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ADRIA: A Summary of Different Tools for Motor and Generator Field Service Activities in the International Market

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ABSTRACT

AREVA Drive In Application (**ADRIA)** – is an innovative program for use at sites all over the world. ADRIA is a full package for medium voltage motor and generator services growth in the long-term, which presents a wide range of applications for nuclear- , thermal- , renewable- hydro power plants and all industrial plants. ADRIA support our customers with an optimized product in MV motor management systems e.g., dismantling, maintenance, repair, tools, containers with full equipped working tools or measure equipment.

Are you planning to open a site? You will need special equipment and very special diagnostic methods for electrical analysis for preventive maintenance scheduling and planning; special support from experts, **ADRIA** is a good, unitized, and flexible solution which can be adapted to different customer requirements.

- Technical modules show low service and maintenance costs due to the life time of electrical machines.
- Measurement module – a solution for the actual condition of the MV motors and generators (vibration, partial discharge, infrared technology, cable analysis, motor – current – analysis)
- Documentation module – for all projects in joining with quality management
- Tools module – support for all activities in service (working tools, office / store containers)
- Man power module – for all service in the field (Experts with world wide experience)
- For pre-maintenance we use, for example, infrared technology. Experts monitor different cycles and find out which parts are creating problems. The maintenance strategy will be clear, shorter and more effective for the next outage.

ADRIA offers great advantages for the global maintenance market providing time, efficiency and preventive scheduling, efforts and saving of costs.
This new technology method has been successfully applied in various motor refurbishment projects in German, Spain or Brazil nuclear power plants since 2010. Further follow-up orders in German and international plants such as in France, Czech, and Switzerland shows, that motor service with **ADRIA** is establishing itself as a reliable and flexible process in power plants worldwide.

1. INTRODUCTION

The ADRIA concept is a summary of different tools, diagnostics and maintenance concepts for motor and generator service activities in the international market.
The meaning of ADRIA is AREVA – DRIVE – IN – APPLICATION.

It's a full package in medium voltage motor and generator services growth up in the long-term, by support our customers with an optimized product in MV motor management systems,

especially for the international market by systematic and continuous integration and adaptation of the different modules to the customers maintenance structure.

The ADRIA concept was developed from AREVA under participation of the nuclear utilities in germany to optimize there maintenance times. Another big issue was the age of the existing drives in the nuclear area and the need -adapted to the expectation of the sites- for the extension of the lifetime of the equipment especially of the electrical drives.

ADRIA can offer a lot of support functions, diagnostics for lifetime analysis and a separate reporting and documentation of the results. This systematic approach includes also the independent maintenance scheduling -directly linked to the components in detail- for the complete drives or equipment.

2. INNOVATIVE MOTOR MANAGEMENT AS AN ALL-IN-ONE SOLUTION FOR ALL ELECTRICAL DRIVES

The smooth running of production process issues is one of the greatest challenges to the operation of plants. During performing the maintenance activities, therefore is also an optimized approach required. The concept is totally free to take the advantages of a planned period of trouble. Free operation times has to be extended to the maximum.
Thanks to the efficient service activities included in ADRIA, the availability times of a plant are increased and the costs for maintenance are reduced.
In addition, a reduced number of failures as one result increased additionally the plant safety and availability.

The ADRIA Maintenance Program is a summery of routine measurement and a number of special parameters, indicative of machine condition, which are trended over longer periods and analyzed by special tools and are used to make decisions on the type and timing of maintenance actions.

2.1 The challenges of ADRIA

After having developed a conception together with the customer, AREVA offers a solution to address these challenges. Considering all the aspects including the different technologies, measurements, documentation, tools and personnel.
ADRIA is and will be a customized motor management solution.

These modules, a specific selection and the appropriate application of the modules results in a perfect condition of the motors in use. According to the results of the module performance, follow-up actions will be defined which are the basis for a working plan for the following outages.
To integrate the ADRIA program in flexible steps over a longer period in the services scheduling of the sites, offers the biggest advantages of ADRIA, the efficient reporting of the lifetime estimation in relation to the originally expectation.

Using and integration of ADRIA modules can increase also the main time between failures!

3. THE ADRIA SOLUTION

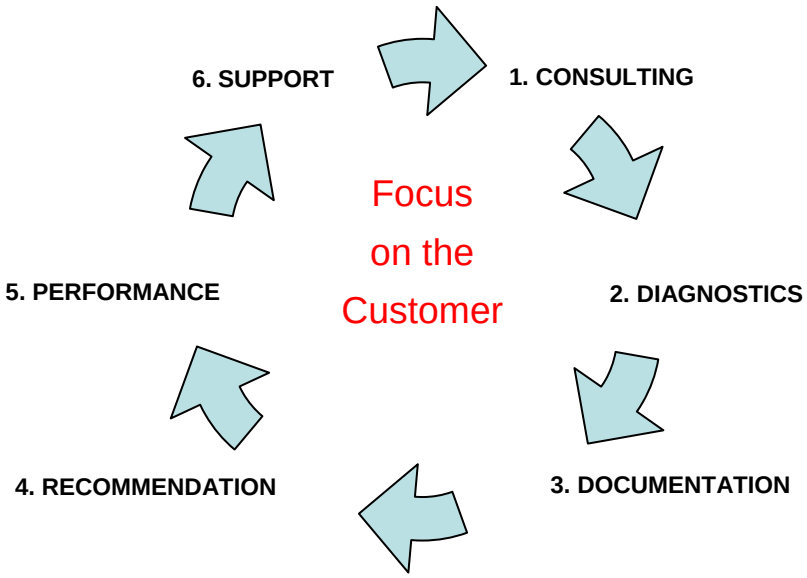


Figure 1: Principle of ADRIA Consulting

3.1 ADRIA Systematic

The Systematic of ADRIA is a intelligent combination of the different modules in combination of the existing maintenance structure of the customer. After analyzing of the existing historical and actual datasets we start together with the customer an adaptive maintenance measuring and analyzing program which will be followed up as the result in the upcoming service program for the electrical drives.

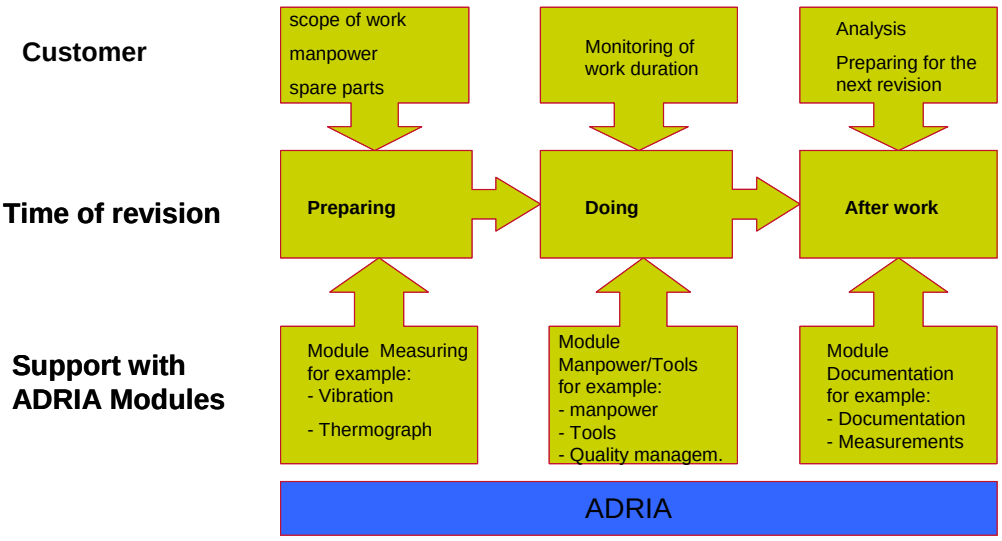


Figure 3: Systematic of ADRIA

AREVA can support the customer in analyzing and trending of the datasets and can provide as an integrated partner the upcoming activities for maintenance. Based on our measurements and analysis we can offer as the biggest advantage also an preventive maintenance program for the customer to save investments for the future on an cost efficiency basis.

ADRIA integrates also the spare & ware part recommendations as one important figure. Flexible support and integration of our specialists around the world to support the customer needs is another important module.

3.2 Using versatile Techniques and modules

ADRIA offers support to the plants operator to avoid failures, localize and remove them. Our versatile conception of techniques makes this possible while a contact-free measurement method is employed in thermography so that a plant does not have to be shutdown, PD measurement is a measurement method with which the depths of insulation technology are being reached. All these processes, be it vibration analysis, cable analysis or be it a motor current analysis (EMPATH), enable a condition-oriented evaluation of the electrical machine and provide a plant operator with the opportunity to optimally plan and perform maintenance activities.

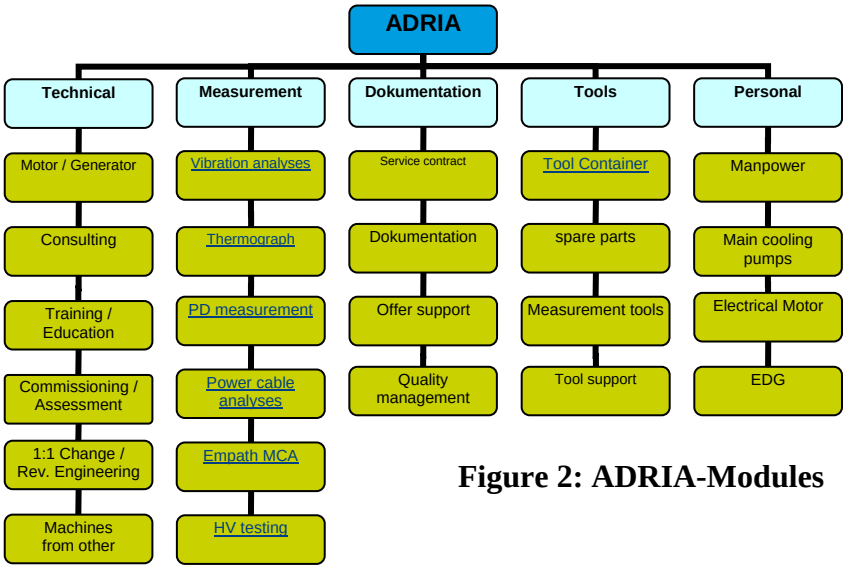


Figure 2: ADRIA-Modules

3.3 ADRIA Diagnostic Modules

The different ADRIA Measuring modules are an integral part of the ADRIA program and mostly the start up procedure to get the basis for the following analysis of the electrical drive.

Start up after analyzing the historical and existing datasets from the client will be the thermographical and MCSA-Method (Motor Current Signature Analysis).

SINGLE MODULES:

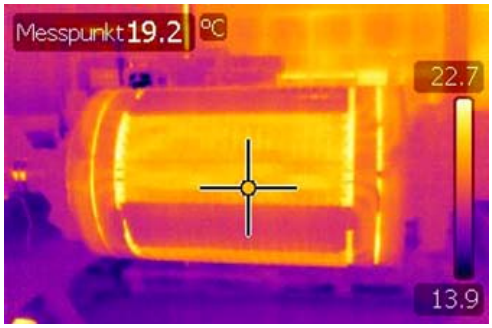
Services
- Consulting
- Diagnostics
- Maintenance
- Reproduction of components

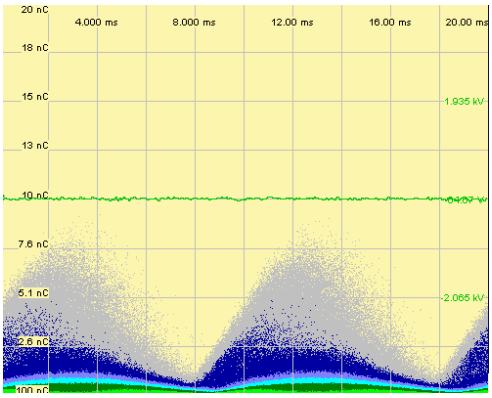
Measurements
- Vibration
- Thermography
- Partial discharge measurement
- Cable diagnostics
- EMPATH (motor – current - analysis)
- High-voltage testing

Documentation
- Quality management
- Reviewing and reporting

Personnel
- Assembly personnel for motors, generators or standby generators
- Training of the customer‘s personnel

Rental equipment / Spare parts
- Tool containers
- Measurement equipment
- Tools
- Spare parts





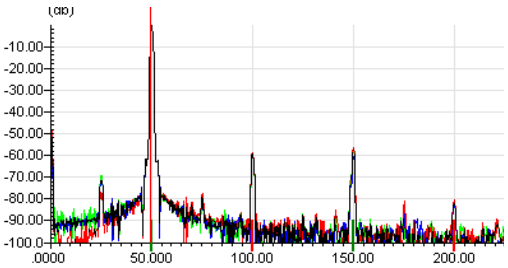


Figure 4: ADRIA-Structure and Measuring Modules

3.3.1 Example MCSA Module

The best measurement for the first analysis of the electrical drive is the MCSA-Method, which will be mostly the first diagnostic method to compare the start up values with the situation today. The MCSA method has the following advantages:

- Measures & analyses electric motor current & voltage
- Provide unique algorithms that can reliably detect the early stages of rotor bar failures in induction motors
- Convenience of monitoring motors & machinery from a central location
- Auxiliary channels allow acquisition & analysis of data from a wide variety of sources
- Non-intrusive remote diagnostic technique

The MCSA offers the Automatic voltage and current level sensing including the automatic alignment of phases to achieve the correct power factor. The datasets will be automatic stored. The analysis of the dataset is immediate; or -depends on the agreement with the client- can be deeply performed later in the office.
The MCSA analysis provides for automatic determination of rotor bar and stator slot counts, additionally for automatic analysis of motor bearing defects which will be shown in the overlaying frequencies of the HV-Inline.

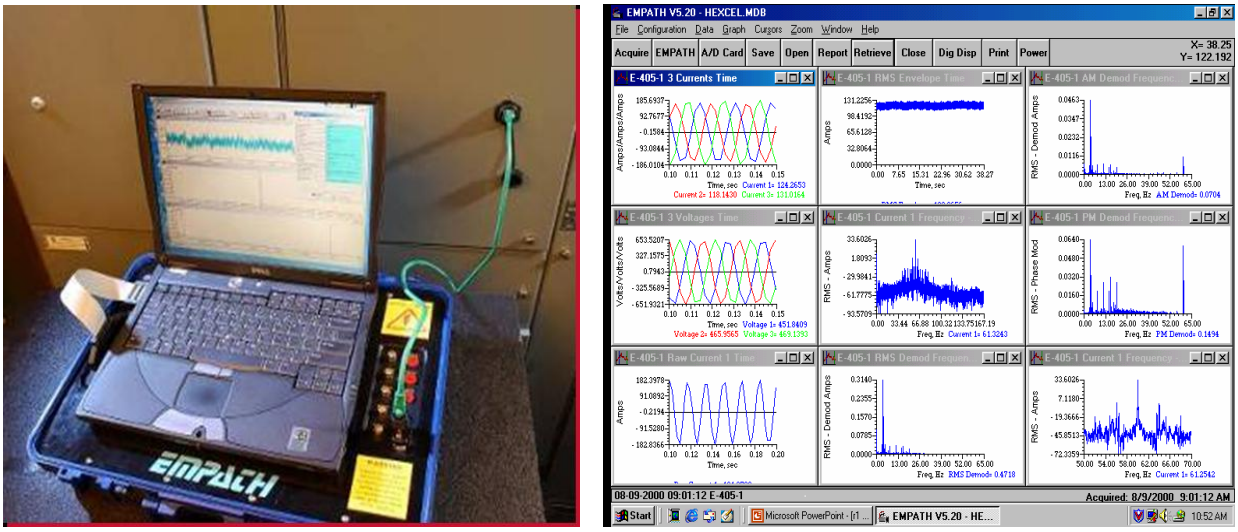


Figure 4: MCSA Tool EMPATH and Analysing Unit

3.3.2 Example Vibration Module

The Vibration analysis -in mobile form- gives more detailed information about the mechanical stresses, especially after the MCSA Diagnostic shows some mechanical defects.

3.3.3 Example Partial Discharge & HV-Testing Modules

The intelligent diagnostic of the PD-Measurement allows the detecting, recording and analyzing of partial discharge events in any kind of electrical equipment, such as transformers, rotating machines, gas insulated switchgears and cable systems.

The insulation of the defects can also be detected in generators and other high-voltage components which are installed in the area of the drive. The PD-Analysis gives the power plant operators the advance to notice possible damages to the insulation.
Continuously measurements, locally and/or remotely will monitor partial discharge activities of a high-voltage insulation system.

- Definition:
  “In electrical engineering, partial discharge (PD) is a localized dielectric breakdown of a small portion of a solid or fluid electrical insulation system under high voltage stress, which does not bridge the space between two conductors. While a corona discharge is usually revealed by a relatively steady glow or brush discharge in air, partial discharges within solid insulation system are not visible.”

PD can occur in a gaseous, liquid or solid insulating medium. It often starts within gas voids, such as voids in solid epoxy insulation or bubbles in transformer oil.
Protracted partial discharge can erode solid insulation and eventually lead to breakdown of insulation

In combination with the HV-Testing method it shows all possible defects and indications of electrical stresses of the drive, especially over a longer period.

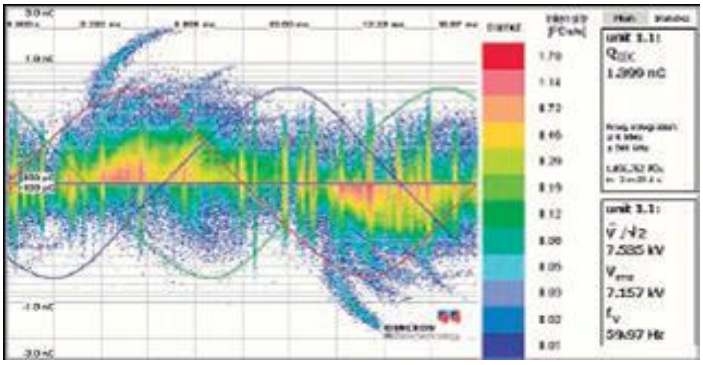


Figure 5: PD Analysis

4. YOUR BENEFITS AT A GLANCE

ADRIA is an all-in-one solution in the field of motors from a single source!
- AREVA is in cooperation with large motor manufacturers
- Increase of the availability times of the plant
- Cost reduction by means of targeted maintenance

ADRIA are developed to ensure that any maintenance issues will be detected and addressed in their earliest stages as possible.
ADRIA offers On-site Services, Proactive maintenance, including preventive and predictive maintenance, planning and scheduling and emergency response.
ADRIA offers Support Services, as well optimizing motor reliability with overhaul, repair and rewinding and upgrade activities.
ADRIA offers additionally the Inventory Management Services, including the rationalization, optimization & storage, and maintenance of spare motors as well as a shared inventory program.
ADRIA offers Consulting & Engineering Services, including the motor management assessment, drive condition reviews and reliability improvements.

5. CONCLUSION

Especially for safety and availability related drives, a steady function according specification and design is essential for safe and reliable plant operation.

Drive monitoring and diagnosis provides important information on the condition and functional behavior of motors and, therefore, supports the way to condition-based and preventive maintenance scheduling.

AREVA provides a complete scope of products and services for state-of-the-art diagnosis on drives and motors in nuclear power plants. With longtime experience and know-how we support plants in all stages of electrical drive diagnostics considering specific motor design / engineering aspects as well as maintenance requirements.

The main result will be the savings of bottom-line money that will drive your business at all.

6. REFERENCES OF ADRIA

AREVA has more than 25 years international experience in motor and drives refurbishments & diagnostics, e.g. in Germany, Switzerland, Brazil, Spain, Finland, China and Eastern Europe.

In nearly the complete german nuclear fleet we are one of the main supplier of services onsite, also for refurbishment activities using our facilities and workshops offsite.

In different international nuclear power plants safety-related and operation-related drives are monitored and under services continuously including the ADRIA concept. The ADRIA program is also used by different non-nuclear sites especially for stressed drives in hydro plants and used partially also for conventional power plants.

In addition specific motor diagnostics (MCSA, PD, Vibration Diagnostics) are yearly performed in several nuclear power plants in the countries worldwide.