

Engineering Service: Hydro Power Plant Operation and Maintenance

Features

The Tokyo Electric Power Company (TEPCO) owns and operates hydroelectric power plants at 160 locations, including 9 pumped storage-type plants (generation facility capacity: 8,986MW).

TEPCO's engineering services are not only design and construction supervision but also operation and maintenance with the aim of achieving sustainable development with following features

- ◆ Effective utilization of water resource
- ◆ Effective maintenance and operation of hydroelectric power plants
 - Study measures for minimum cost for maintenance with keeping supply reliability
 - Engineering methods and other techniques of facility diagnosis while the plant is in operation

Basic Concept or Summary

Example 1. Reconstruction of Hydro Power Plant

In order for operation reliability improvement, efficient use of water resources, and economical benefit, it is necessary to rehabilitate or reconstruct the aged hydro power plants. With over 30 years of experience in rehabilitation and reconstruction work on hydroelectric power plants, TEPCO provides engineering services that range from planning to implementation of rehabilitation and reconstruction work.

Table Example of reconstruction

	Before	After
Output [kW]	6,200	6,600
Max. Discharge [m ³ /s]	11.13	11.13
Net head [m]	69.9	69.4
Rotating Speed [min ⁻¹]	600	429
Number of unit	3	1
Type	Horizontal shaft Francis	Vertical shaft Francis
Commencement of year	1919	1997

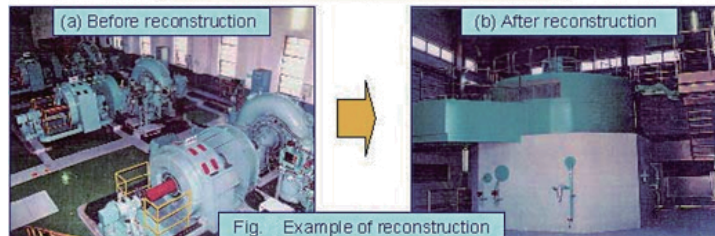


Fig. Example of reconstruction

Example 2. Lubrication Oil Diagnosis for Hydro Power Facilities

Turbine oil is used as bearing lubrication oil for hydraulic turbine generators. Through long time of operation, oxide compounds and worn particles in the oil increase and this may cause the bad conditions such as temperature increase of bearing metal, poor lubrication, etc. To prevent bearing metal abrasion, it is necessary to analyze oil viscosity, water content, oxidation degree, etc. Diagnosis of lubrication oil includes the analysis of worn particles in the oil, which contribute to find a sign of bad condition.

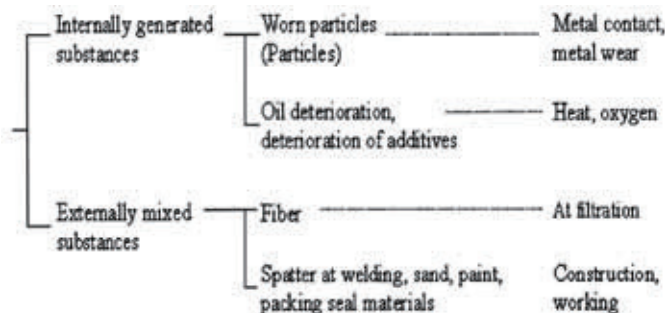


Fig. 1 Classification of contaminants



Fig. 2 Diagnostic equipment for lubricating oil

Example 3. Service Life Assessment for Generator Stator Windings

The purpose of the Service Life Assessment method is to evaluate the present Dielectric Strength of Generator Stator Windings in hydroelectric power plants, and to decide the effective measures of accident prevention and the economical maintenance intervals. This method is developed by cooperative research. It is required unit stoppage for nondestructive performance test.

The scope of the Service Life Assessment method refers to resin-insulated generators with a rated voltage of 6kV or more. This method is also applied to compound insulation, and to insulation with a rated voltage of less than 6kV.

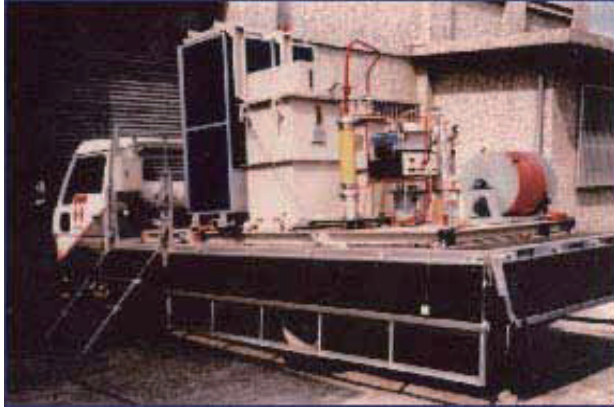


Fig. 1 Insulation diagnostic machine

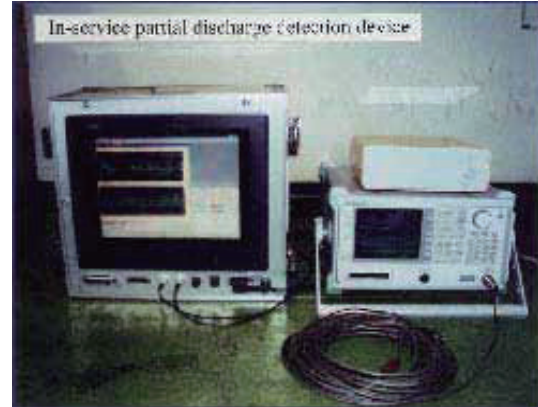


Fig. 2 In-service partial discharge detection device

Effects or Remarks

- ◆ Effective utilization of water resource
- ◆ Maintenance cost reduction for hydro power plant due to following
 - Appropriate maintenance method and maintenance cycle by evaluating facility performance
 - Avoidance of severe troubles by appropriate diagnose
 - Early time maintenance with remaining life assessment of equipment

Installation in Practice or Schedule

- Domestic**
 - ◆ Operation and maintenance of hydroelectric power stations within TEPCO (164 locations, 8,983MW)
- Overseas**
 - ◆ “Engineering Services for Rehabilitation Works of Umiam Stage II,” India (2004)
 - ◆ “Feasibility Study for Rehabilitation Works of Umiam Stage III,” India (2006)
 - ◆ “Engineering Services for Rehabilitation Works of Namgum Hydro Power Station,” Laos (2004)
 - ◆ “Hydro Power Plant to protect Rice Terrace World Heritage Site Project in the Philippines” (2010)

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