

Appendix 9.3.TDI-NE.2
NECPL - ABB Support Services



Power Systems - HVDC Service

ABB HVDC Care Lifetime support

HVDC technology from ABB provides customers with stable, high performance power transmission systems, today as well as tomorrow. Our HVDC support services give you total assurance in all phases of the installation lifecycle.



ABB provides lifetime service support

To maintain high availability and reliability in HVDC installations over the long term, it is important to plan for future support and spare parts. ABB is always ready to give your installation the latest available systems, functions, upgrades and technical support.

Support and services

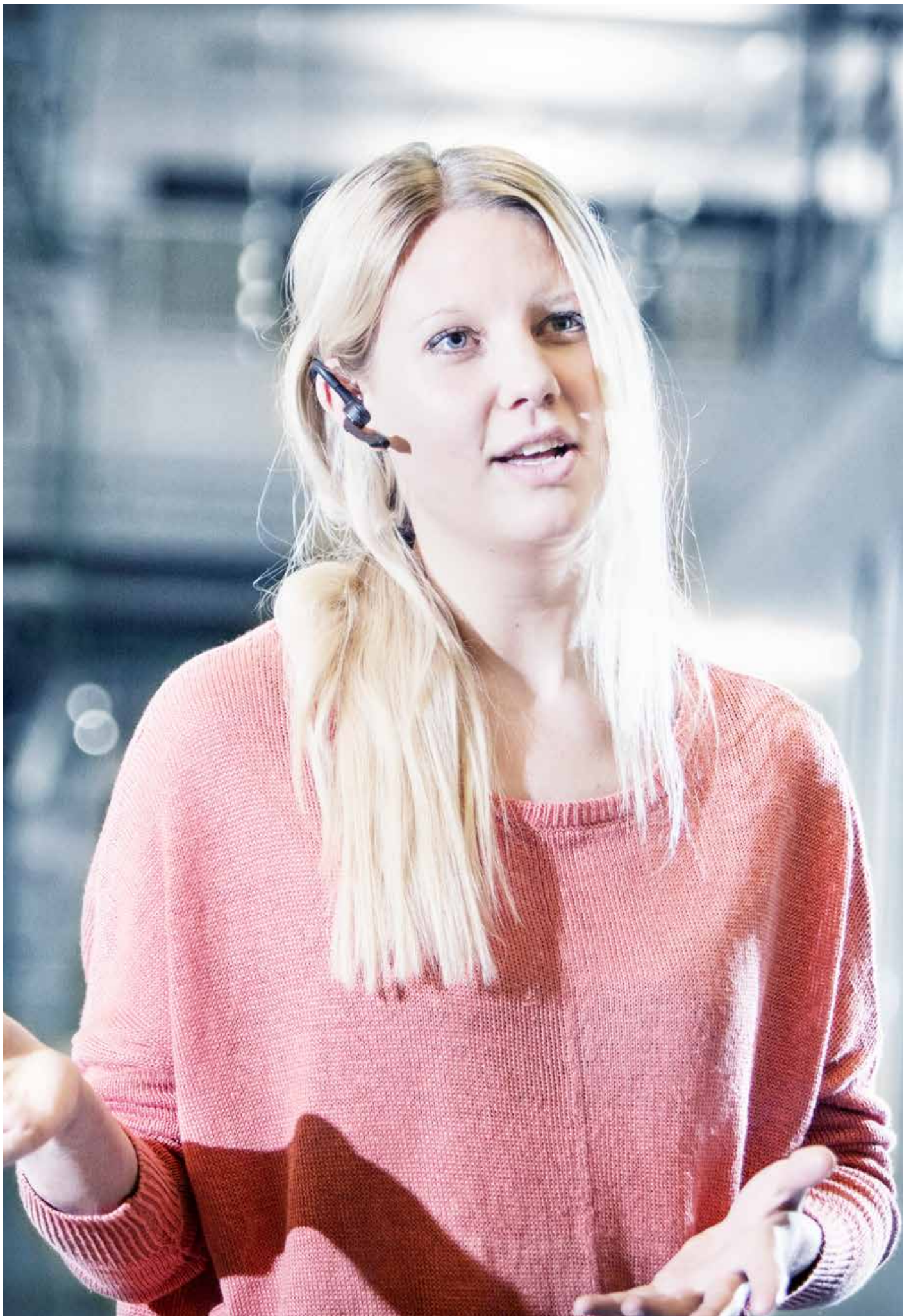
Your company should be able to focus on its core business throughout the entire life cycle of an HVDC installation. The foundation of a solid, well-functioning installation is laid at the project execution phase. We will manage the warranty period together and prepare your personnel to avoid unnecessary outages. Following customer takeover, ABB's HVDC support

team takes responsibility for all issues that may arise during the warranty period. A dedicated resource is appointed to handle the installation.

A commitment throughout the entire lifecycle

ABB HVDC equipment, like this converter station in Finnböle, Sweden (shown in the picture below) represents a significant investment. Servicing and upgrading can ensure that the operator gets the most out of the equipment as well as extend its life. HVDC offers a complete product portfolio including several options of service support packages, based upon your specific needs.





Service agreements

Flexible service adapted to your needs

Complete life cycle services

HVDC technology from ABB provides customers with stable, high-performance power transmission systems, today and tomorrow. Our HVDC support services will give you total assurance in all phases of the installation life cycle.

Service level agreements are built from a combination of the following service products. Additionally, a support agreement defines service level, validity time, and whether the service is recurrent (license) or a one-time delivery.

ABB recommends two levels of support packages, shown in the table below.



Gives you direct access to our 24/7 phone support of technical experts. Corrective maintenance is included.



There is an option to add more comprehensive and customized services. Upgrade projects are handled as separate agreements.

Services	Basic	Optional
24/7 phone support	✓	
Corrective maintenance	✓	
Basic training - Control systems & valves		✓
Supervision		✓
Remote access		✓
Advanced training		✓
Preventive maintenance		✓
Life cycle management		✓
Condition assessment		✓
Advanced services		✓
Spare parts management		✓

Phone support

Direct access to HVDC experts 24/7

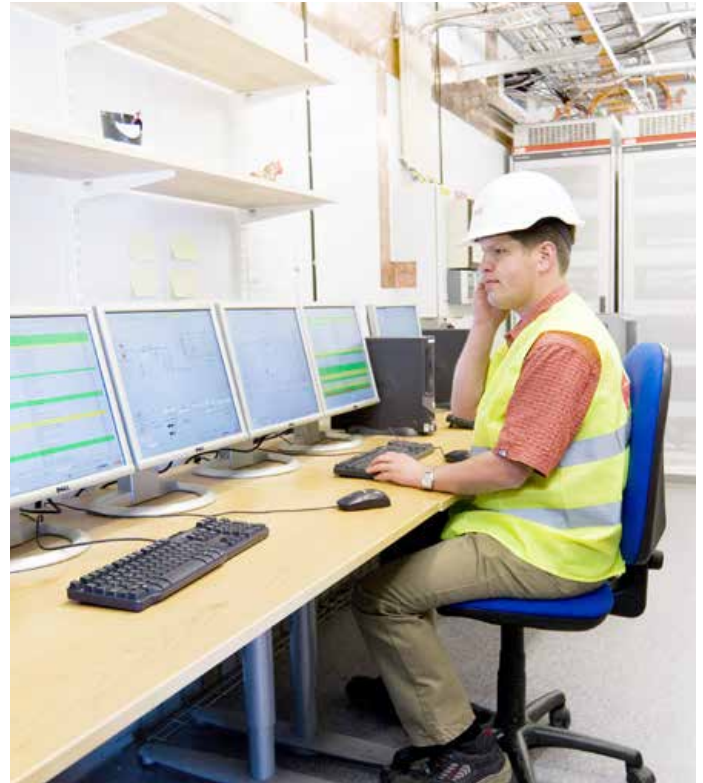


ABB provides a broad portfolio of services that are adaptable to your needs. We know from experience that customers have different requirements in terms of service levels and options, depending on the type of installation and its place in the product life cycle.

In many cases, corrective actions are only needed from time to time when unscheduled problems occur. ABB is committed to supplying support solutions that meet your needs and specifications. To rectify a problem as soon as possible, ABB provides several support options.

In the event of a problem, 24/7 phone support provides the security of a hotline at any time by phone, e-mail, or some other agreed upon means of contact. Quick connection to a skilled, knowledgeable ABB engineer offers direct access to the solutions you need immediately, and saves valuable time. Minor incidents are usually solved quickly, and in the event of a major issue, you will have the right support from the start.

The remote access service lets ABB troubleshoot and operate the converter station from a secure remote location within the ABB network.

ABB HVDC phone support provides direct expertise in the following areas:

- Control system support
- Valve support
- Main circuit support
- Auxiliary system support
- Valve cooling system support
- Spare parts support
- 24/7 phone support

ABB phone support service in summary:

- Provides a contact for support requests from business partners
- Answers how-to questions
- Analyzes alarms based on information from authorized maintenance personnel, recommends actions
- Provides instructions for implementing recommended actions

Corrective maintenance

ABB's emergency service that finds, isolates and corrects faults, restoring your system



Corrective maintenance service ensures skilled ABB personnel are on standby to assist you in the event of problems at your HVDC installation.

If unresolved over the phone support or by remote access, ABB HVDC will send a qualified technician to your station within an agreed upon time period to help find the solution.

ABB HVDC corrective maintenance is a service designed to detect, isolate, and rectify a fault and bring individual pieces of equipment or an entire system back to working order.

ABB corrective maintenance services typically consist of:

- Fault tracing
- Equipment replacement
- Equipment repair
- Restoration
- Corrective maintenance report with recommendations, if any
- ABB performs corrective maintenance on selected ABB equipment

ABB corrective maintenance in summary:

- Qualified ABB support staff on standby, ready to mobilize on-site in the shortest time possible
- Together with authorized customer maintenance personnel, ABB support staff analyze and identify the problem, and guide maintenance staff to the solution
- Afterward, a corrective maintenance report describes the problem, the corrective actions taken, and suggests preventive measures to avoid future problems

Preventive maintenance

Ensuring system availability and reliability



Preventive maintenance helps you to ensure the reliability of the systems and the components.

Preventive maintenance is key to ensuring the reliability and availability of an HVDC link during its entire lifetime. As a delivery is executed, preventive maintenance for HVDC systems will be outlined in a preventive maintenance plan. The purpose is to foresee and describe recommended preventive maintenance activities, and to estimate the manpower requirements for these activities.

ABB HVDC preventive maintenance service provides systematic inspections to detect and identify impending problems before they can become actual problems or even major failures.

A preventive maintenance program ensures system availability and reliability, and is intended to serve as an overall planning guide for the customer. Below is a summary of common preventive maintenance activities. All preventive maintenance on selected ABB equipment are performed at a fixed price.

ABB offers adapted and specialized technical supervision services. The supervisors have comprehensive knowledge of the equipment concerned e.g. control, valves and cooling systems.

To ensure future reliable operations, ABB provides condition assessment service. The condition assessment is a process that measures the actual and required condition of a HVDC station or a certain equipment.

ABB preventive maintenance services typically consist of:

- Preventive maintenance plan
- Systematic inspection
- References to manuals, providing details of the work
- Inspections to identify impending problems
- Planned and scheduled repairs prior to equipment failure
- Recommended time intervals for specific maintenance activity
- Life cycle management
- Spare part management

Training

Ensuring system competence



ABB provides comprehensive training for engineers, operators, programmers and maintenance personnel, including up-to-date technical expertise and support for a full range of products, systems and applications. Training is available at ABB facilities worldwide, at customer sites and online.

It includes theoretical and hands-on training sessions designed to provide operation and maintenance personnel with the skills they will need to maximize the reliability, productivity and safety of their systems.

Orientation training

An introductory course that gives a basic overview of the delivered HVDC system to customer staff.

Engineer training

Designed for personnel dealing with system engineering and analysis.

Operator training

Comprehensive and thorough training program with theoretical classroom sessions and hands-on training in the operation of the

HVDC System, including:

- Processing supervision and control
- Control of HVDC transmission
- Interpretation of disturbances and supervision of the control system to understand when to notify maintenance personnel

Maintenance training

Comprehensive and thorough training program with theoretical classroom sessions and hands-on training in maintenance of the control system, main circuit equipment and auxiliaries.

Additional training and active on-site participation is available during project installation and commissioning.

Benefits of a tailor-made training course

- Gain detailed knowledge of special solutions for HVDC system functions
- Increased understanding of how operator settings and trim settings affect control
- Obtain better knowledge of the potential sources of disturbances in your system
- Reduce downtime by avoiding long and unnecessary troubleshooting

Spare part management

Minimum outage time with maximum spare part support



ABB retains all technical documentation for the full lifetime of the projects it delivers. For older projects where system demands have changed over time or replacement parts are no longer available, our engineering departments will work out a new specification to ensure suitable equipment is always available for our customers.

In the event of circuit board failure or the breakdown of other vital devices in the control and converter valve equipment, the delivery time of replacement parts is crucial. ABB HVDC therefore maintains a store of replacement parts of many different types. ABB is your prime source for spare parts of all kinds, and takes care to ensure suitable replacement equipment is always available for delivery.

ABB can offer the following spare parts service solutions:

- Condition assessment to determine which spare parts are needed on hand to handle emergencies
- Recommendation of parts to order in advance for planned maintenance
- Asset inventory
- Stock management
- Recommended storage methods

Key benefits of ABB HVDC Spare part management

- Improved availability
- Reduced downtime
- Minimal production loss, reduced risk
- Detailed spare parts management plan

Upgrades

Increase efficiency and performance in existing HVDC stations



After some years of operation, for example at midlife of the scheme, a life time assessment of certain equipment's or systems could be of advantage to maximize system lifetime and reduce downtime.

Such assessments are available for all HVDC specific equipment within ABB, e.g. converter transformers, thyristor- and IGBT- valves and control equipment. For conventional AC equipment included in the HVDC scheme, e.g. breakers, disconnectors, filter reactors as well as cables, similar assessments are also available. By doing the assessments the owner will get a reliable estimate for the planning of future upgrade, service and operation.

Mid life upgrades of HVDC installations

Technology develops quickly, so when an installation has been in service for a number of years, it may be desirable to upgrade. Proactive upgrades can save operators time and money by avoiding equipment failure that can lead to severe outages. The lifetime for the control and protection system for HVDC stations can be expected to be around 30 years, but in HVDC installations 15 years and older some parts may require upgrading, depending on the general condition of the equipment and the availability of spare parts. The technical lifetime for thyristor valves is very long, probably around 50-60 years. Other examples of assets with a long practical life are overhead lines, cables, buildings, switchyards, and

transformers. When parts of these assets are failing they can often be replaced on component basis, such as breakers, parts of a cable, single phase transformers etc.

Overall, an upgrade increases the lifetime of an installation.

An ABB upgrade can provide your HVDC station with a new control system, new functionality, and a new generation of hardware and software. A control system upgrade can be done with a relatively short system outage and has shown to be an efficient way to prolong a high performance of an HVDC link. To upgrade older installations, ABB adapts modern systems and equipment and integrates them into existing HVDC stations.

The many good reasons for carrying out a technical modernization include:

- Extending system lifetime
- Higher availability and reliability
- Better cost efficiency
- Improved performance
- Increasing operating efficiency
- Solving potential spare part problems
- Easier technical support
- Additional features to handle addition of renewable energy in the system

Contact us

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