance

The entire protection system WIC1 is designed for a maintenance-free period of 25 years, hence there are no specific jobs necessary to be done during the operating life of the relays. Very often, a periodical check of the protective adjustments is required by the end user. Such checks are left to the choice of the user and can be carried out as described under 6.2.



אחזקת שנאים

הנחיות אחזקה לשנאים אטומים תוצרת ארדן

הערה – כל הבדיקות יבוצעו בשעות היום תוך הקפדה על רמת תאורה מספקת

1. בדיקה תקופתית כל 6 חודשים, ניתן לבצע את הבדיקה כאשר השנאי תחת מתח ולאחר נקיטת כל אמצעי הבטיחות.
 - 1.1. בדיקת ראייה למציאת נזילות כולל בדיקת הרצפה לעקבות נזילות במידה וקיימות.
 - 1.2. בדיקת גובה שמן וטמפרטורת השמן במכלול ה-DGPT.
 - 1.3. בדיקת אי המצאות סימני נזילות באזור שסתום הביטחון.
 - 1.4. שלמות מבודדי הקרמיקה, ואי המצאות סמני נזילות באזור מבודדי המתח הנמוך והגבוה.
 - 1.5. וודא שאין רעש חריג מהשנאי.





2. **בדיקה שנתית**, מתבצעות כאשר השנאי מנותק מהרשת ולאחר נקיטת כל אמצעי הבטיחות הנדרשים:

- 2.1 יש לבצע את הבדיקות התקופתיות לפי סעיף 1 ולתקן את הנדרש תיקון.
- 2.2 יש לחזק את בורגי חיבורי המתח הנמוך ל-flag מ.ב.

2.2.1 בורגי M10 – 25-35 Nm

2.2.2 בורגי M12 – 40-60 Nm

2.2.3 בורגי M16 – 100-150 Nm

- 2.3 יש לחזק את בורגי ה-flag ללולב מבודד מ.ב.

2.3.1 בורגי M10 – 25-35 Nm

2.3.2 בורגי M12 – 40-60 Nm

- 2.4 יש לבדוק תקינות DGPT ע"י בדיקה חשמלית של כל ההתרעות המכוונות.

- 2.5 יש לוודא תנועה חופשית של מחלף הדרגות בכל המצבים, בסוף הבדיקה יש להחזירו למצב עבודה הרצוי.

- 2.6 נתק וחבר חיבורי plug in bushing.

3. **בדיקות 5 שנתיות**, מתבצעות כאשר השנאי מנותק מהרשת ולאחר נקיטת כל אמצעי הבטיחות הנדרשים:

- 3.1 יש לקחת דגימת שמן מהשנאי ולבדוק את איכותו. הבדיקה תבוצע ע"י טכנאי מוסמך ולפי נוהלי ארדן תעשיות חשמל.

- 3.2 יש לבדוק בעזרת "מגר", בדיקות בידוד סלילי מ.ג - סלילי מ.ב, סלילי מ.ג - מיכל ובין סלילי מ.ב. והמיכל.

- 3.3 יש לבדוק יחס ליפופים בכל מצבי מחלף הדרגות.

- 4. יש לוודא קבלת דוח בדיקה בסיום כל סדרת בדיקות תקופתיות המוגדרות במסך זה, קבלת דוח בדיקה מפורט מארדן יאפשר הארכת אחריות השנאי.

7. תחזוקת השנאים

יש לוודא שהכבלים מהודקים למחברים לפי מידת המומנט הנכונה. בדוק שגם שאר חיבורי המתח מהודקים לפי המומנט הנכון.

לבסוף, יש לבדוק שהספייסרים של הסליל מהודקים למקומם כנדרש.

שים לב לכך שכל ההתקנים שהוזכרו לעיל יכולים להשתחרר כתוצאה מעומס רגעי או בגלל רעידות בליבה היכולים לקרות כאשר השנאי בפעולה.

לעיתים השנאי יכול לספוג לחות מסיבות שונות. במקרה כזה השנאי צריך לעבור תהליך ייבוש ואח"כ יש לבדוק את התנגדות הבידוד לפני חישוב מחדש. יש להשתמש במגה - אוהם-מטר כדי לוודא שיתקבלו ערכים של 1000 מגה - אוהם.

הבדיקה אמורה להתבצע בין כל פאזות המתח הנמוך לאדמה, בין סלילי המתח הגבוה והנמוך ובין סלילי המתח הגבוה לאדמה.

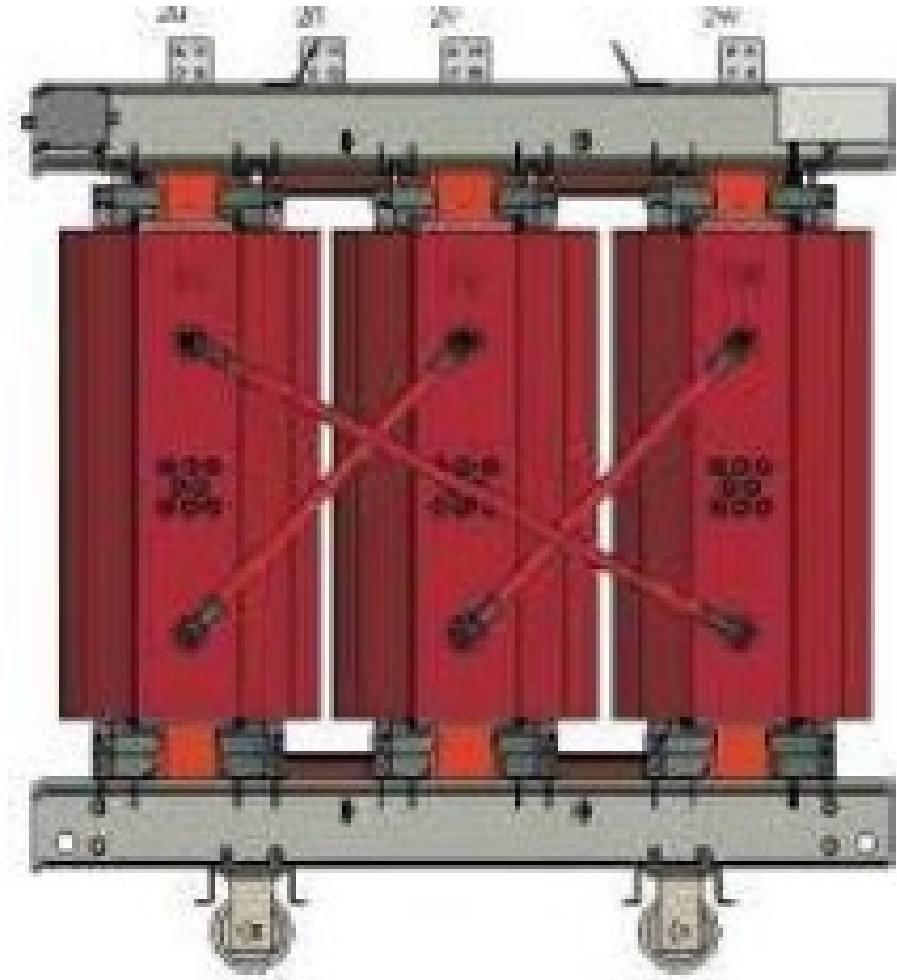
שנאי יבש בעל ליפופי שרף יצוק דורש אחזקה מועטה. למרות זאת, נדרשת סדרת בדיקות. תדירות כל בדיקה תלויה בתנאי הסביבה והעבודה.

בסביבה שהיא יחסית נקייה ויבשה ובתנאי עבודה נורמאליים הבדיקות יכולות להתבצע בתדירות נמוכה.

מומלץ בכל זאת לבצע בדיקה אחת לשנה.

מומלץ להקטין את תדירות ההתקנות הממוקמות בסביבה מלוכלכת במיוחד או מאובקת או אם חשוף לעוצמה משתנה של עומסים.

אריגים יבשים ואויר דחוס ישמשו לניקוי הסלילים מאבק. יש לבצע גם בדיקה ע"מ לוודא שאין לכלוך שחוסם את דרכי האוורור בין סלילי המתח הגבוה לנמוך, או בין סלילי המתח הנמוך לליבה.





תוצאה	תדירות אחזקה/הערות	בדיקה נדרשת
רצף חשמלי	שנתי - ומעקב אחר התנהגות לא שגרתית	בדיקת התנגדות תרמית
לפי הנחיות יצרן הבקר	פעם בשנה	בדיקת ממסר בקרת הטמפרטורה
נקה עם לחץ אויר ומטלית יבשה	חצי שנתי ואחרי הפסקת מתחים	הסרת לכלוך, אבק וגופים זרים מהסלילים
להדק בעזרת מפתח מומנט לפי טבלה מצורפת !!!	שנתי - ומעקב אחר התנהגות לא שגרתית	חיזוק הברגים והחיבורים של מתח גבוה/נמוך, החיבור משולש ופס האפס.
להדק בעזרת מפתח מומנט לפי טבלה מצורפת !!!	שנתי - ומעקב אחר התנהגות לא שגרתית	חיזוק הברגים והאומים שמיועדים לאבטח את השנאי לרצפה
מ.ג. - הארקה מיני $250M \Omega$ מ.ג. - הארקה מיני $50M \Omega$ מ.ג. - מ.ג. מיני $250M \Omega$ הבדיקה תבצע באמצעות מד מגר עם מתח מעל 1000V	בכל פעם שהשנאי נשאר ללא שימוש לתקופה ארוכה	בדוק את הבידוד בין הליפופים ובין הליפופים להארקה
הדק בעזרת מפתח מומנט. 20-40 Nm	בבואך לחשמל את השנאי לאחר אחסון ממושך. בדוק כל שנה ולאחר אירוע יוצא דופן	לבדוק ולחזק את כל ברגי התמיכות של הסלילים.
השוואת מדידות התנגדות בין חיבורים. לא יכול להיות הפרש הגדול מ-50%. בדיקת שהמדידות הן נמוכות	יש לבדוק את התנגדות החיבורים המוברגים בעזרת אוהם-מטר להתנגדות נמוכה	התנגדות נמוכה

תודה על ההקשבה

- רומן מיידמן
- חשמלאי מהנדס
- בודק סוג 3
- 050-9754620