



Half-Lifetime Maintenance of HV Equipment

Nov 2024

HV AIS equipment

Circuit Breaker



Disconnecter



Surge Arrester



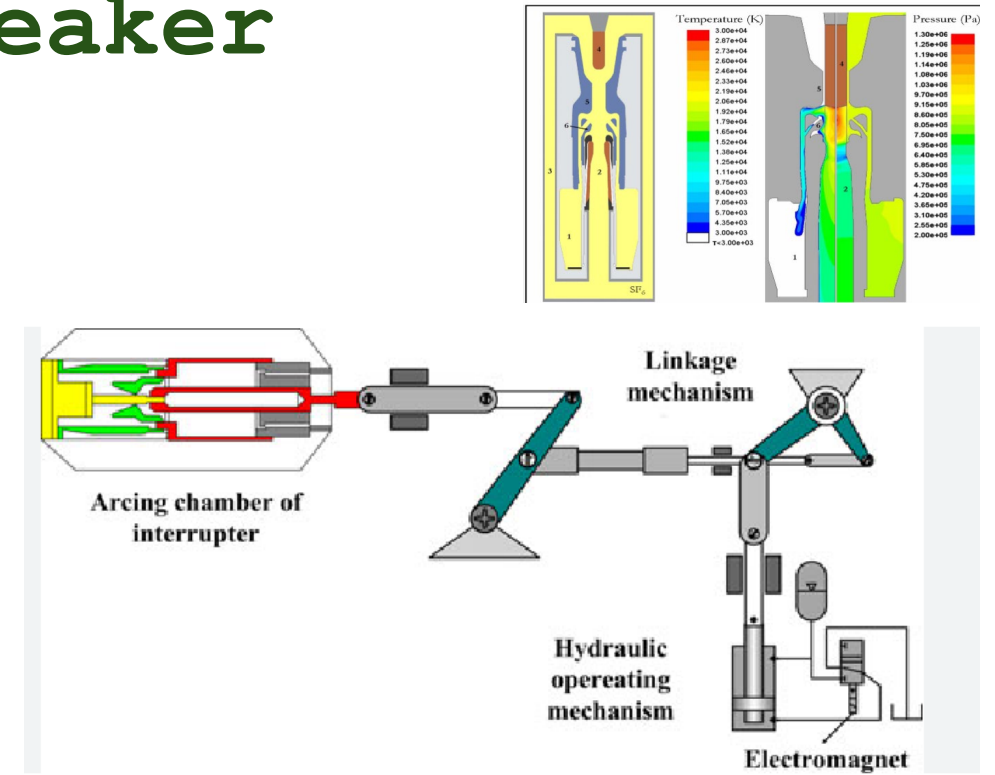
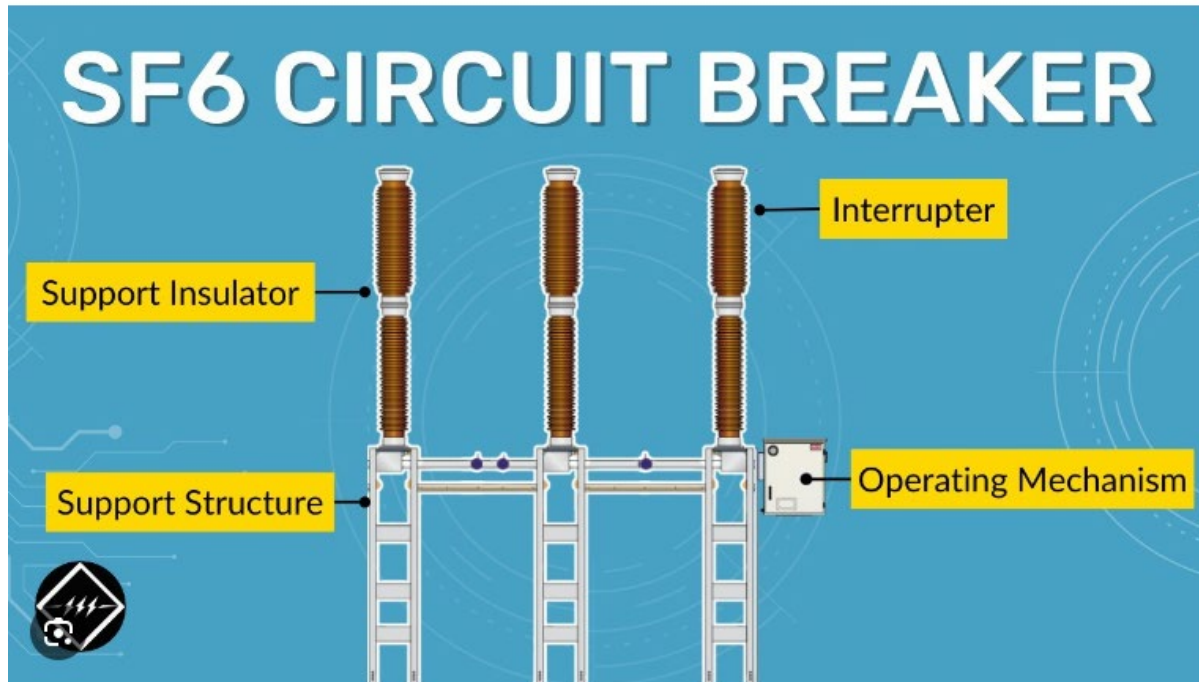
Voltage transformer



Current transformer



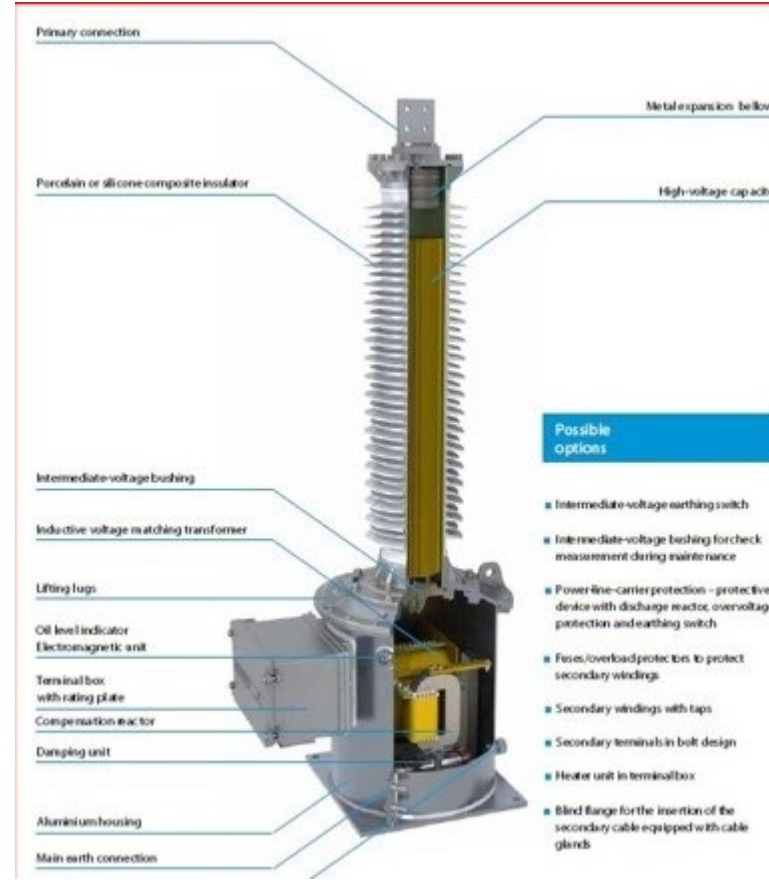
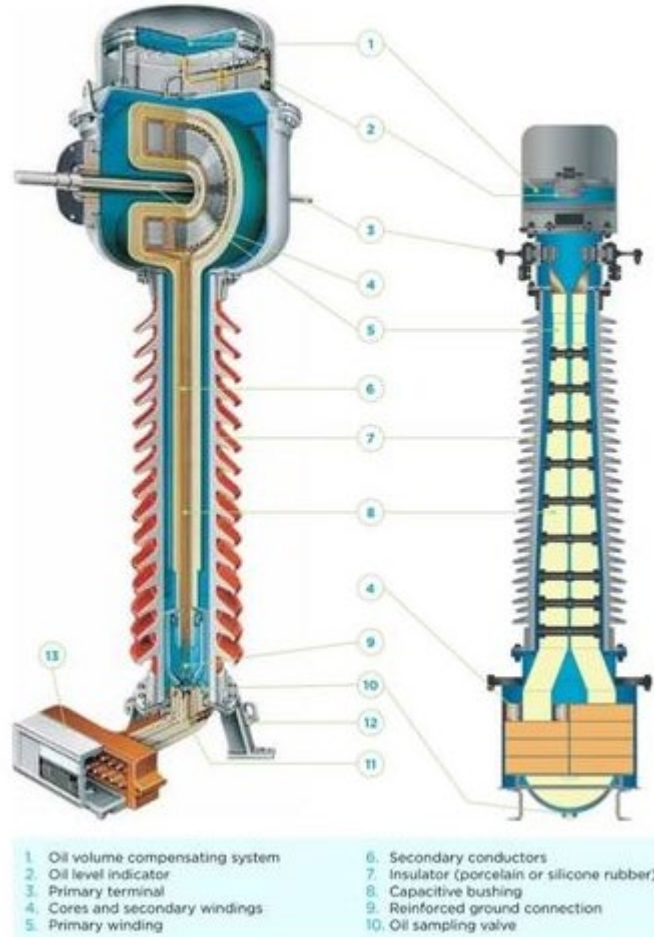
Circuit Breaker



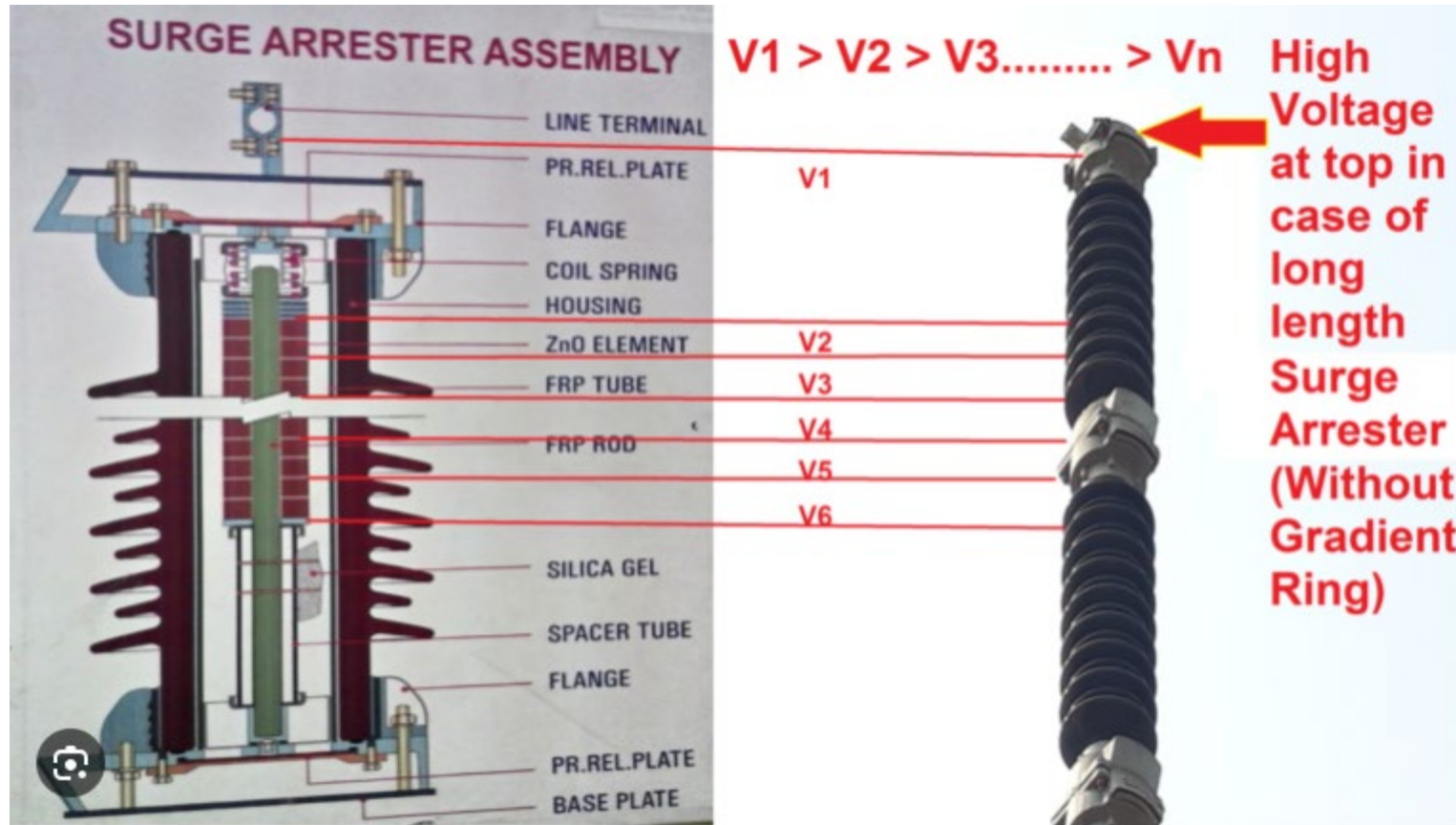
Disconnect



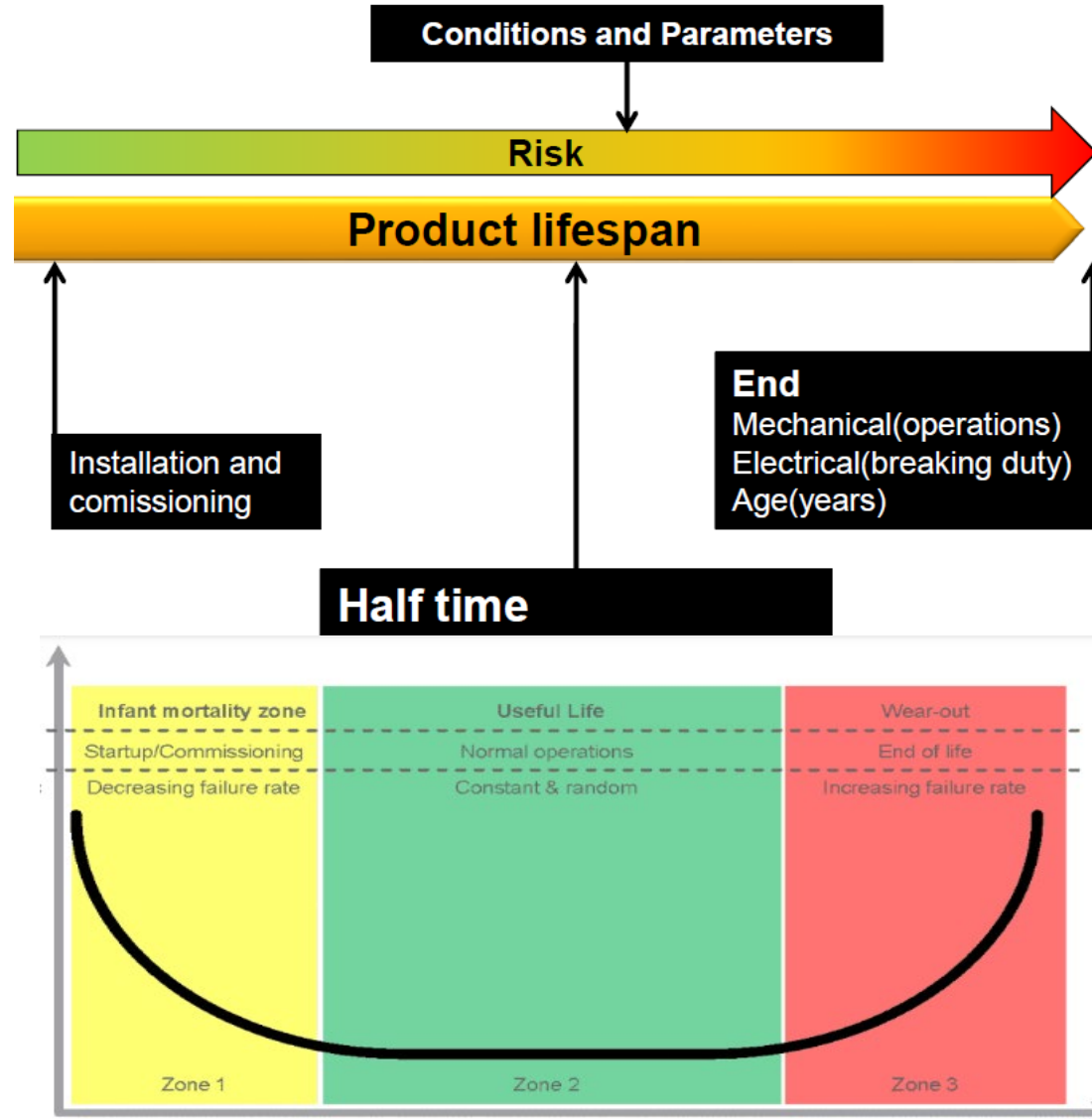
Instrument transformers



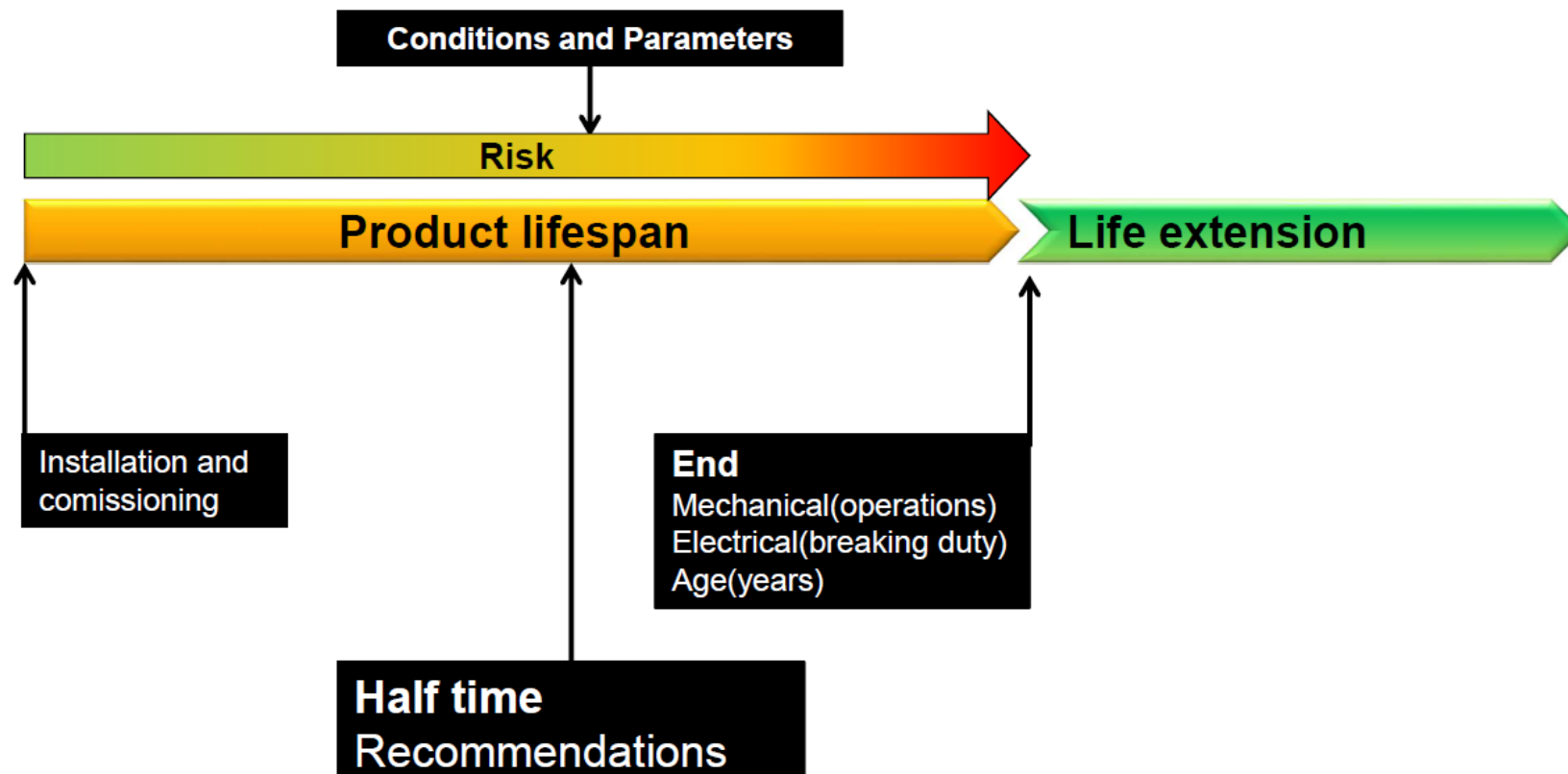
Surge arrester



Principle of Half-lifetime



Principle of Half-lifetime maintenance



Circuit breaker lifespan

Mechanical wear

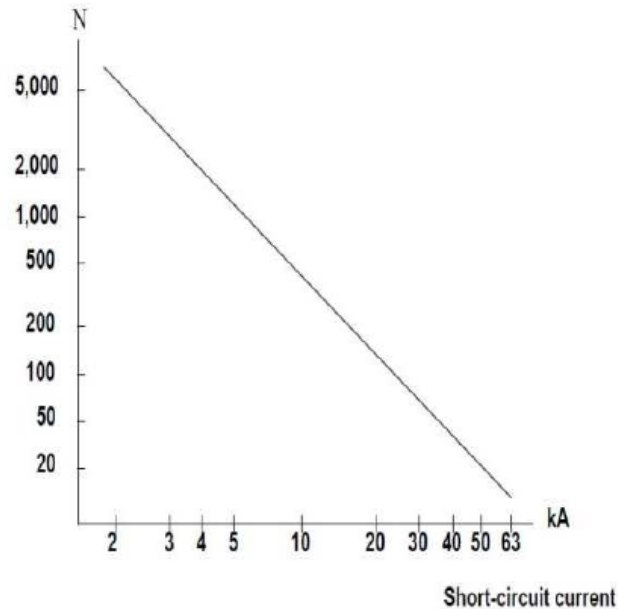
- **What is a mechanical operation?**
 - A mechanical operation means switching a few hundred ampere
- **How many mechanical operations are the SF₆ circuit breakers designed for?**
 - 10 000 M2
 - 2 000 M1



Circuit breaker lifespan

Electrical wear

Number of interruptions



- **SF₆ circuit breakers are designed for :**

- 5 000 electrical operations at rated current
- From 1 up to 5 000 electrical operations for short circuit currents, depending on the level of the current.

As the short circuit current rises, so does also the contact wear due to burning and the metal losses eventually becomes so great the contacts needs replacement.

(see graph to the left)

- **Key events in the electrical lifespan:**

- 1= Installation and commissioning .
- 2= Mid-life.
 - 2500 operations at nominal current or x number of short circuit current operations depending on the level of the current.
- 3= Full-time.



- $\sum n \times I^2 = 20,000$

$$10 \times 30^2 + 20 \times 20^2 + 20 \times 10^2 = 19,000$$



Circuit breaker lifespan

Maintenance history



Lack of maintenance

Failing to follow maintenance recommendations for the circuit breaker can shorten the lifespan of the circuit breaker as well as cause minor and major failures.



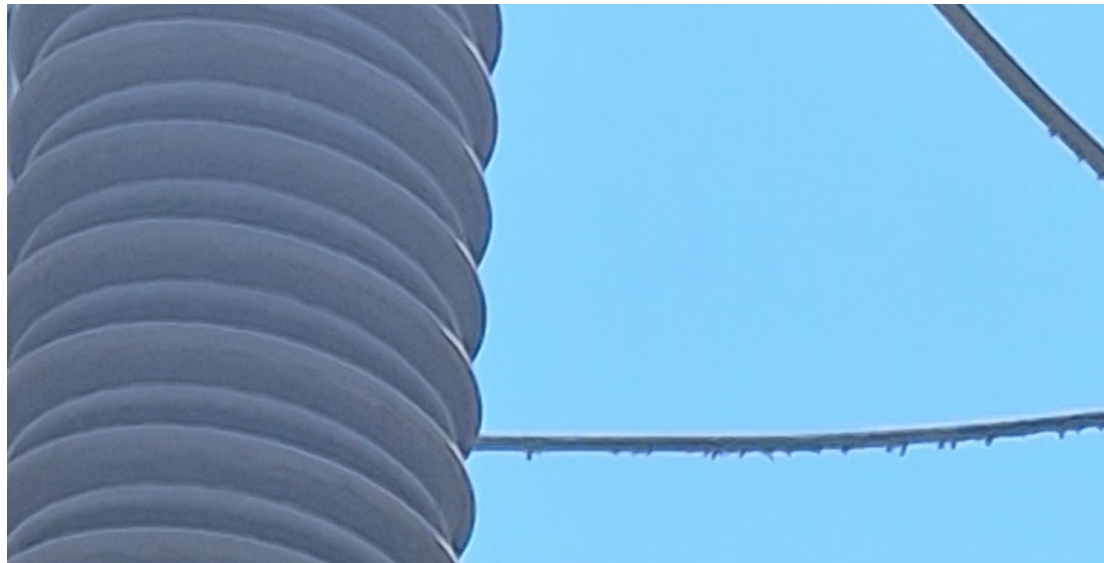
Circuit breaker lifespan

Environment

How does the environment affect the circuit breaker lifespan?

High and low temperatures affect ageing of organic parts.

Pollution may cause flashovers and corrosion, also affects ageing of organic parts



Half-lifetime maintenance of circuit breakers

Maintenance by factory specialist at site:

- Complete dismounting and move to clean closed workshop with lifting capabilities
- Opening of breaking chamber and conditional cleaning and replacement of parts
- Replacement of dynamically stressed gaskets
- Maintenance of operating mechanism
- Installation and commissioning

Maintenance at the manufacturer's facility:

- Complete dismounting and packing
- Shipment to the manufacturer facility
- Shipment to site
- Installation and commissioning

Procurement of strategic spare parts



Maintenance of Disconnectors

Every 5 years or after 1000 operations*:

- Clean contacts and apply Mobycoate BR2 paste
- Greasing of bearings and pivot
- General inspection as per check list of commissioning

Procurement of strategic spare parts

If can not be inspected periodically or in hard conditions :
to open and close switches whenever possible to clean contacts.



Maintenance of Instrument transformers

During first 15 years :

- Insulator clean
- Oil level is correct
- Check of oil leaks mainly through seals
- No mechanical damage/rust
- Thermovision check may be performed

After 15-20 years or damage:

- Oil sampling and analyses of oil condition + DGA for all over condition of the device
- Power factor measurement for CTs by Capacitive Tap (if supplied) or without Capacitive Tap as per O&M provision



Instrument transformers correct oil sampling

- Only during dry weather
- Through oil filling plug
- Removed gaskets replaced
- Oil sampling kit can be ordered
- Sampling by use of clean and dry syringe
- First filling of syringe for cleaning purpose only
- To avoid gas penetration into syringe (if gas still penetrated it must be taken out) + clear statement in the report



Figure 5.1



כ-750
עובדים

כ-350
עובדים
מקצועיים

כ-55
מהנדסי
חשמל
ומכונות

בקבוצה מועסקים:

מאות שנות ניסיון מצטבר בהנהלה ובצוותי העובדים

כ-925
מיליון ₪

הזמנות שיא

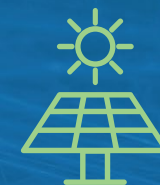
כ-700
מיליון ₪

מחזור שנתי

החברה ממוקדת בהנדסה, תשתיות,
ושירות בעולמות האנרגיה והחשמל



מתקינים ומחברים לרשת עשרות פרויקטי
תשתיות ואנרגיה מתחדשת - עשרות
לקוחות בתיקי שירות



חדשנות ופריצה לתחומי הפעילות העתידיים של
משק החשמל והאנרגיה - מובילים נכסים לעצמאות
אנרגטית



מענה מלא למגמות בעולם האנרגיה - חשמל ירוק ואפס
פליטות, פתיחת שוק החשמל לתחרות וביזור משק החשמל
והאנרגיה

