Development of electric circuit practical training equipment that enables innovative human resource development

Naoki Ueno

Bureau of Waterworks, Tokyo Metropolitan Government,
1-19-1 Tamagawa-den'enchofu, Setagaya-ku, Tokyo
ueno-naoki@waterworks.metro.tokyo.jp

Introduction

Veteran employees who have worked for a long time in the operation management at the water purification plant feel that **the recent water purification plant has become easier to maintain.**
The reason is that the function of the facility improvement, advancement of automation, fewer troubles, and the daily maintenance become easy.
In addition, as outsourcing has progressed, the employees have few opportunities to repair the facility, and less likely to experience accidents and troubles.
Yet, there are still many scenes where facility officials need knowledge and skills in the mechanisms of facilities, such as the detection of anomalies at daily inspection, the supervision of contractors, the initial response at the occurrence of an accident, and others.
On the contrary**, young employees have few experiences of accidents and troubles**, and it is difficult to refine their skills only with daily work.
In addition, few veteran officials could give the lecturers of OJT because the number of veterans have been reduced and exchanged by outsourcing, **thus young employees have lack of sufficient spare time for OJT.**
Therefore, the Bureau of Waterworks, Tokyo Metropolitan Government (hereinafter referred to as, "Tokyo Waterworks") opened a training and development center in 2005 with equipment which were actually used at water purification plants.
In addition, **Tokyo Waterworks developed original practical training equipment for setting practical skills.**

【Fig.1】Electrical training room (Training and development center)

Electric Circuit Practical Training Equipment

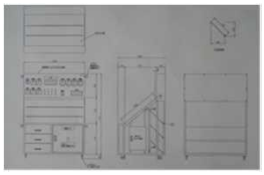
・In the water purification plant, a wide variety of new and old facilities is mixed and operated complicatedly.

・As a result, an operator needs to become familiar with the "**reading and understanding ability of the control circuit**" as necessary common knowledge for operating these various facilities.

・Therefore, Tokyo Waterworks developed **practical training equipment that enables wiring exercises to master the basics of electrical circuits and control** (Figures 2and 3).

・With this practical training equipment, **trainees can acquire the basics of electric circuits** and could deal with various old and new facilities in water purification plants.

【Fig.2】Practical training equipment



【Fig.3】Practical training equipment drawing

3 Features of the Training Equipment

1 Experience with reality

・The training equipment can be connected to other equipment actually used in the water purification plant (pump, valve, motor ,compact air compressor, and others (Figures 4and 5))
・Experience of trial and error for wiring the equipment to make it work properly.
⇒Development of further practical and effective skills

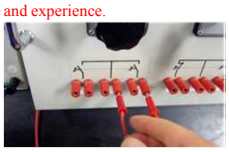
【Fig.4】Connecting to the valve

【Fig.5】Connecting to the motor

2 Excellent operability

・Improvement of wiring connection method:
one-touch wiring connection method by utilizing banana plug
・The shortening of work hours: less than 1/10
⇒ Trainees can practice more circuits in the same time
Acquisition of wide range of knowledge and experience.

【Fig.6】Conventional connection method



【Fig.7】Banana plug connection method

3 Versatility and economy: Adopting detachable panels

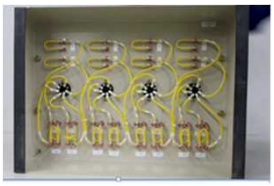
・There are 13 panels. (Figures 8,9 and 10)
・By combining panels and mounting them on the workbench, various circuits can be assembled.
⇒By combining these panels, trainees can practice a wide range of practical training
e.g. basic level : ON / OFF circuit, AND circuit,
advanced level: control pumps and valves.

・The structure of this panel is very simple and just wired on the reverse side (Fig. 11).
⇒It can be made easily and inexpensively

【Fig.8】Panel example (Operation Panel)

【Fig.9】Panel example (Relay Panel)

【Fig.10】Panel example(Sequence Panel)



【Fig.11】Panel reverse side

Results

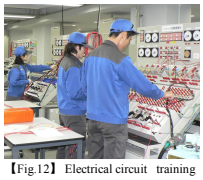
● The number of trainees
Over 300 employees (from FY 2005 to FY 2016):
:Almost all of the new employees who work for the facility system

● Questionnaire result of the training evaluation (FY2016)
Extremely satisfied 82%

Increase in number of employees with the knowledge of the electric circuit

➢ Rental of the training room to other waterworks utilities.
(Including the Japan Water Works Association)

Contribution to the waterworks utilities in Japan



【Fig.12】Electrical circuit training

Conclusions

● The number of employees who have knowledge about the control circuit has increased.
They contribute to early detection of defective parts at the facility.

● Effective training for young employees will be important regardless of size of the water utilities around the world.

● This practical training equipment which was developed by our officials could make a great effect with reasonable production cost. Thus, it is greatly helpful for nurturing technical personnel.