

SUBSTATION AND SUPERVISORY CONTROL FACILITIES FOR SHITAMACHI SEWERAGE TREATMENT PLANT, YOKOSUKA CITY

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1. FOREWORD

The Shitamachi Sewerage Treatment Plant built by the Yokosuka city began operation as a separation (partial convergence) type sewerage treatment plant in April 1969. Yokosuka City is located in a hilly region on the Miura Peninsula. The treatment area of the Shitamachi Sewerage Treatment Plant has 18 pumping stations for 3 systems which mainly relay waste water. The water treatment method uses the standard activated sludge method and the generated sludge is incinerated.

Accompanying expansion and modernization of facilities, the electric facility was also installed in stages. The major part of the entire equipping plan has been completed and is introduced here, centered about the receiving and distributing and supervisory control facilities.

Table 1 Outline of facility

Planned processing area		3,277.92ha
Planned processing population		280,000 persons
Planned processing capacity (daily maximum in fair weather)		123,200m ³ /d
Treatment method		Standard activated sludge method
Pumping station	Waste water relay pump	18 sites
Sand basin and pump facility	Sand basin	Waste water 4 Rain water 2
	Waste water pump	6
	Rain water pump	3
Pumping station	Waste water relay pump	18 sites
Water treatment facility	Initial settling basin	11
	Aeration tank	18
	Final settling basin	19
Sludge treatment facility	Concentration tank	6
	Dehydrator	7
Incineration facility	Fluidized bed	3

2. OUTLINE OF FACILITY

The treatment plant facility is outline in Table 1.

3. SYSTEM COMPOSITION AND FUNCTIONS

A simple wiring diagram of this facility is shown in Fig. 1. The system block diagram is shown in Fig. 2. The main composition and functions are described below.

3.1 Receiving and distributing facility

The service system is underground service from the Tokyo Electric Power Co., Ltd. The receiving system is 66 kV normal and spare two circuits receiving 1MOF system.

A 1,500 kVA (6.6 kV) gas turbine emergency generator is used to supply power during a power interruption.

The receiving and distributing facility is outlined in Table 2. The special high voltage facility is shown in Fig. 3.

3.2 Supervisory control facility

The interior of the plant is connected by one dataway with a centralized supervisory distributed control system as the base. There is a supervision station at the water treatment facility, sludge treatment facility, and incineration facility. The functions corresponding to each are installed and at the same time, special consideration was given to securing central supervision facility reliability by providing a total supervision function. The waste water pumping station group is supervised and controlled by telemeter aimed at efficient operation of the water treatment facility.

Table 2 Outline of receiving and distributing facility

Special high voltage facility	66kV, normal, spare 2 circuits receiving, SF ₆ totally-enclosed 3,000kVA transformer×2 banks (4 banks)	1 system
Emergency power generator	6.6kV 1,500kVA, gas turbine generator	1 system

<Note> (): Overall plan

Fig. 1 Simple wiring diagram

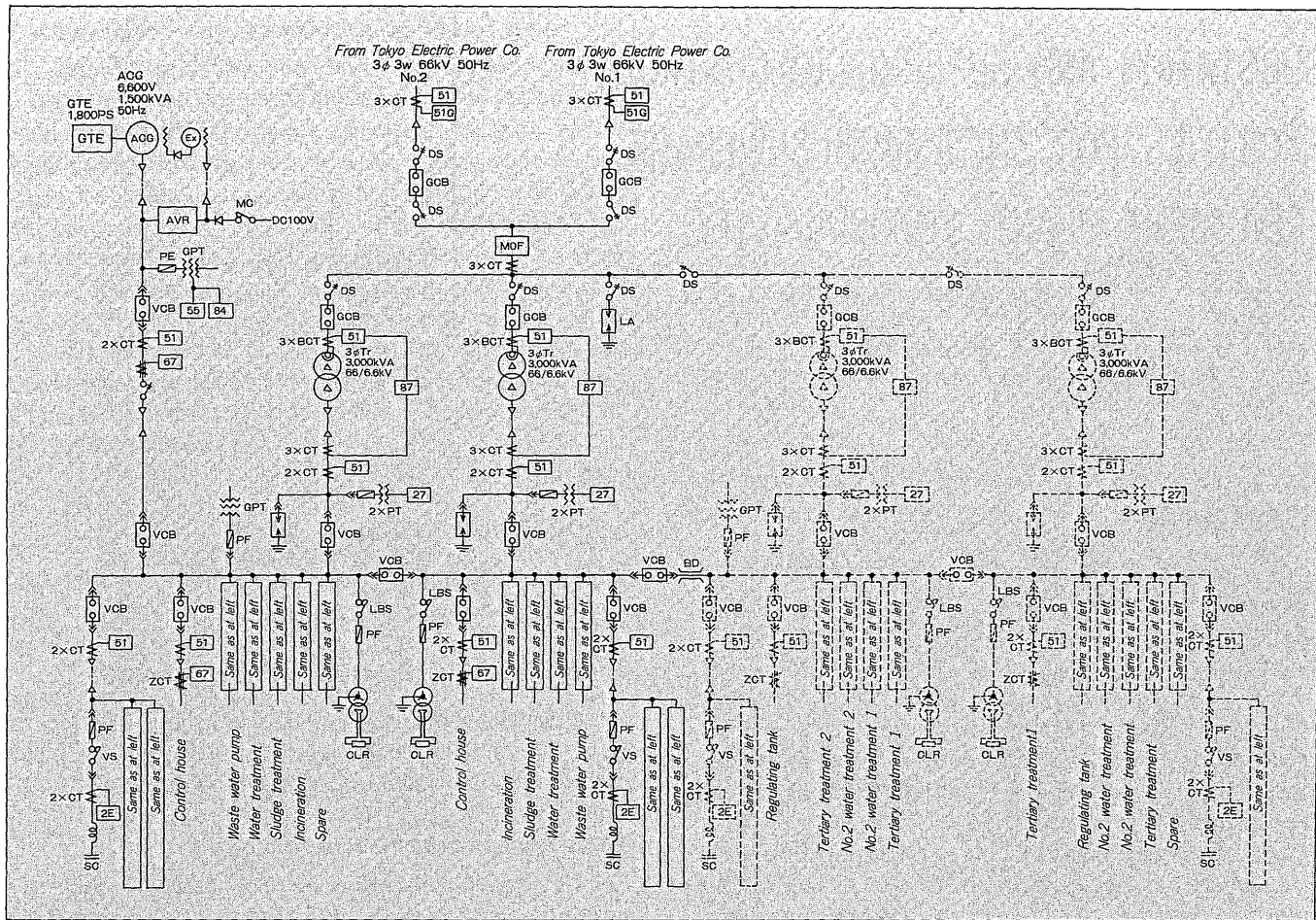
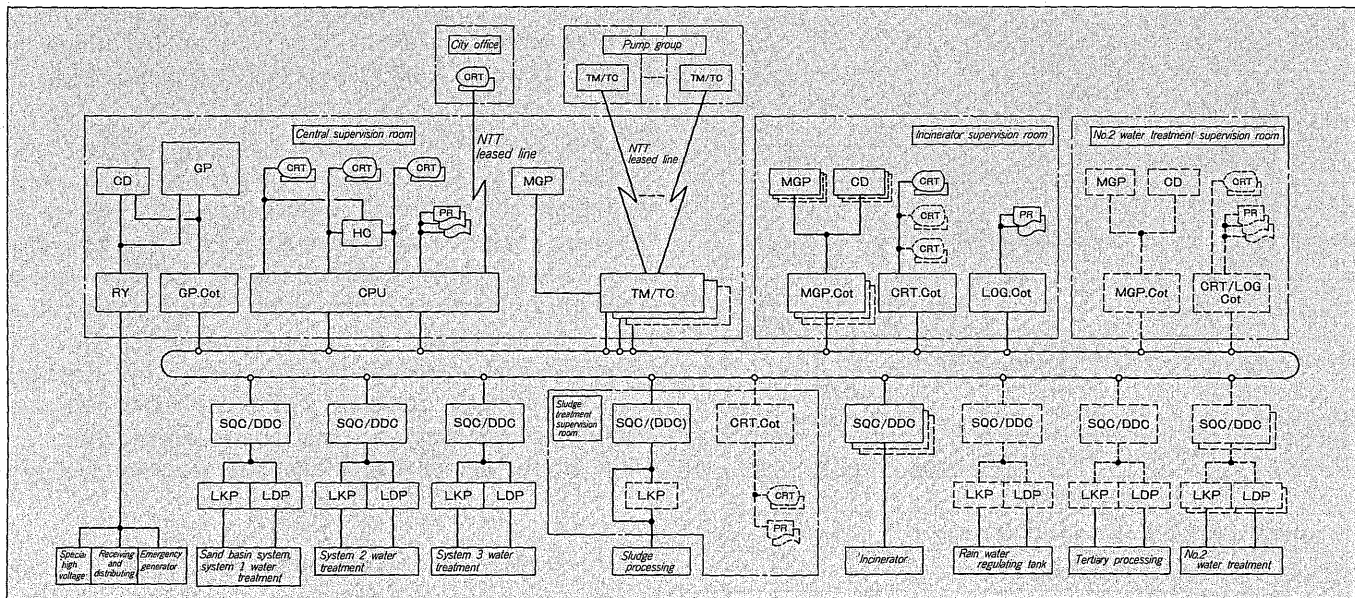


Fig. 2 System block diagram

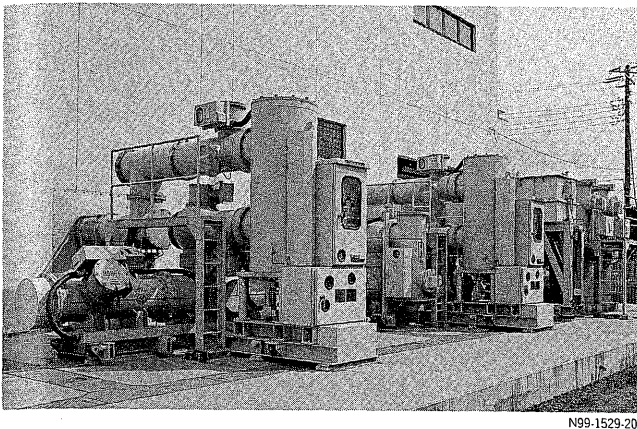


The master station is connected by a dataway and data is fetched at the central supervisory facility. A supervisory terminal is installed so that rainfall related data can be checked at the Headquarters Sewage Department during

rainy weather.

The composition of the supervisory control facility is shown in Table 3. The central supervision and operation facility is shown in Fig. 4.

Fig. 3 Special high voltage facility



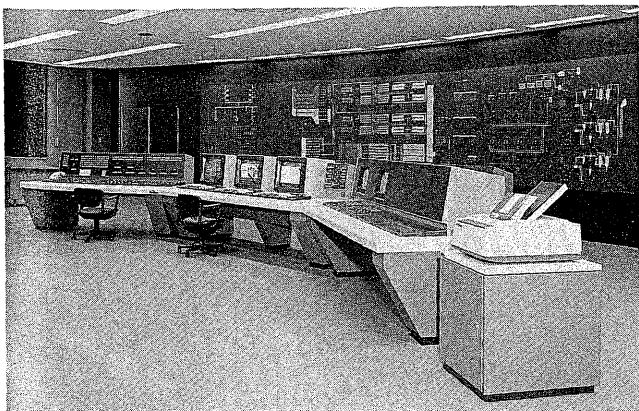
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Table 3 Outline of supervisory control facility

Supervisory control facility	Supervision and operation controller	Center, water treatment (PFU-1500II)	2
		Sludge treatment	(1)
		Incineration (PFU-1500 (PFU-1500II/1200II))	2
	Graphic input/output device: Receiving and distributing, water treatment (HDC-100/200)		2
	Remote supervisory control system (SAS-300)		3
	Mini graphic input/output device: Incineration (HDC-100)		1 (3)
	Rain water supervision terminal (F9450ΣmkII)		1
Plant control facility	Sand basin, water treatment SQC-DDC controller (HDC-100/PCS-100)		3
	Sludge treatment SQC controller (HDC-100)		1
	Incineration SQC/DDC controller (HDC-100/PCS-100)		1 (3)

<Note> (): Overall plan

Fig. 4 Central supervision and operation room



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4. SYSTEM FEATURES

4.1 Receiving and distributing facility

- (1) Because this treatment plant is near the coast and the receiving and distributing facility has to be installed in a limited space, the special high voltage receiving and distributing facility used a gas insulated switch (GIS). Structurally, GIS has all the devices and buses compressed by lumping 3 phases installed in a metal container and sealed in SF₆ gas. There is no danger of deterioration due to soiling, corrosive gas, etc. and an almost maintenance-free construction is realized and at the same time, there is no danger of electric shock. The installation space is about one-half that of the housing type cubicle system.
- (2) The emergency power generation facility engine was made a gas turbine system that can be easily quieted. This system does not require cooling water, has few auxiliary machines, and maintenance is easy. It features a lightweight generator that generates little vibration.

4.2 Supervisory control facility

- (1) The supervision and operation room is divided into three sites: (1) central supervision room that plays the central role of the treatment plant (mainly water treatment), (2) incinerator plant aimed at dedicated and efficient correspondence at the machinery side, (3) sludge treatment plant. Each supervision room can supervise and operate its facility and at the same time, receive data of other related facilities.
- (2) The central supervision and operation consists of two controllers. The functions are divided into supervision, operation and logging. However, in an emergency, back-up is possible and a reliability which ensures stable and safe operation of the plant is provided.
- (3) A CRT is used for detailed supervision and setting and operation. Operation efficiency is increased by also using a graphic panel in general supervision.
- (4) The supervision and operation room is aimed at operator livability and supervision and operation efficiency and was not only device design, but also arrangement were studied.
- (5) The receiving and distributing facility stresses supervision and operation reliability and the transferred signal were sent directly.
- (6) The controllers are distributed in electric room units to distribute the control risk and the transfer of a large amount of data to the center was realized economically by dataway connection.
- (7) Fuzzy control taht allows advanced water quality control was introduced at water treatment.
- (8) To operate the numerous waste water pumps divided into the trunk lines of three systems, central supervision an operation and data one-dimensional management were realized at the Shitamachi Water Treatment Plant by telemetry.

- (9) A waste water in-flow forecasting control system by dynamic programming was introduced so that efficient and advanced waste water treatment can be performed by forecasting and planning techniques when the waste water pump group is completed in the future. This forecasting control system is installed at the central supervision and operation controller and automatically operates and controls the waste water pumps of all the pumping stations in accordance with the waste water in-flow plan established by operation processing.
- (10) The disaster supervision system at the Headquarters Sewage and Waterworks Department during rainy weather is severe, but a rain water supervisory terminal was installed here to grasp the rainfall, river water level, pump operation state, and other information. This

uses a system that transfers the data collected at the Shitamachi Water Treatment Plant from each waste pumping station.

5. CONCLUSION

The new expansion plan for the Shitamachi Sewerage Treatment Plant is developing positively in its long history. At the supervisory control facility, reliability, safety, and operability have been realized at a high level and new ideas have been incorporated. Even facility modernization coexists with the old facility and switching is performed carefully. In the future, electric facilities matched to the facility operating characteristics and installation environment demanded by Yokosuka City will be delivered.

