



Medium voltage service

Air Insulated Switchgear Life Cycle Services

Strategy

Air Insulated Switchgear (AIS) is the most common type of medium voltage equipment with the largest installed base. Its life cycle is generally quite long, so the service strategy applied is extremely important to guarantee the required reliability over time.

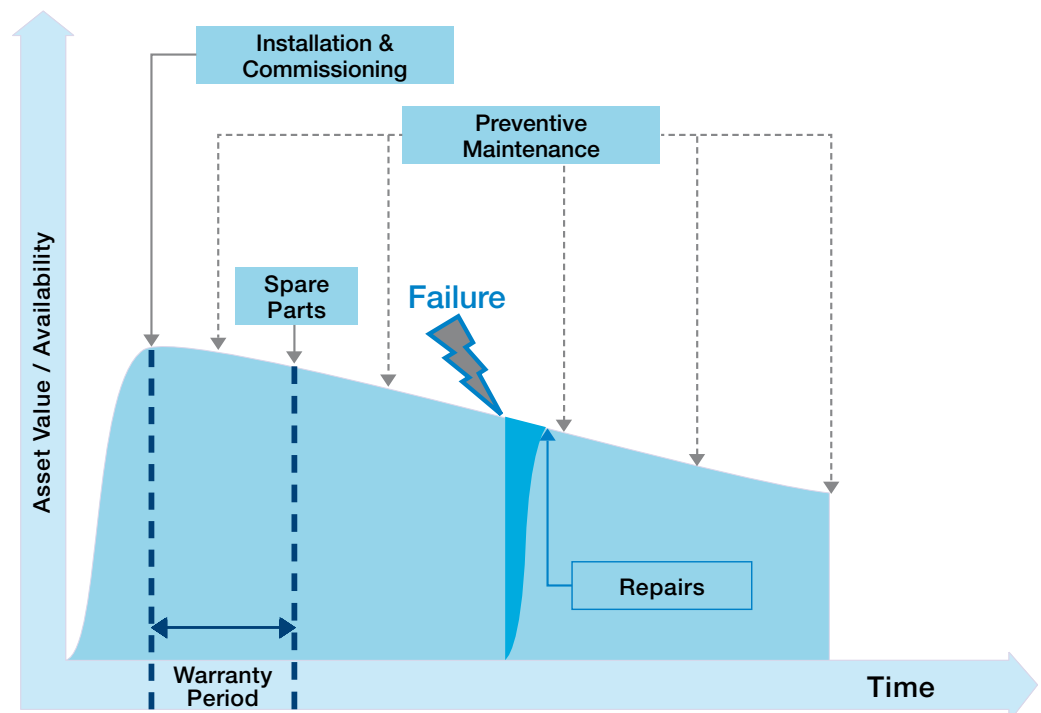


ABB supports AIS users with optimized and cost-effective strategies implementing the right actions at the right time. Asset managers are fully assisted in moving from conventional approaches (“Corrective maintenance” and “Preventive maintenance”) to advanced strategies (“Risk-based maintenance” and “Condition-based maintenance”).

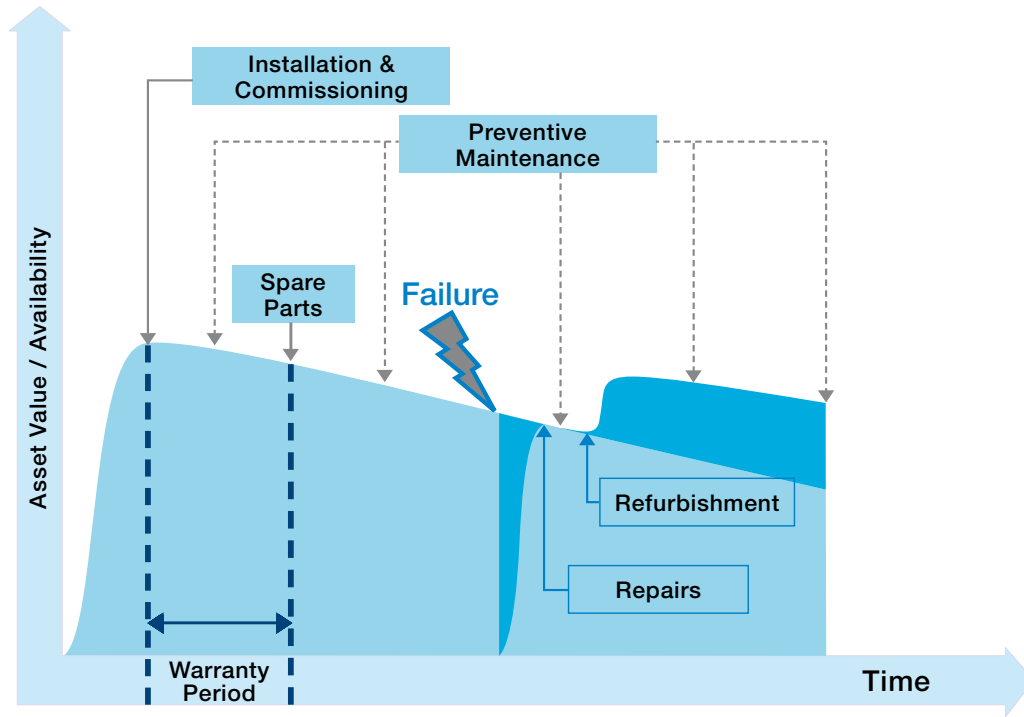
This way, the service activity is no longer driven by predefined timeframes, observations and past experiences, but takes the actual condition of the equipment, the required reliability level and the life time extension expectation into account. This assessment is performed by trained technicians as part of risk-based maintenance programs or is carried out automatically by means of on-line monitoring systems for condition-based maintenance solutions.

The ABB approach to AIS Life Cycle Services is divided into two steps:

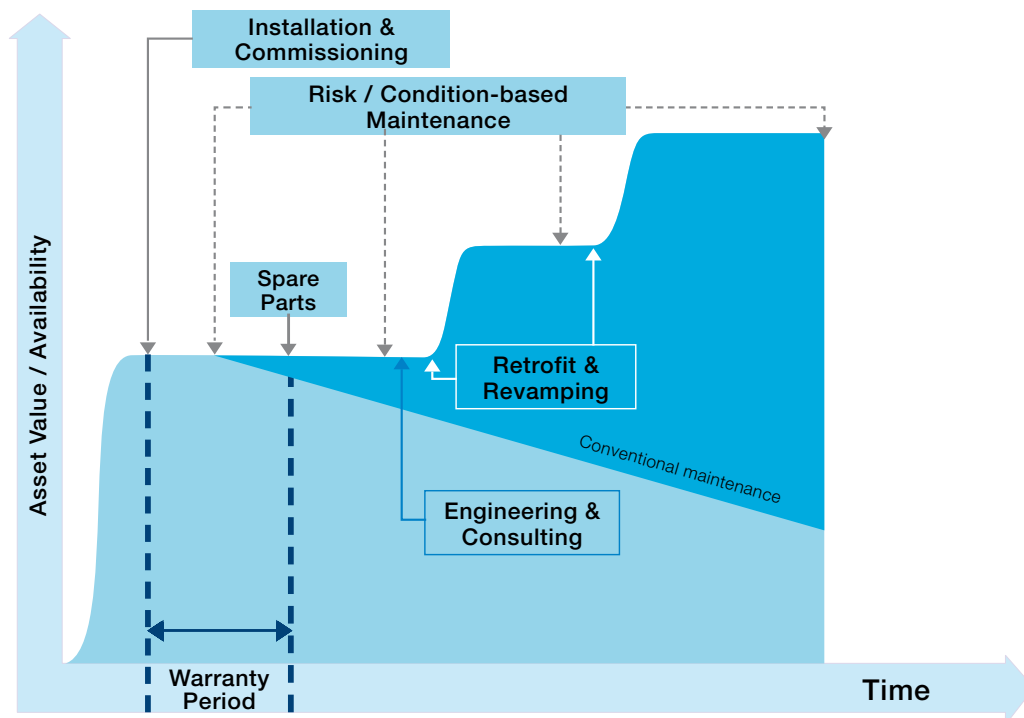
- Asset condition and risk assessment
- Life cycle support package



Trend throughout the switchgear life when conventional strategies are applied (“Corrective maintenance” and “Preventive maintenance”)



Trend throughout the switchgear life when conventional strategies are applied ("Corrective maintenance" and "Preventive maintenance") plus refurbishment at the end-of-life period



Trend throughout the switchgear life when advanced strategies are applied ("Risk-based maintenance" and "Condition-based maintenance")

Asset condition and risk assessment

Asset condition assessment

The condition assessment provided by ABB starts with data collection. An inspection and testing activity provides the most comprehensive and cost-effective data gathering option. The data on the history of the switchgear, including but not limited to system diagrams, equipment application, operating duty, maintenance history, environment and condition, history of faults or significant events, existing studies and individual component data & test results are collected. All this information is then processed in the asset condition analysis.

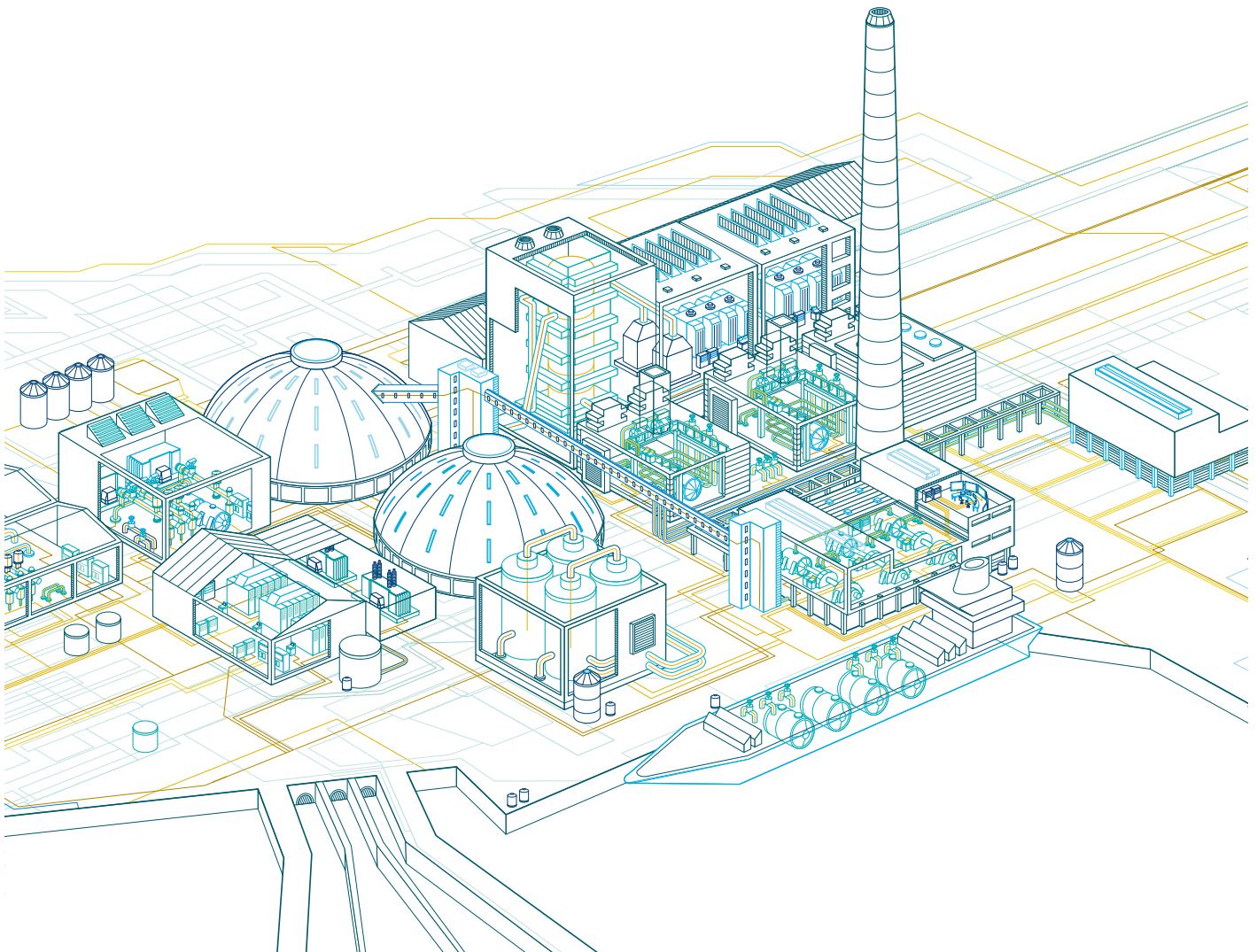
Risk assessment

Risk assessment defines the maintenance plan and is based on the following elements:

- asset condition assessment
- condition index (failure risk evaluation)
- importance index (targeting critical equipment)

The output is a priority list of service activities taking the following into account:

- risk level of each piece of equipment
- resource optimization
- cost impact of each action
- associated benefits in terms of reliability and life extension



Effect of the environment

Effects due to environmental conditions are generally underestimated, but they have a significant impact on modifying the service scheduling, especially when combined. Normal, favourable or severe situations must be taken into account when scheduling and also during the condition and risk assessment for the reasons indicated below.

Environmental condition	Description	Effects
Ambient temperature	Evaluate the minimum (Tmin) and maximum (Tmax) values measured during the year.	Lubricant ageing, physical and functional degradation, mechanical stress (especially in cases of a significant temperature range)
Humidity	Typical conditions: <ul style="list-style-type: none"> • normal humidity: up to 60% • area next to water basins: from 70 to 90 % • tropical zones or particular industrial processes: more than 90% 	Metal corrosion, circuit tracking and loss of insulation
Salt or chemical agents	Typical conditions: <ul style="list-style-type: none"> • neither saline nor chemical environment • near the sea (1 to 10 km) or in an industrial area • marine, onshore (less than 1 km), or in a chemical plant 	Lubricant ageing, physical and functional degradation, mechanical stress, metal corrosion and increase in circuit resistance
Dust	Typical conditions: <ul style="list-style-type: none"> • commercial or public buildings: little concentration of dust • industrial buildings: <ul style="list-style-type: none"> - air conditioned: little dust - ventilated with filters: medium level of dust - unprotected: high level of dust 	Lubricant ageing, physical and functional degradation, mechanical stress, operating mechanism wear and circuit tracking

The environmental parameters are referred to the room where the switchgear is installed.

Important information about the lubricant:

- it has an expiration date and therefore it is necessary to check what available on stock before its use
- use only the lubricant specified in the user manual.

ABB asset condition assessment is based on two sections:

- inspection check
- instrumental analysis.

Both parts are suggested to give a full assessment, but depending on equipment accessibility, the first one could be performed to get a preliminary overview.

The “Asset condition and risk assessment by ABB” allows dealing with other conditions (load type, IP degree, DC components, vibration, altitude, equipment parameters, etc.) whose parameters are complex in detection and interpretation. Those conditions can actually accelerate the equipment aging and compromise the proper working.

Time-table at page 9 shows a typical asset assessments schedule. If not yet applied, the preliminary survey at page 7 can support user decision asking for an ABB assessment.

Preliminary survey

The “Preliminary survey” is a simple tool for evaluating the need for a more in-depth assessment carried out by ABB. Its use is strongly recommended for those plants where conventional maintenance strategies are still applied and no other assessment has been performed.

Check each environmental and operational condition, compare the plant situation with given range/status values and flag the relevant cell in the choice column.

Connect to our website www.abb.com/mediumvoltage by selecting → Service → AIS Preliminary survey and complete the survey.



Id	Condition	Range/Status	Choice	
1	Ambient temperature	IEC		
		Tmin < -5°C and Tmax > 40°C		
		Tmin < -5°C or Tmax > 40°C		
		Tmin > -5°C and Tmax < 40°C		
		ANSI	Tmin < -30°C and Tmax > 40°C	
			Tmin < -30°C or Tmax > 40°C	
			Tmin > -30°C and Tmax < 40°C	
		GB	Tmin < -25°C and Tmax > 40°C	
			Tmin < -25°C or Tmax > 40°C	
Tmin > -25°C and Tmax < 40°C				
2	Maximum relative humidity in substation	Up to 60% 60% to 90% 90% and above		
3	Salt or chemicals in the air	None Close to sea or industrial area position Marine or onshore or chemical plant position		
4	Dust - ventilation in the substation	Air conditioned Ventilated with filters Not protected		
5	Protection and control electronic devices	Correct function Incorrect operation reported once False tripping or permanent incorrect function		
6	Average load current (% of nominal)	Up to 90% 90% to 100% 100% and above		
7	Mechanical or load current circuit-breaker operations (per year)	Up to 10 10 to 300 300 to 500 500 and above		
8	Load current operation of contactor (per day) 0 points if not installed in the plant	Less than 5 5 to 10 More than 10		
9	Fault current operation of circuit-breaker or contactor (per year)	Less than one One More than one		
10	Racking in operations (per year) Multiply by 10 times the operations if motor operated	Less than 5 5 to 10 More than 10		
Number of years from the last ABB assessment				

Note: Environmental conditions (Id numbers from 1 to 4) refer to the entire lifetime of the switchgear including the period in stock at site, whereas the operational conditions (Id from 5 to 10) relate to the most critical installed device.

Life cycle stages

Definition of life stages

In general, the switchgear can be in one of the following life cycle stages regarding the years of life:

- early life: up to 9 years
- mid life: from 10 to 20 years
- late life: more than 20 years

Duration stages will be decreased if the number of apparatus operations exceeds the following typical values (see the relevant user manual to find out the maximum number of operations for the specific apparatus):

Switching apparatus type in the switchgear	Number of operations		
	Early life	Mid life	Late life
Vacuum circuit-breaker	Up to 2.500	2.500 to 7.500	7500 and above
SF6 circuit-breaker	Up to 2.500	2.500 to 7.500	7500 and above
Oil circuit-breaker	Up to 750	750 to 1.500	1500 and above
Air-Magnetic circuit-breaker	Up to 5.000	5.000 to 10.000	15.000 and above
Contactors	Up to 250.000	250.000 to 750.000	750.000 and above



Typical switchgear life cycle

ABB recommends to carry out an asset condition and risk assessments according to the following time-table for AIS operating in normal conditions with switching operations not exceeding the numbers given in the previous page.

Years of life	Warranty	Assessment	Note	
Early life	1	standard	Installation and commissioning	
	2	standard	Asset condition assessment is recommended at the end of standard warranty period. It is mandatory for applying extended warranty.	
	3	extended		
	4	extended	R	
	5	extended		
	6			
	7		Early-life period assessment	
	8			
	9		R	End of early-life period assessment
Mid life	10			
	11			
	12			
	13			
	14		R	Mid-life period assessment
	15			
	16			
	17			
	18			
19		R	End of mid-life period assessment Engineering and consultation for end-of-life handling	
Late life	20	standard for replacement or retrofit	In the case where a retrofit or replacement is applied	
	21	standard for replacement or retrofit	R (M)	
	22	extended for replacement or retrofit		
	23	extended for replacement or retrofit	In the case where a retrofit or replacement is applied	
	24	extended for replacement or retrofit	R	
	25			
	26		Late-life period assessment In the case where a retrofit or replacement is applied	
	27			
	28			
	29		R	End of late-life period assessment
	30			De-commissioning and replacement

R - Recommended
M- Mandatory

Life cycle support

Typical service packages

ABB prepares typical service packages that fulfil the switchgear needs for each life cycle stage.

Services	Early life	Mid life	Late life
Switchgear integrity			
Reconditioning of insulators and surfaces	•	•	•
Refinement and conductivity improvement of joints in current path	•	•	•
Current path and insulation refurbishment			•
Safety upgrade (for operators, devices, processes)			•
Control and protection			
Enhancement and correction of the control and protection functionality	•	•	•
Protection relay preventive maintenance		•	•
Protection and control relay upgrade		•	•
Protection and control relay replacement			•
Training			
Product training and application training for operators and technicians	•	•	•
Life extension training for technicians, refresher training for operators		•	•
Switching apparatus			
Functional check and corrections of circuit-breakers, contactors, earthing switch mechanisms and accessories	•	•	•
Mechanical activation for circuit-breakers with low number of operations (10 operations recommended per year)	•	•	•
Oil replacement for oil breakers (recommended every 4 years)	•	•	•
Predictive maintenance of circuit-breaker, contactor and earthing switch mechanisms and accessories		•	•
Installation of Upgrade kits		•	•
Circuit-breaker and contactor retrofit			•
Spare parts			
Provision of operating spare parts	•	•	•
Provision of critical spare parts (due to possible product phase-out)		•	•

Customer support agreements

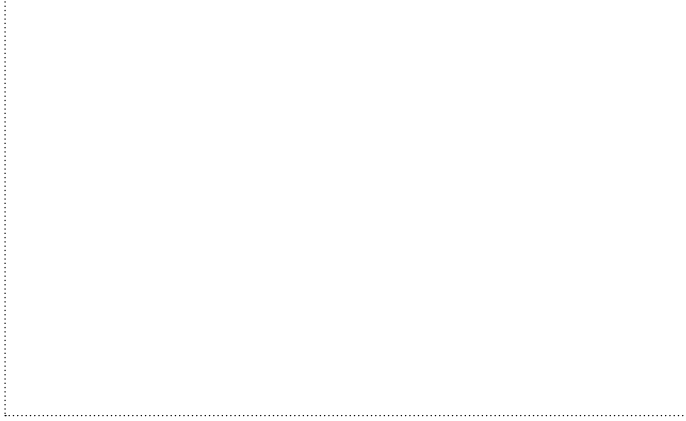
The "Customer support agreement" is the easiest way to secure the switchgear availability during the whole lifecycle. Typical agreement covers periodic asset condition and risk assessment or installation of monitoring system for condition-based maintenance. Training for site operators, maintenance

of protection and control equipment, switching apparatus and all switchgear components are also included. All services are provided by trained and certified ABB service expert technicians.

The agreements are based on a modular selection of services, chosen by the user with the support of ABB personnel and matching the operational needs.

	Level 4	Level 3	Level 2	Level 1	Entry level
Skills Development Services	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Emergency Maintenance Services	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Diagnosis, Condition Assessment and Safety Upgrades	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Self-Maintenance Service	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Delivered Maintenance Services	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Contact us



Your Service sales contact: www.abb.com/contacts

More Service information: www.abb.com/productguide

The data and illustrations are not binding. We reserve the right to make changes without notice in the course of technical development of the product.

© Copyright 2011 ABB. All rights reserved.