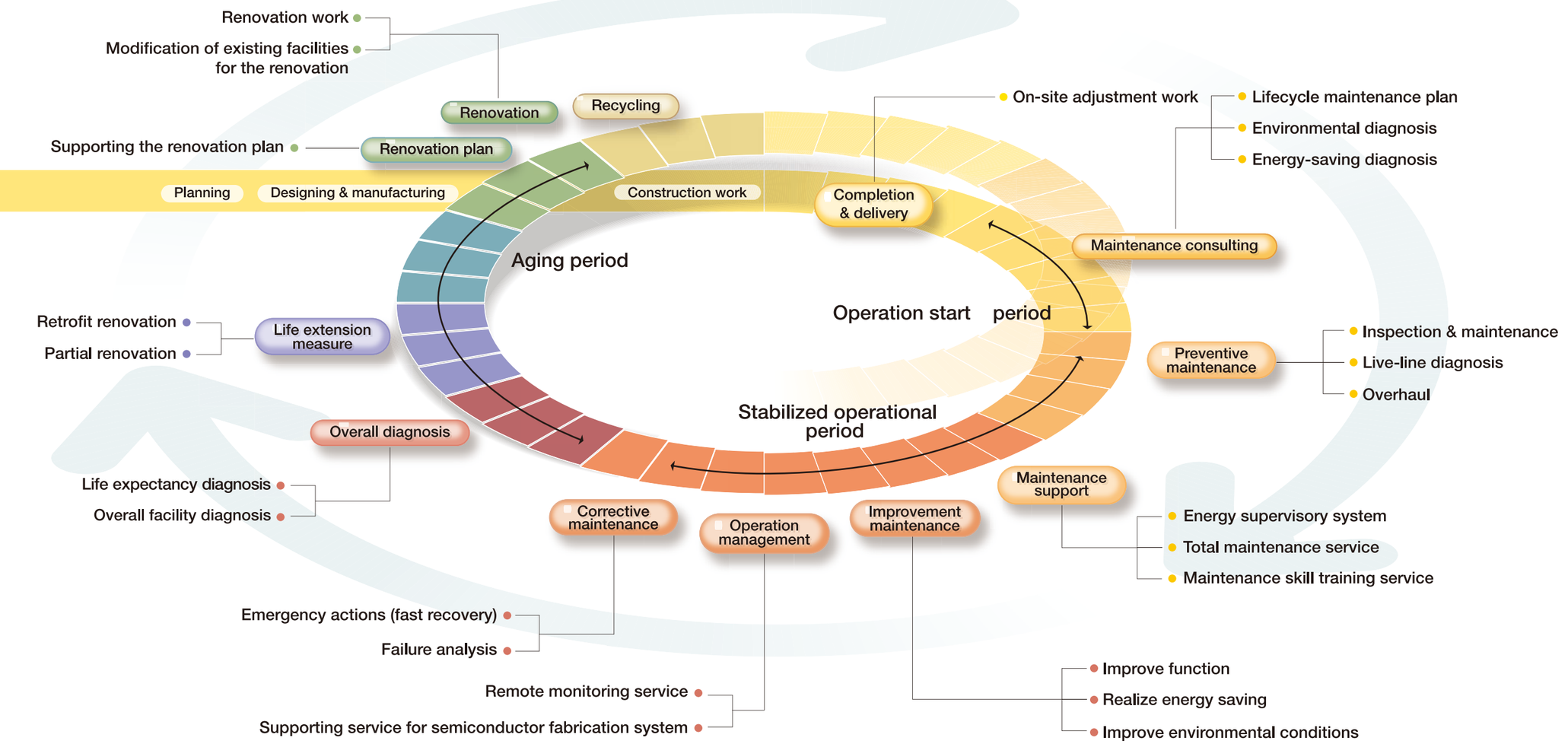
MEIDEN
Quality connecting the next

Meiden Lifecycle Maintenance Services

Lifecycle Maintenance Services for Existing Facilities

Lifecycle Engineering



Meiden wide range of maintenance services are intended to maintain all roles of our customers' facilities from facility introduction to renovation and abolition. These services are also available for the improvement of facility performance and functions. To keep creating a sustainable society, our maintenance services are devised to cover overall lifecycle for the purposes of positively contributing to society.

ONE-STOP SERVICE OF MEIDEN ENGINEERING!!
We can do maintenance works for all of your electrical facilities regardless of their manufacturers and consult for them and mechanical facilities.

C O N T E N T S

Necessity of maintenance

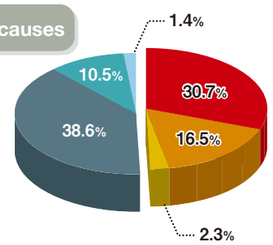
In order to prevent system failures and assure stabilized operation, maintenance services by professional engineers are indispensable. These engineers are required to possess sufficient technical expertise in regard to equipment and facilities.

Failure statistics

Present failures in electrical systems

1. Causes are classified into the categories of unsatisfactory maintenance, intentional actions, errors, and imperfect facilities.
2. In more than half of all cases, failure spots are mostly located in circuit breakers and switches.
3. The phenomena of failures result from the reduction of insulation, ground faults, and burning.

Classification by causes

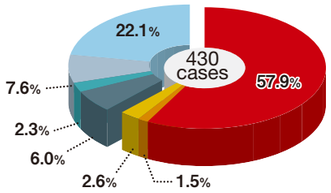


- Unsatisfactory maintenance
- Intentional actions and errors
- Imperfect facilities
- Natural phenomena
- Contact with other matter
- Others (including unclear causes)

* Unsatisfactory maintenance includes natural deterioration.

Excerpt from electrical security statistics by Nuclear and Industrial Safety Agency of Ministry of Economy, Trade and Industry, Fiscal 2002

Classification by failure spots

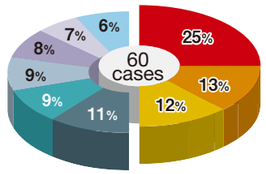


- CBs and switches
- Cables
- Cables, Wires, etc.
- Transformers, equipment
- Insulators
- Surge arresters
- Others

* CBs and switches include incoming switches.

Excerpt from electrical security statistics by Nuclear and Industrial Safety Agency of Ministry of Economy, Trade and Industry, Fiscal 2002

Result of analysis on classification by phenomena of failures for 60 cases of equipment operated over 20 year



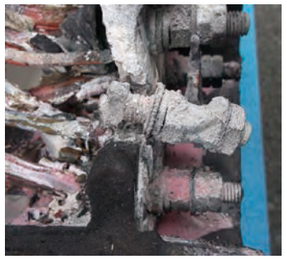
- Reduction of insulation
- Ground faults
- Burnout
- Overheating
- Short-circuiting
- Oil leakage
- Malfunction
- Welding down
- Others

Excerpt from consideration of reliability in long-used incoming and transforming facilities by The Japan Electrical Manufacturers' Association (JEMA), Fiscal 1999

Examples of failures and deterioration

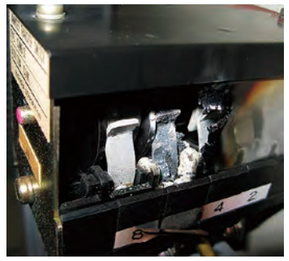
The following photos show typical accidents of each equipment.

Power Receiving Substation



Burning out of a tap changer on a molded transformer by the looseness with vibration

Burn-out due to ageing degradation of VT



Burn-out due to deterioration of contact part of ammeter change-over switch

Excerpt from consideration of reliability in long-used incoming and transforming facilities by The Japan Electrical Manufacturers' Association (JEMA), Fiscal 1999

Rotating machine facilities

Intrusion of cooling water caused by deterioration in the packin

Stator winding ground fault in a steam turbine generator

Stator winding ground fault in a cage-rotor type induction motor

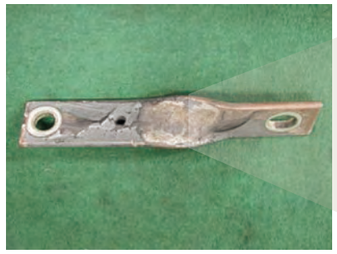
Tracking in stator winding of a cage-rotor type induction motor

Burnout of a current collector of a wound-rotor type induction motor

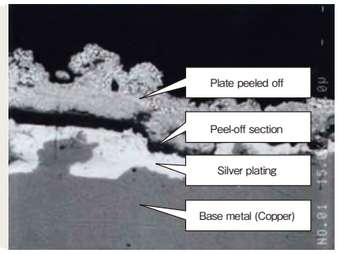
Burnout of a stator winding of a regular-use engine generator

These are examples of failures caused by deterioration.

Conductor silver plating peel-off is caused by sulfuric corrosion.

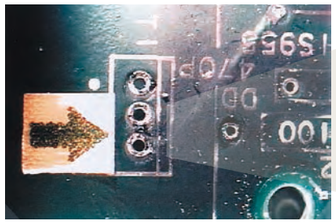


Conductor with peel-off (contact side)

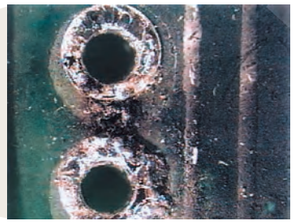


Conductor surface cross-section × 200

Short-circuiting in printed circuit board caused by copper migration



Transistor through-hole part × 10 times

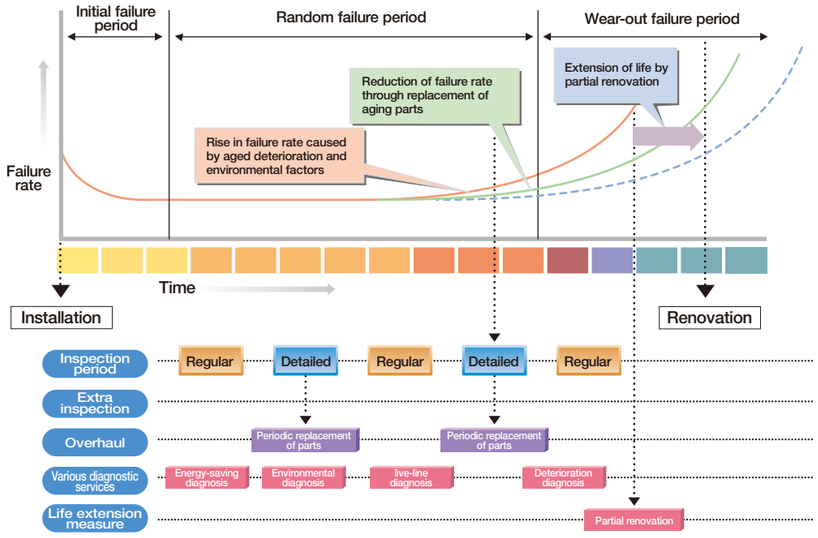


Short-circuiting section × 50 times

Maintenance consulting

We propose an optimum maintenance plan based on various diagnosis.

Maintenance processes



Lifecycle maintenance plan

Table of maintenance plan

Based on the operation mode of facilities and operating environment, we propose adequate types and periods of inspection as well as timing for replacement of parts.

Example: Table of maintenance plan for high-voltage power receiving substational system

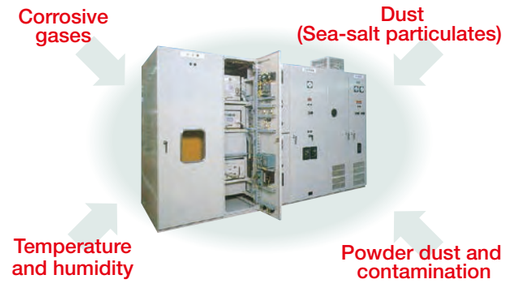
[Outline of facility] C-GIS: Main and standby incoming lines in a 2-bank configuration
Transformer: Oil-filled transformers 2 units

		Year	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22
		Transition	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
High-voltage facility	Compact Gas Insulated Switchgear (C-GIS) (2L-2B)	Power receiving unit 1	○	-	○	-	◎	-	○	-	○	-	◎	-	○	-	○
		Power receiving unit 2	-	○	-	○	-	◎	-	○	-	○	-	◎	-	○	-
		VCT unit	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
		Transformer 1	○	-	○	-	◎	-	○	-	○	-	◎	-	○	-	○
		Transformer 2	-	○	-	○	-	◎	-	○	-	○	-	◎	-	○	-
	High-voltage oil-immersed Tr.	Transformer 1	○	-	○	-	◎	-	○	-	○	-	◎	-	○	-	○
		Transformer 2	-	○	-	○	-	◎	-	○	-	○	-	◎	-	○	-
	High voltage operator panel		○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	Relay panel		○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	Alarm panel		○	○	○	○	○	○	○	○	○	○	○	○	○	○	○

Note: ○ Regular inspection ◎ Detailed inspection
Periodic replacement of parts will be performed in the second detailed inspection.
Facility deterioration diagnosis is executed in the 20th year to determine the time for renovation.

Environmental diagnosis

Some environmental conditions of installation locations for various equipment units are liable to cause corrosion, rust generation, and deformation in materials of the parts used. Such phenomena can directly affect the occurrence of equipment failures and reduction of operational life. We are ready to investigate environmental conditions of the location of installations and also evaluate the environment of equipment installed. Based on the result of the investigation, we can provide adequate proposals to our customers.



Measurement of corrosive gases

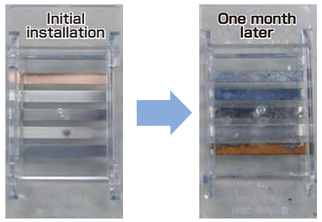
① Intermittent measurement

Based on the measurement results of field temperature, humidity, and gas elements (sulfur dioxide, nitrogen dioxide, hydrogen sulfide, chlorine, ammonia) , including the contamination degree, an evaluation of the environment is carried out. Gas elements are analyzed by sampling gases on site. This measuring method is based on JEITA* IT-1004.

*Japan Electronics and Information Technology Industries Association

② Continuous measurement

Using a gas monitoring unit, temperature, humidity, corrosive gas density, and presence of floating dust are measured continuously for more than a month. Based on the result, we examine the degree of influence of various environmental parameters on equipment on site.



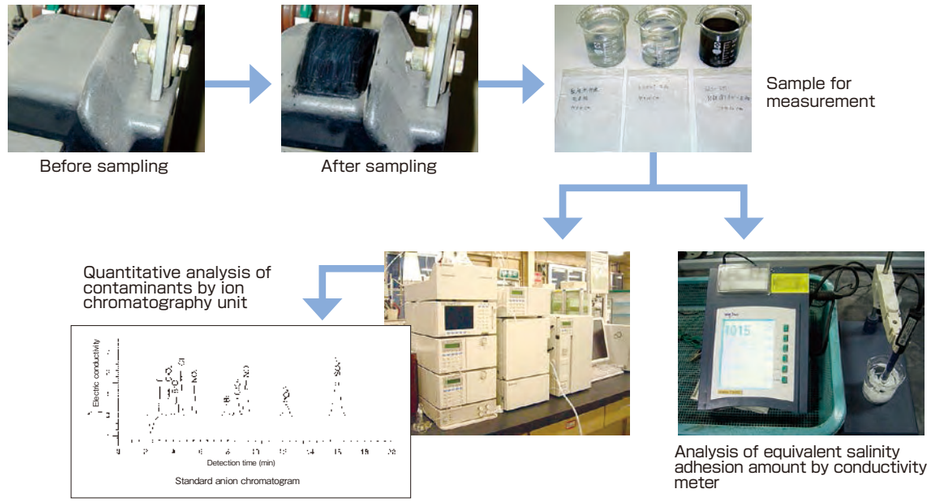
Sample for corrosion / Fujitsu Quality Laboratory Ltd. / Eco-checker

③ Corrosion-sample measurement

The progress rate of corrosion is confirmed by placing a sample on site for the during of a month at the longest. From the result the corrosive gas density is estimated.

Measurement of contamination degree (dust)

For the evaluation of floating dust (and debris) around the location of installation, measurement and analysis of the contamination degree are carried out. Based on the concrete data obtained, we offer proposals and suggestions to our customers.



* Meidensha Corporation possesses public approval for [Registered Organization of Measurement Certification Business] and [Organization of Working Environment Measurement].

Energy-saving diagnosis

Support for energy-saving measures

We offer effective proposals on the basis of sufficient investigation through energy-saving diagnosis and practical measurements.

Energy-saving diagnosis
- Grasping of existing facilities
- Grasping and investigation of used energy
- Analysis of various energy data

→ Simplified diagnostic services / Detailed diagnostic services → Discovery of energy-saving measures and replacement

Measurement services
- Long-term and short-term data logging
- Proposals based on data analysis

Energy-saving tuning
- We identify and propose operational improvements while minimizing capital investment

Support for business relating to lawful restrictions
- Support for the creation of periodic reports and management standards
- Support for the creation of interim and long-term project sheets
- Support for the creation of reports relating to various regulations

Energy-saving diagnostic car

Electric power measurment (for a fixed period)

Temperature and humidity telemetry (for a fixed period)

Energy-saving measures taken for objective facilities

Power receiving substation systems
Basic Unit management, power factor management, demand management, transformer loss management, and Web based monitoring

Adoption of inverters for air-conditioner pumps

Motor power and air-conditioning facilities
Improvement of facility capacity and control system, operation control, improvement of cooling-water type heat exchanger efficiency, and Web based monitoring

Improvement of lighting facilities

Lighting facilities
Improvement for adequate luminance and light on/off system, operation control, and Web based monitoring

Environmental improvements
Contamination and environmental purification, improvement of temperatures, cleaning of piping systems, and Web based monitoring

Improvement of refrigerator efficiency

Preventive maintenance

We propose a variety of preventive maintenance measures to keep your facilities operating in the best condition.

Inspection and maintenance

Patrol inspection[*1]
Abnormalities of the facilities are checked by visual inspection, meter indications and humansenses (such as vision, hearing, scent and touch.)

Simplified inspection[*2]
Based mainly on visual checks on external appearance of facilities, minimum checks are carried out in regard to system functions.

Regular inspection
This inspection is intended to ensure preventive maintenance by obtaining more detailed information that cannot be acquired from patrol inspection and simplified inspection.

Detailed (precise) inspection
In addition to regular inspection, equipment is overhauled for maintenance so that the equipment inside is cleaned, functions are checked, and characteristics are examined for their accuracy. In this manner, equipment is checked for its presence of abnormality.

Extra inspection
When abnormality is discovered at the time of various inspections or in the case when an accident occurs, this inspection is carried out to take restoration measures. In this case, replacement of aged parts is also carried out, as required.

*1: Patrol inspection is performed by Meidensha if the customer`s facilities can hardly be suspended.
*2: Simplified inspection cannot be found in any general category. It is intended in order to set up a maintenance plan for regular inspection or detailed inspection.

Inspection of vacuum circuit breaker

Characteristic test of protective relay

Irregular inspection for the gas-turbine exhaust port

Replacement of aged parts

Maintenance supporting tools and facility diagnostic tools

We always use a variety of new and updated tools to accomplish qualified inspection and diagnostic services.
*These testing devices are our in-house tools for maintenance service, and are not commercially available.

Using diagnostic tools, diagnostic services are given to respective equipment and units.

Objective equipment and units	
Transformers and instrument transformers	Capacitors
Circuit breakers, switches, disconnecting switches	Power cables
GIS	Storage batteries, DC power units
Surge arresters	Uninterruptible power units
Power fuses	Rotary machines (motors and generators)
Switchgears and busbar boxes	Miscellany

Circuit breaker operation tester

Contact resistance meter

Contact resistance meter for auxiliary relays

Artificial ground fault tester

Automatic timer tester

Auxiliary relay tester

Dynamic response tester for generators

Megger tester

Inspection support tools (Example)

Testers for checking the operating time of plug-in analog timers and the operation of auxiliary relays

Automatic timer tester

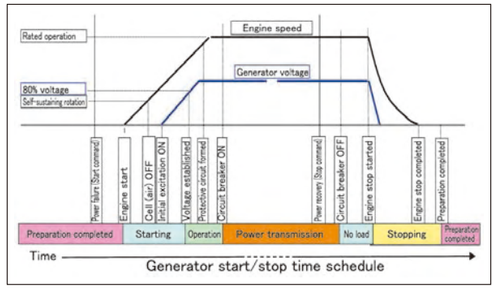
Auxiliary relay tester

Tester for checking that the ground relay is activated properly when a ground fault occurs

Artificial ground fault tester

Tester for checking the soundness of an entire control system including the starting/stopping conditions of a generator

Dynamic response tester for generators 5101



Tester for checking various operations and characteristics such as closing and opening of circuit breakers

Circuit breaker operation tester 3101

Facility diagnostic tools (Example)

Tester for checking the deterioration state of plug-in auxiliary relay contacts

Contact resistance tester for auxiliary relays

Insulation diagnostic vehicle equipped with a set of insulation diagnostic devices

Instruments for checking the occurrence of hazardous partial discharge due to deterioration/ contamination of insulating materials by inspecting the operation state of facilities in live state

Partial discharge tester 6110・6120
(for detecting electromagnetic/ultrasonic waves)

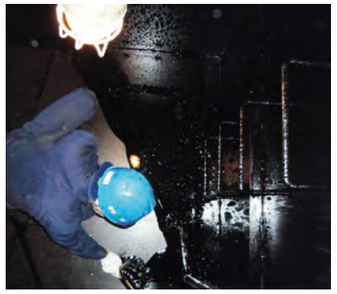
Ultrasonic tester

Ultraviolet camera

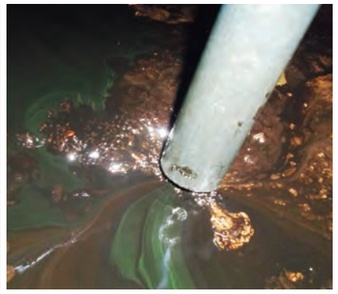
Inspection and diagnosis for subsidiary facilities of a power generating plant

Generator sets are crucial for implementing a business continuity plan (BCP) once a disaster strikes, However, when the Great East Japan Earthquake occurred, many generators stopped working because individual fuel supply tanks became clogged with suspended sludge stirred up by vibration and the fuel could not be supplied even though sufficient fuel remained.
As measures against such earthquakes, we recommend our customers to inspect underground tanks periodically : these inspections produce remarkable results.

Inspection of a 100kL underground fuel tank



IInspection of a fuel service tank



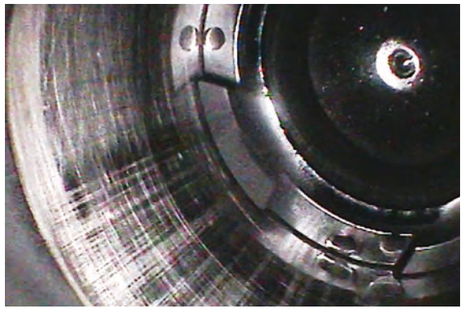
Sludge accumulated in the underground tank

Diagnosis by industrial fiberscopes

We inspect and diagnose inaccessible and invisible parts of engines and subsidiary facilities with industrial endscope.

Inspection inside an engine cylinder inside

Inside of generator air cooler piping



Engine cylinder inside

A crack inside a gas turbine

Live-line diagnosis

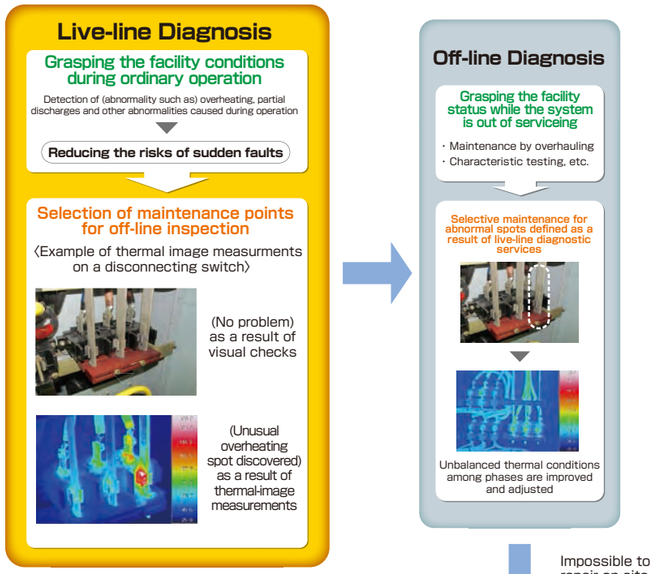
● We propose a new preventive maintenance plan where a live-line diagnosis is added to the periodic inspection.

In order to detect a slight abnormality in advance that cannot be found by the shut-down inspection , various kinds of tools are used to support accrately this inspection.

① Reduces the risk probability of unexpeted accidents (grasping the early symptom of abnormality)

② Supports shut-down inspections efficiently and accurately (focusing on maintenance points)

③ Effective management of maintenance cost and support of the facility renovation plan (presentation of optimal maintenance program)



Impossible to repair on-site

Overhaul

Facility renovation plan

Live-line diagnostic tools

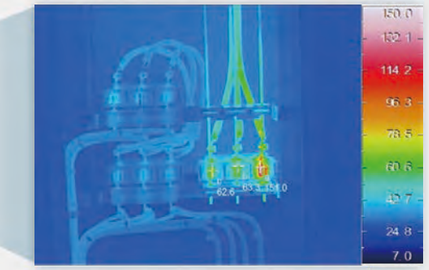
· Thermal image device (thermography)
· Corona discharge detection (acoustic and electromagnetic wave methods, etc.)
· Environmental measurement (equivalent salt deposit density method)

Catalog for reference: Live-line Diagnosis on Electrical Facilities

● Thermal diagnostic imaging

Thermal image diagnosis: Example 1

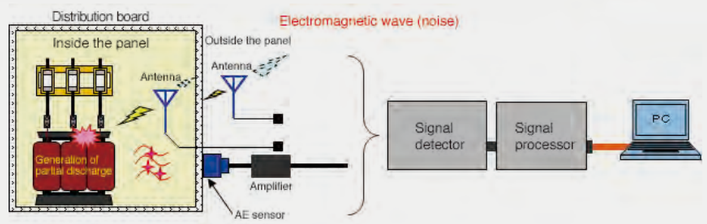
Measuring part: Control center



Local overheating found in Phase R

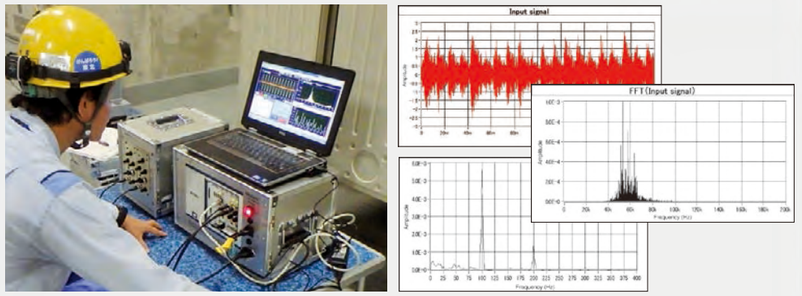
● Partial discharge diagnostic system for preventing accidents, decreasing energy loss, and investigating the state of deterioration

Detection of partial discharge using acoustic method (AE sensor) and electro magnetic method (antenna)



● Detection of partial discharge by acoustic method (AE sensor)

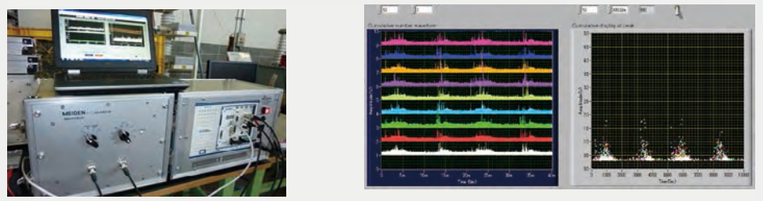
Example of measurement of partial discharge using AE sensor



Partial discharge tester using AE sensor

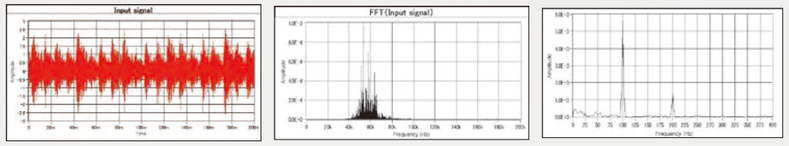
● Detection of partial discharge by electromagnetic waves

Example of partial discharge diagnosis using electromagnetic waves



Partial discharge tester using electromagnetic waves

Example of corona discharge measurements



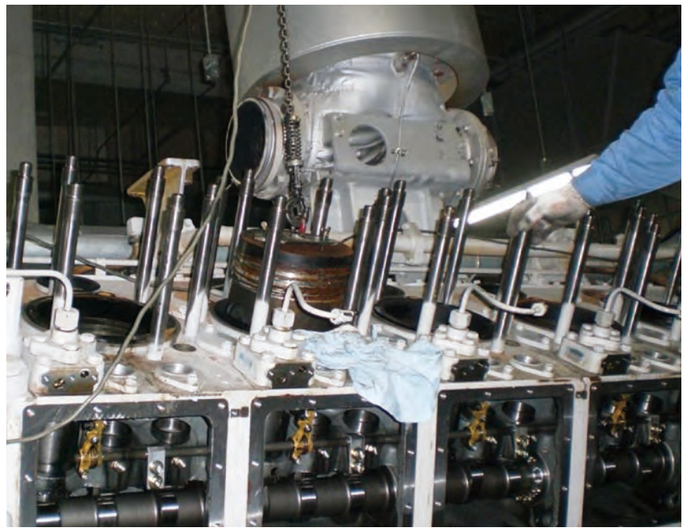
Identification of a corona discharge point with a corona detector camera

An example of corona discharge detection using an AE sensor

Overhaul

An overhaul includes parts replacement such as bearings and brushe in rotary machines and re-insulation of windings to extend the operation life. Overhauls are performed based on the result of inspections and diagnoses.

Gas turbine being overhauled



Diesel engine being overhauled

Maintenance support

We support maintenance work widely, including technical and training aspects.

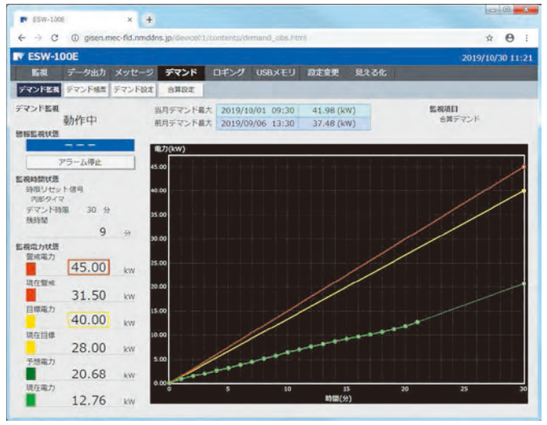
Energy measurement Web system

● Product overview and features

- Monitoring and sharing the results of energy saving remotely.
- Handling energy management work for buildings, plant facilities, and other locations.
- General-purpose measurement sensors and wireless LAN communications are supported so no large-scale construction is necessary.
- The system is equipped with demand monitoring and reporting of electric energy, Web trend graphs, and many other functions.
- Notebook computers, iPads, and other mobile devices are also supported through Web access.

Easily visualize the energy you use!

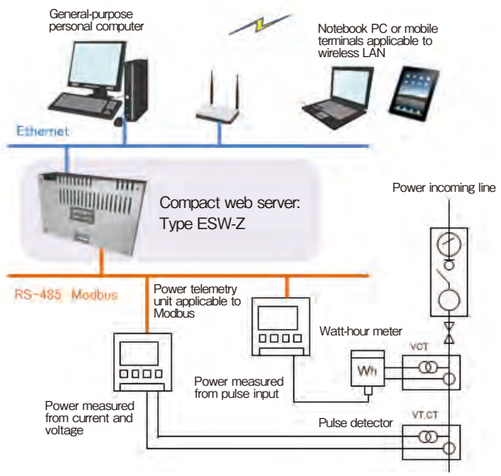
● Demand monitoring function



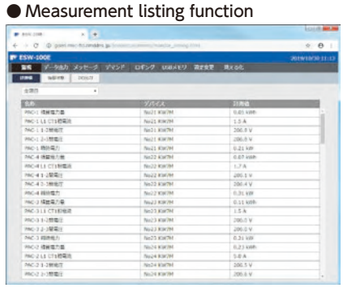
● Compact Web server

● Supports mobile terminals

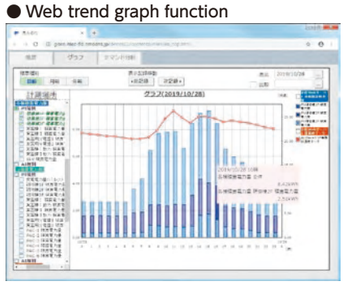
ESW 100E system diagram



● Measurement listing function

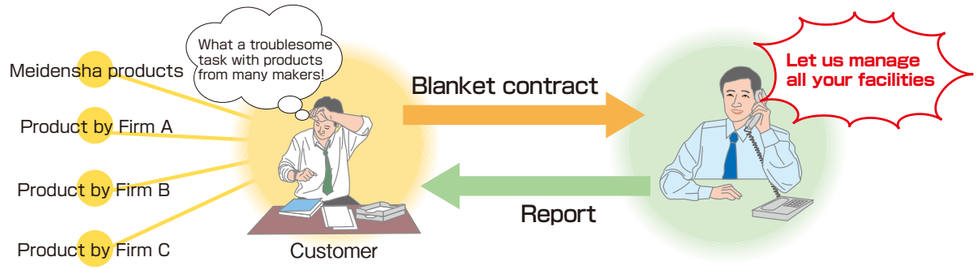


● Web trend graph function

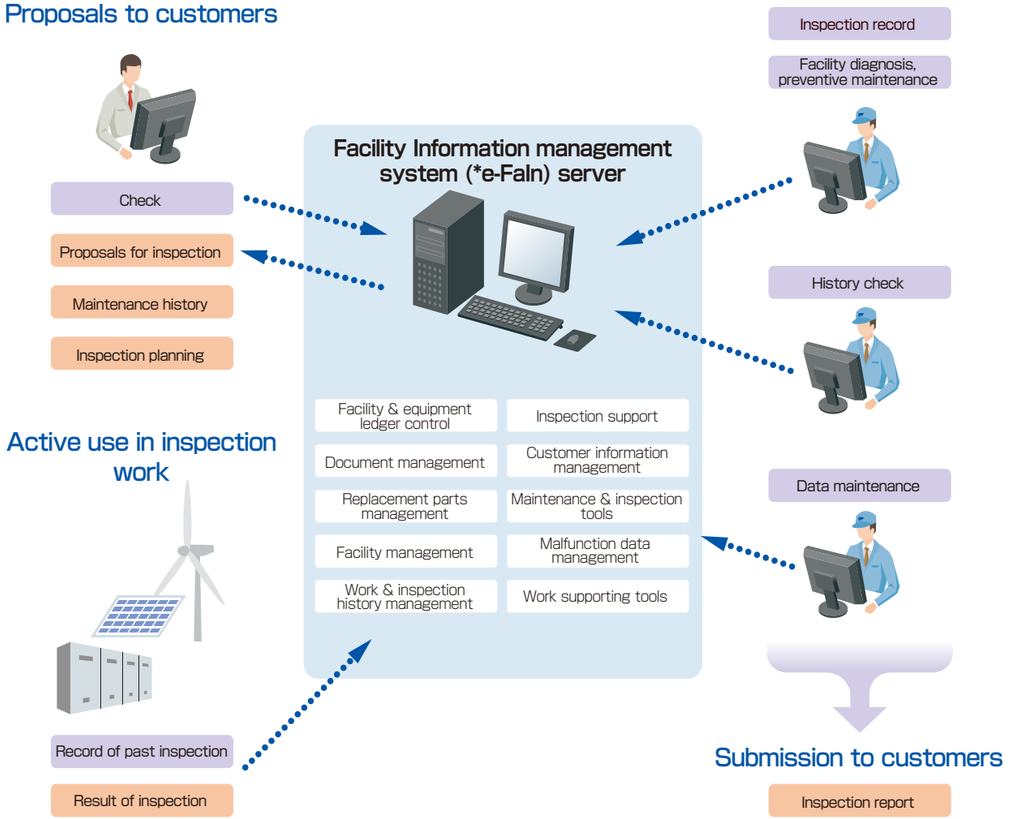


Total maintenance service

To eliminate “annoyance” from our customers, we accept a blanket contract for facility maintenance, involving products made by other firms.
Using a facility information management system (e-Faln)* established inside our company, as a manufacturer, we offer various proposals with a spirit of safety and sincerity.
We establish ledgers of facilities and documents to be submitted to government offices on your behalf.



Facility Information management system (*e-Faln)



* Registered trademark of Meiden Engineering Corporation

Maintenance skill training service

We provide training program on maintenance techniques to both our customers and Meidensha engineers at Meiden Engineering Center.


Meiden Engineering Center

Education for maintenance technical expertise and technical maintenance training for customers.

Education for maintenance technical expertise includes:
- Technical training for the newly employed
- Safety education
- Education for work managers
- First-year and third-year follow-up training
- Education for nurturing multi-skilled technicians
- Other training

- Support for technical training for customers
  It is possible to provide education mainly for customers on the maintenance of electrical facilities.
- Maintenance technical training for customers
  This training program for customers focuses on acquiring techniques for maintaining electrical facilities.
  - Training mainly for acquiring operation techniques, learning maintenance and inspection methods, and ensuring safety observance
  - Learning the procedure for reproducing on-site situations and emergency measures
  - Learning applicable laws and regulations as well as environmental issues

*Please contact our Sales Dept. if you wish to attend our training program.

Technical education using systems

Training on operation, inspection, and emergency measures is provided using the same systems as those used on site.

High-voltage (66kV) power receiving substation system
- Learning substation planning and facility capacity, how to select power receiving systems, types of power receiving/transformation relays, types of power receiving facilities, and inspection methods.
- As practical training, education on maintenance such as the following is provided: power failure/recovery switching test using an High-voltage power panel simulator, troubleshooting, general inspection, system operation, and continuous operation test.

High-voltage power receiving substation system

Regular-use generator set
- Outline of regular power generation facilities and applicable laws and regulations
- Principle and outline of diesel engines
- Methods for inspecting regular power generation facilities

Water treatment plant
- Learning the outline of water supply/sewerage systems
- Practical training using facilities simulating a sewage treatment plant
- Troubleshooting

Catalog for reference: Guidance to the Meidensha Technical Center AB8-3072

Technical training on unit devices

Acquiring technical knowledge on device structure, operation methods, and maintenance and inspection methods using actual devices

Circuit breaker/switchgear

- Acquiring knowledge on types of switchgear and their roles
- Understanding structures and features
- Acquiring maintenance techniques such as inspection, disassembly, and maintenance

Transformer

- Acquiring knowledge on types of transformers and their roles
- Learning the methods of inspecting High-voltage(66kV) and high-voltage oil-immersed transformers and dry-type transformers
- Learning diagnostic methods for deterioration of insulation oil

Motor

- Understanding structure by disassembling/assembling engines
- Acquiring maintenance/inspection techniques

Rotating machine

- Learning the structure, standards, and principle of rotating machines
- Acquiring vibration/noise analysis and diagnostic techniques

Variable-speed controller

- Acquiring knowledge on the structure, standards, and principle of variable-speed controller
- Acquiring techniques on maintenance and inspection
- Acquiring techniques on test run/adjustment methods

Dynamo device

- Learning the basic principles of dynamometers and generation of torque
- Learning operation methods and inspection techniques using actual devices

UPS

- System configuration and start/stop operation of UPS
- Switching and operation at the time of an accident and bypass operation for maintenance
- Measurement of UPS output voltage/current and measurement of harmonics

Protective relay

- Acquiring knowledge on the operation and principle of protective relays, and their structure, functions, and characteristics
- As practical training, the following maintenance training is provided: handling of various protective relays, testing methods, appearance inspections, and operation characteristics tests

Generator

- Basics of generators
- Types and applications of power generation facilities
- Structure and features of emergency power generation facilities
- Test run method and inspection method of power generation facilities
- Knowledge on laws and regulations concerning power generation facilities

Miniclad systems

- Features of miniclad systems
- Devices constituting miniclad systems
- Miniclad system inspection method
- Troubleshooting

Computer/telecomputer

- Basic operation, principle, and applied techniques of computers and telecomputers
- Outline and education using actual OPS6000 system

PLC (sequencer)

- Outline of principle and operation of PLC (sequencer)
- Outline of programming
- How to use loaders
- Training on programming

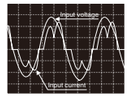
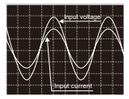
Improvement maintenance

Functional improvement and energy saving are intended.

Improvement of function and energy saving

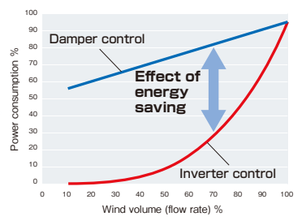
Along with our actions for the extension of equipment life, we promote functional improvements (measures taken against harmonics and noise) and energy saving (improvement of power factor).

① Advantages of renewal to converter controller.

Item		Conventional type	Converter type
Main circuit	Connection diagram	3-phase AC power — Converter — Inverter — Motor	3-phase AC power — Motor
	Rectification	Diode	IGBT + diode
	Inversion	IGBT + diode	IGBT + diode
Control system	Rectification	No control	Approximated sine-wave PWM control
	Inversion	Approximated sine-wave PWM control	Approximated sine-wave PWM control
Input power factor		Approx. 0.85	Approx. unity (0.95 or above)
Control system		Nil or dynamic control (motor energy consumed through resistor)	Dynamic power recovery (motor energy fed back to the source)
Input current waveform			 Control of harmonics toward the source side (Clearing the guideline for harmonics control stipulated by Ministry of Economy, Trade and Industry)

Reference catalogs : Converter CV240S LB537-3130, Inverter VT240S LB535-3090

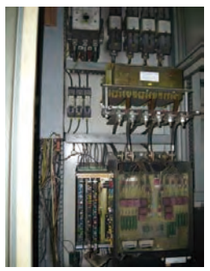
② Energy saving for fans / pumps and environment-friendly operation are possible



When inverter control is adopted for fans and pumps, a great effect of energy saving can be attained compared to damper control. For example, as shown in the figure on the left, when operation is performed with the speed reduced by 30%. The required power can be reduced from 80% to 30%. Thus reducing energy consumption and CO_2 emissions.

Is there any product which is difficult to maintain?

Even for products made by other firms and/or those imported from foreign countries, it is possible to extend equipment life and improve functions through the adoption of inverters for equipment including motors.



【 Control unit 】

Before renovation　　After renovation

【 Motor 】

Before renovation　　After renovation

【Examples; An electrical apparatus manufactured overseas was improved/ renovated using Maidensha inverter. 】

Counter measures for the environmental effect

●Counter measures against corrosive gases : Photo-catalyst type corrosive gas decomposer.

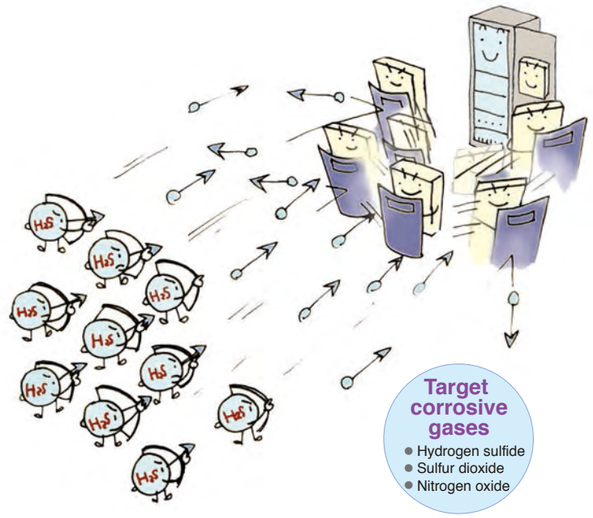
Decomposes corrosive gas within a distribution board and electric room to prevent malfunction and deterioration due to corrosion of electronic devices.

AIRPURIF CL series

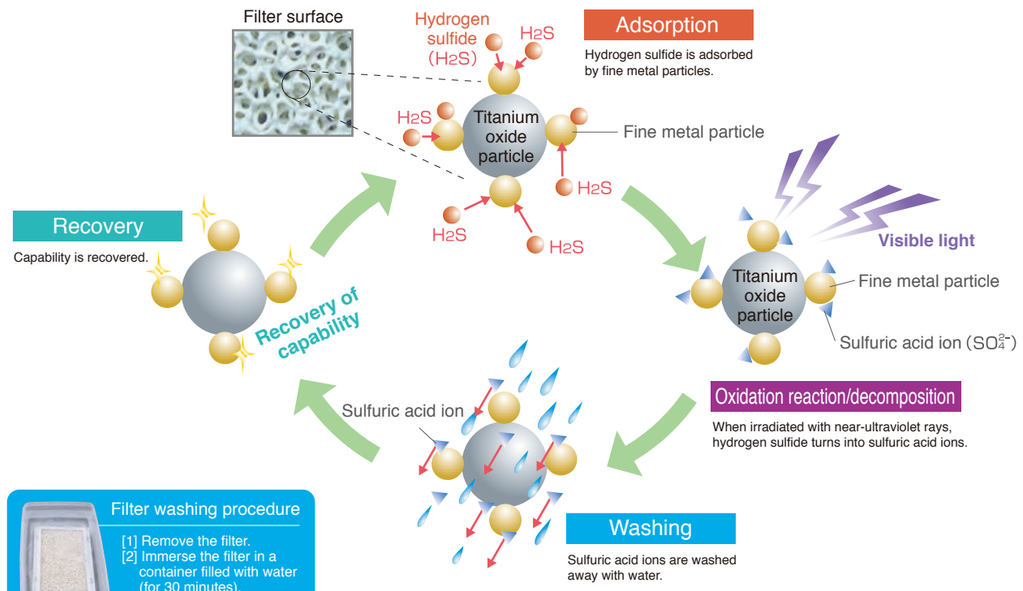

CL110 【For use within distribution board】


CL620 【For use within electric room】


CL720 【For use within electric room】



●Principle of decomposition



Filter washing procedure

[1] Remove the filter.
[2] Immerse the filter in a container filled with water (for 30 minutes).
[3] Rinse with fresh water.
[4] Dry in the sun.

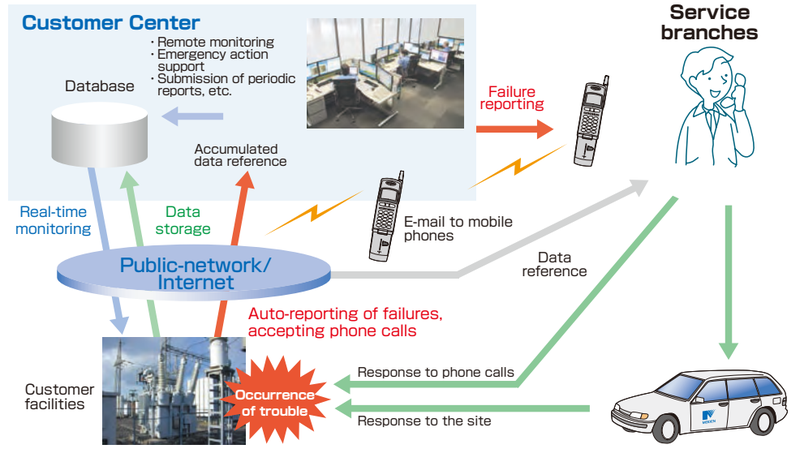
Operation and management

Leave your system support and management to us.

Remote monitoring service

Your facility conditions are monitored, and if any abnormalities are reported, appropriate measures will be taken immediately.
As requested, operating conditions are periodically examined and a report is issued.
By analyzing the operating status of your facilities, more advanced services. such as facility diagnosis, predictive/ preventive maintenance, remaining life estimation, and proposal for optimum operations, will be provided. (These services are available for customers under contract.)

●Management of remote monitoring services in japan.



●TELEMOT MINI (Meiden compact wireless telemetering system)

Meiden wireless telemetering system, “TELEMOT MINI,” is an advanced remote monitoring and supervisory control solution integrating our expertise on supervisory control and advanced technologies. The compact and power-saving system can be used in various places for various applications.

Compact all-in-one structure

・The built-in 3rd-generation mobile phone module enables immediate use.
・The system integrates a processor, memory, and basic IO, providing remote supervisory control only with the main body.
・Significant reduction in initial and running costs.

Two operation modes are available, and the unit can also be driven by a battery and solar panel.

・Conventional normal operation mode and power-saving mode using a solar panel and battery are available.
・In the normal mode, advanced supervisory control similar to the conventional TELEMOT is performed.
・In the power-saving mode, the system is started periodically, or in response to a request from the host, and moves into sleep mode on completion of processing, which ensures long-term operation

Software featuring advanced supervisory control functions built into the system (normal mode only)

・Detection of status change, and monitoring of deviation from analog upper/lower limits
・Data compilation function, data transmission function (periodic, event, real time)
・Data processing function (such as pulse integration, integration of number of times of operation, and maximum/minimum/average processing)
・Terminal function setting, failure monitoring, and power interruption monitoring via the network.

Provision of total solutions

・The system is included as standard in Meiden supervisory control systems (MEISVY VS/LS series) (normal mode only).
・Provision of ASP service using Meidensha’s data center

Catalog for reference: [TELEMOT cdma] MB597-2996

Semiconductor fabrication system supporting service

According to trends on the industrial market, we offer our own solution services to the semiconductor fabrication site where technological trends are always changing.

●Maintenance and preservation support

We strive to reduce costs and improve working ratio based on our expertise and experience in support services, from the viewpoint of our customers.

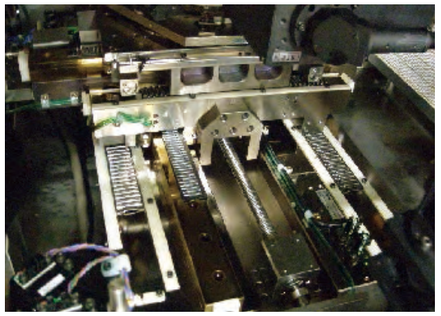
●Measures taken for life expectancy

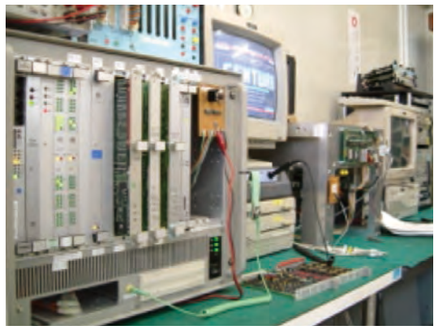
Latest technologies and information are used to extend the life of devices and parts, contributing to environmental issues and helping reduce costs.

●Engineering and servicing (Improvement and repair maintenance)

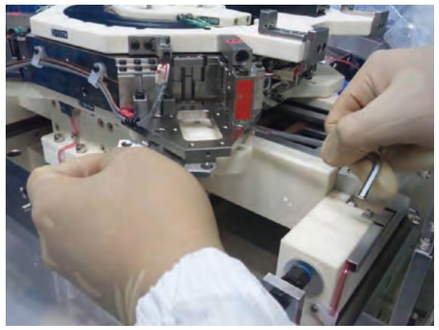
We identify problems in daily operations to ensure higher security, and propose improvements to boost productivity.

Refurbish of equipment and units, various testing





Control rack (Power source and IC boards) repair and life extension services



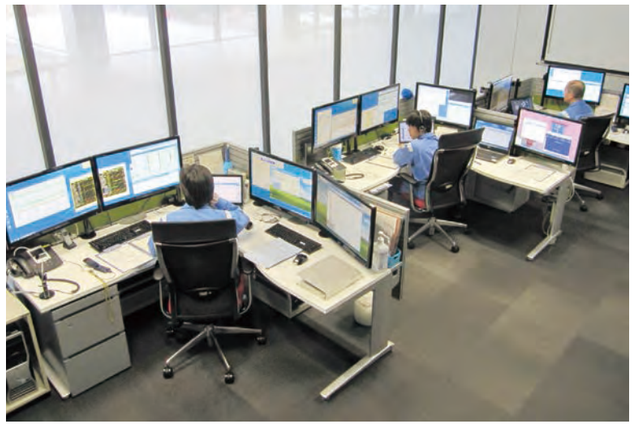
Exposure stage mechanism repair and refurbish

Corrective maintenance

We take measures quickly for unexpected accidents.

Emergency actions

Professional staff at the Customer Center are ready to accept toll-free calls from customers 24 hours a day, 7 days a week, throughout all service areas. Well experienced engineers and technicians can be dispatched from a nearby service base of the company so that customers' facilities can be recovered in the shortest amount of time possible.



Customer Center on duty around-the-clock

For inquiries to our Customer Center

Toll-free calls: 0120-099-056 (Japan domestic only)

●Traveling power supply vehicle

The highly functional power supply vehicle can quickly travel to places that require power.

Various types ranging from 35 to 4000 kVA are available.

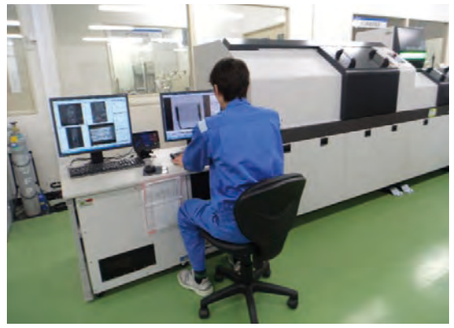
The power supply vehicle plays an active role in various fields as a traveling emergency power supply; it can provide lifeline service in case of commercial power interruption and emergencies, as well as temporary power for various events.

Failure analysis

Reflection of failure analysis for preventive maintenance

・Finding out the cause of failure by replacement parts from its repair maintenance.
・Finding out the cause and the spot of failure by advanced analysis, Propose a preventive maintenance from the horizontal development.

●Examples of failure analyzers



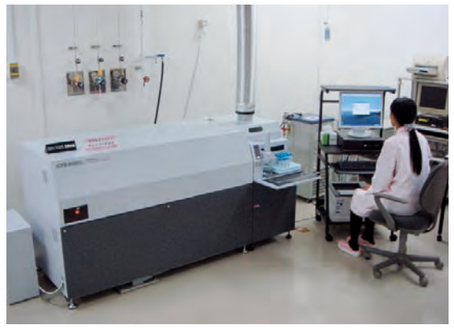
3-dimensional X-ray CT scanner

Scanning electron microscope, X-ray analyzer (SEM-EDS)

FT-IR (Fourier Transform Infrared Spectrophotometer)

X-ray analysis microscope (XGT)

Gas chromatograph electron capture type detector (GC-ECD)



High-frequency plasma generation spectrograph

Overall diagnosis

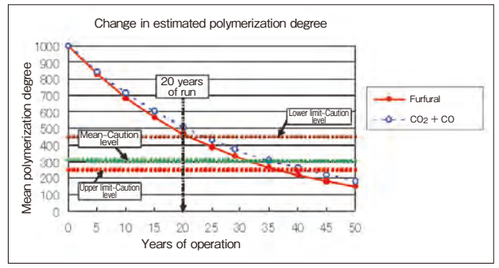
The state of deterioration is grasped in order to estimate life expectancy.

Life expectancy diagnosis

●Life expectancy diagnosis on an oil-filled transformer

The operational life of an oil-filled transformer is determined by the deterioration grade (mechanical strength) of insulation paper wound around the transformer coils. Progress of deterioration is greatly affected by the period of operation, machine type, and operating conditions, such as loading, oil temperature, etc. Along with progression of deterioration in the insulation paper, mechanical strength is lowered and various deterioration products (such as furfural, CO_2, CO, etc.) are increased. By analyzing the amount of furfural and CO_2 + CO, the grade of time-related deterioration of insulation paper can be diagnosed and the transformer life can be estimated.

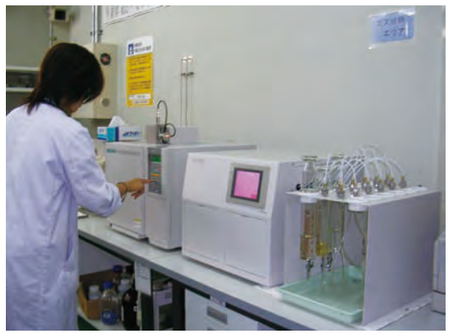
Furfural analysis



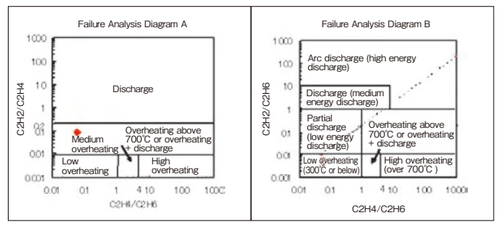
Life expectancy based on polymerization degree

●Oil analyzing techniques

For oil-filled electrical equipment, various kinds of decomposed gases are generated if there is any abnormality inside. This results in changes in characteristics of the insulation oil.
When insulation oil is sampled from equipment, gases in oil are analyzed and characteristics of insulation oil are measured. Based on the analytical result, internal conditions of equipment are estimated. This approach is helpful for early discovery of internal abnormality. In this manner, the internal conditions of equipment at the time of failure can be diagnosed.



Gas-in-oil analysis



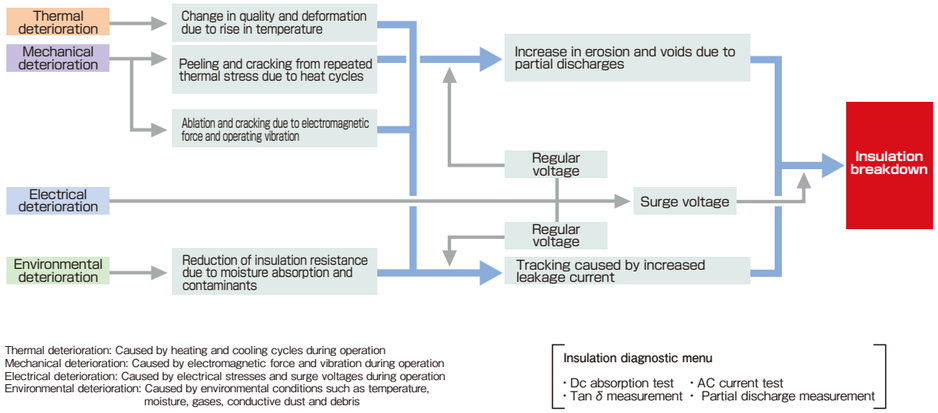
Failure diagnosis by gas components

●Life expectancy diagnosis on rotating machines (motors and generators)

Advantages of rotating machine diagnosis
・Necessity of overhaul and rewinding can be judged.
・The life can be extended economically.

①Insulation diagnosis

Process of insulation deterioration



Thermal deterioration: Caused by heating and cooling cycles during operation
Mechanical deterioration: Caused by electromagnetic force and vibration during operation
Electrical deterioration: Caused by electrical stresses and surge voltages during operation
Environmental deterioration: Caused by environmental conditions such as temperature, moisture, gases, conductive dust and debris

Insulation diagnostic menu
・Dc absorption test ・AC current test
・Tan δ measurement ・ Partial discharge measurement

②Life expectancy prediction

Example of an insulation diagnostic test result for a rotating machine

6.6kV, 85kW, 3-phase IM Years of operation: 33 years Characteristic data measured	
R1 (1kV)	4760MΩ
tanδ0 (2kV)	8.2%
C0 (2kV)	19.1nF
R1C0	91ΩF
tanδ0/R1C0	0.09%/ΩF
qm1 (1.25E/$\sqrt{3}$)	370pC
Estimated dielectric strength (VBD/E)	4.1
Residual % breakdown voltage (VP)	20%
Estimated breakdown voltage	27kV


Insulation diagnostic test


Diagnostic car for electrical facilities


Diagnostic car interior

●Deterioration diagnosis of circuit breakers and contactors

We propose parts replacement or a renovation plan based on the operating conditions (number of operation times:) and the results of diagnostic tests such as contact resistance measurement.

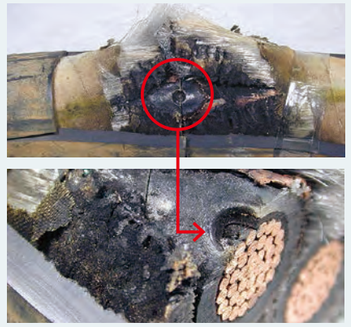
●Cable deterioration diagnosis

Judging from our diagnostic technologies and accumulated experience in regard to insulation deterioration, we propose an adequate method of deterioration factor analysis and preservation, and also offer suggestions for improvement.


Diagnosis of power cable insulation

Typical troubles

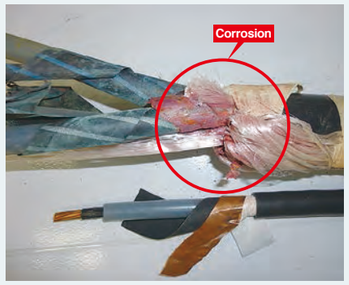
●Dielectric breakdown due to water tree



What is water tree?

The water-tree phenomenon is an insulation degradation which causes arborescent defects in insulating materials due to moisture around the cable insulating materials and partially concentrated electric fields.

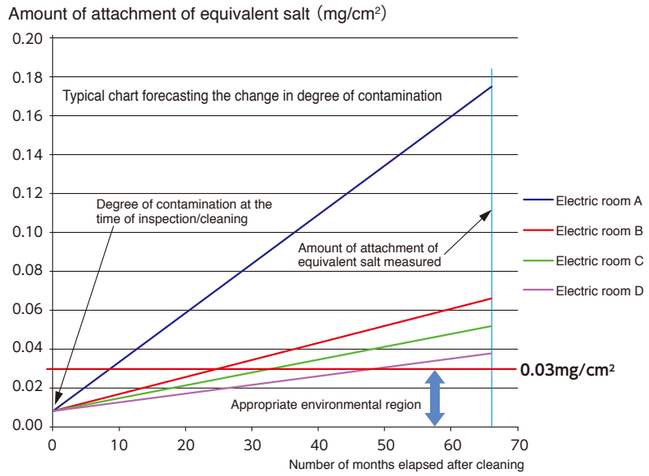
●Corrosion/ breakage of copper shielding tape



Corroded/ broken cables cause electric discharge and heating at the fractured part, which accelerates degradation of the insulating material.

●Forecast of change in degree of contamination based on environmental diagnosis

The change in degree of contamination is forecast based on the amount of attachment of equivalent salt and the amount of suspended powder dust, and appropriate inspection/cleaning intervals are proposed.



●A small amount of PCB analysis

Analysis are conducted to judge whether the equipment such as transformers and capacitors are classified as PCB waste*2. A small amount of insulation oil is sampled and a minute content of PCB is measured.
According to the Act on Special Measures Concerning PCB (Act on Special Measures Concerning Promotion of Adequate Treatment of Polychlorinated biphenyl refuses enforced in June 2001), PCB waste must be treated or its treatment should be entrusted by March 31, 2027.

*2 When PCB concentration in insulation oil exceeds 0.5mg/kg, it is regarded as a PCB waste.

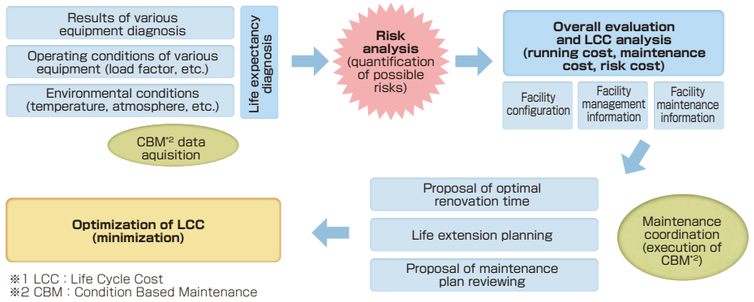
Objective equipment requiring analysis: Transformers, capacitors, reactors, switches, circuit breakers, etc.

Purpose of analysis: Certificate of no contents needed at the time of product delivery, inspection at the time of abolishment.

Overall facility diagnosis

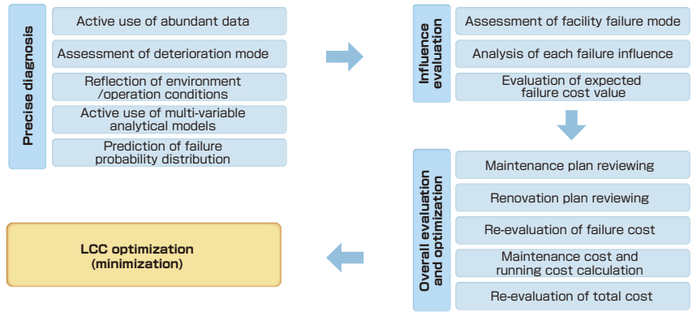
●Outline of overall facility diagnosis

From the stabilized operational phase to the aging phase, we support the optimization of LCC[*1] through our overall diagnostic services of facilities.

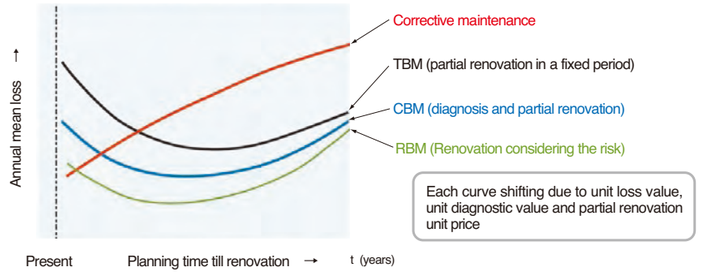


※1 LCC : Life Cycle Cost
※2 CBM : Condition Based Maintenance

●Risk analysis and development of overall evaluation

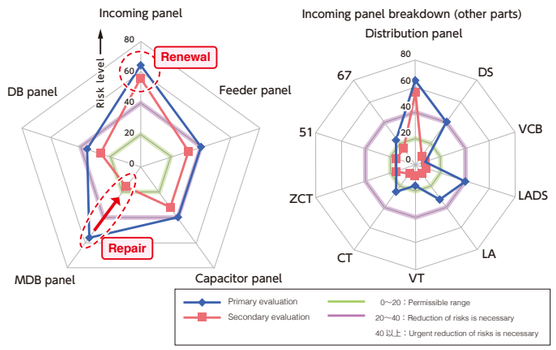


●Reduction of total cost (=LCC) by introduction of CBM and RBM



●Visualization of cost effectiveness by radar chart

Example of radar chart for diagnosis results



Evaluation in a comprehensive manner calculation of risk level from the present degradation and its influence.

Features

・Make the best use of all information of diagnosis results and environment condition.
・Failure level and its influence are evaluated for each facility
・Quantifying the hidden risks
・Visualizing the cost effectiveness learning from Primary and Secondary evaluation
・Judgment support of renovation or life extension
・Utilizing the evaluation tables by the Ministry of Land, Infrastructure, Transport and Tourism telecommunications equipment deterioration diagnosis. (Electric Power Equipment)

Life extension measure

This service assures continuous operation of facilities.

Retrofit renovation and partial renovation

・Interchangeability of electrical functions and performance is secured. At the same time, structural interchangeability is also secured while replaceable parts are updated.
・It is devised to reduce field fabrication work as much as possible so that the renovation period can be reduced to the shortest amount of time.
・Where replacement parts are unavailable, such parts will be designed and manufactured.

●Circuit breaker

Oil circuit breakers may have been too obsolete and manufacturing is discontinued. Such machines are replaced by advanced vacuum circuit breakers to extend operational life of the system.

Catalog for reference: Vacuum Circuit Breaker (GB36-2580)


Before renovation


After renovation

●Monitoring unit

The direct monitoring unit, in which constitutive parts are already discontinued and repair services are no longer available, is replaced by an alternative unit having improved functions equipped with a touch panel and a PLC (Programable Logic Controller).


Before renovation


After renovation

●Printer for the monitoring system

Some monitoring systems installed in plants are still using dot impact type printers. They are now difficult to repair and maintain.
We have created a new renovation method by which output information to the printer is saved in a personal computer (PC) so that the data can be monitored on the PC screen and hard copies are printed out on the updated laser printer as required. A single PC can control up to two printers. Such a method is immediately helpful for space saving, paperless routines, and digitization of data.


Before renovation


After renovation

●Panel for emergency power generating unit

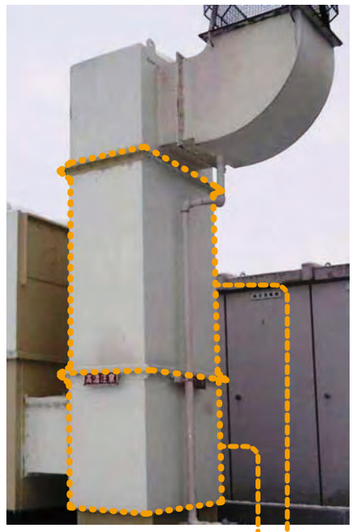
Simultaneously at the time of engine overhaul, a control panel used for 30 years is renovated to a new panel with the latest replacing parts and the same functions.

Old panel before renovating

New panel after renovating

●Exhaust duct for a gas turbine

This renovation is performed due to the destruction of the exhaust duct interior.



Inspection of an exhaust duct

Renovation of an exhaust duct

Lower part of an exhaust duct

Mid-section of an exhaust duct

Renovation plan

We will support your renovation plan with utmost care.

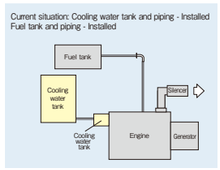
Supporting the renovation plan

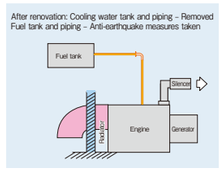
●Power generating facilities

We respond to customer requests such as [We want to have an emergency power supply facility that is highly dependable even in the middle of earthquake disaster.], [We want to eliminate claims possibly arising in the case of noise and black fume during rutine inspection.], and [We want to use the generator room more efficiently.]

①Countermeasures against earthquake disasters

We propose an emergency power generating facilities that is not affect by cutting off the cooling water cansed by earthquake. (Cooling water tunk system → radiator method or Gas turbine method)





Investigation into damage data about private power generating facilities at the time of the Hanshin-Awaji Great Earthquake

・System shutdown due to interruption of water supply for water-cooled generators: 12.0%
・System shutdown relating to fuel supply for power generating systems: 13.7%

		Water outage	Fuel	Failures	Others
Water-cooled power generating facilities	Out of 33 units	16 units	8 units	9 units	10 units
Radiator type power generating facilities	Out of 195 units	Nil	36 units	Nil	2 units
Gas turbine generators	Out of 96 units	Nil	14 units	1 unit	

・A great effect is demonstrated for the gas-turbine power plant where no cooling water is required.
・A substantial effect can be expected if countermeasures are taken against earthquakes for fuel tanks and piping systems.

②Environmental measures

It is possible to select a power generating unit for which black fumes of exhaust gases is taken into consideration.
(Optional setup of Fume Removal Unit DPF*)
* Diesel Particulate Filter

・With the DPF equipment, more than 99.97% of black fume and more than 80% of particulates can be removed.

DPF not installed

DPF installed

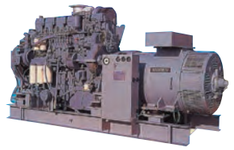
Exhaust of black fume shortly after the start of driving engine

③Space saving

By renovation to all-in-package power generating equipment, it becomes unnecessary to select a large installation location and a compact system layout can be attained. (Silent type all-in-package system)

・With a soundproof package, audible sound level can be lowered to 75dB(A) or below at a point one meter distant from the machine.
・All the devices can be accommodated inside the cubicle. (Also available for high-voltage machines)
・When installed outdoors, the generator room can be used effectively.

Existing facilities can also be utilized for renovation. Subsidiary facilities can be used without modifying the generator room.



Sound level:
1m from machine side 110dB(A)

Adoption of low-noise type

Sound level:
1m from machine side 75dB(A)

Catalog for reference:
35 ～ 1250kVA Emergency disel power generation device CB20-2001
200 ～ 1250kVA Emergency disel power generation device CB28-2352
200 ～ 1875kVA Emergency disel power generation device CB21-2019

Recommendation of Maintenance Contract

For Long-Time Stabilized Operation of your Facilities

In order to assure a long and safe operation of your facilities without any problems, we are ready to accept proxy maintenance and inspection duties in place of yours.

In order to adjust optimally maintenance service to your facility operation plan, we sincerely recommend that you complete the maintenance and inspection contract so that inspection and repair services can be accomplished promptly and most efficiently.

Advantages of a maintenance and inspection contract

When the contract is made with the company:

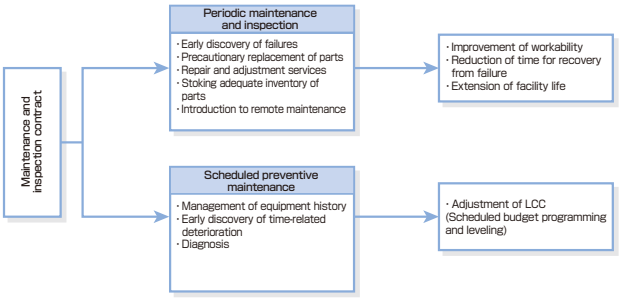
① Most assured inspection and adequate replacement of parts can be carried out in consideration of time-related deterioration.

② Early discovery of deterioration symptoms can be made. predictive measures are taken to avoid failures.

③ Supplementary parts (authentic) can be furnished promptly.

④ Professional engineers offer proposals for repairs and improvements. They provide timely technical support.

⑤ Lifecycle cost can be curtailed.



MEIDEN

MEIDEN ENGINEERING CORPORATION

5-5-5, Osaki, Shinagawa-ku, Tokyo, 141-8607 Japan
E-mail : customercenter@mb.meidensha.co.jp

www.meidensha.com/mec/

THAI MEIDENSHA CO., LTD.
15th Floor, Rasa Tower Ⅱ, 555 Phahol Yothin Road, Chatuchak, Chatuchak, Bangkok 10900, Thailand
Phone: 66-2792-4200 Facsimile: 66-2792-4299

MEIDEN ELECTRIC (THAILAND) LTD.
898 Moo 2, Bangpa-in Industrial Estate, Udomsorayuth Rd., Klongjig, Bangpa-in, Ayutthaya 13160, Thailand
Phone: 66-35-258258～59,60 Facsimile: 66-35-258261,62

Specifications in this catalog are subject to change without notice.

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