

## Outdoor-type Communication Facility Cabinet with Attemperation Function – Smart Cabinet –

### 1. INTRODUCTION

Furukawa Electric (FEC) launched the Smart Cabinet collectively developed with NEXCO-East Engineering Company Limited, which can simultaneously accommodate indoor-type communication equipments and ability to support the building of an out-door type communication station. The Smart Cabinet can house equipments, such as optical-metal internet protocol (IP) transmission equipment, server and power source/Uninterruptible Power Supply (UPS), etc. up to 320 W of total maximum heat generation. The inside cabinet temperature can be maintained in the range of 0 to 40°C with an ambient outdoor temperature between -15 to 45°C in summer with direct sunlight and high temperature, as well as in winter in cold districts.

### 2. ABOUT OUTDOOR-TYPE CABINET FOR COMMUNICATION FACILITIES

Due to changes in road communication network path to IP etc., there is a growing demand for outdoor-type cabinet for high performance communication equipments, which can house indoor communication equipments simultaneously and build outdoor-type communication station. Many precision type equipments, such as uninterruptible power supply (UPS) and modem are housed in the communication cabinet. But these precision type equipments can malfunction due to inside cabinet temperature fluctuation created from the heat generated by the equipment itself or from the change in external ambient environment such as temperature rise by solar radiation in summer and temperature drop in winter. To prevent these problem, an inside temperature control system with an air conditioner etc. is required. But the latter with a conventional mechanical type cooler and compressor has complex mechanical parts that can be a source of problems in terms of weight and price. Furthermore, in the air polluted environment on the roads, reliability is often an issue because of the increase in maintenance frequency due to break down of mechanical parts. Also another problem of higher environmental concern is expected by the use of refrigerant. In this framework, FEC developed the new outdoor-type communication equipments cabinet based on new design concept, and solving the problem of the conventional outdoor-type cabinet.

### 3. PRODUCT CONCEPT

The product concept of the Smart Cabinet is to reduce the power consumption and to provide conditions where indoor equipments can be used outdoor. Here, technical studies are conducted to address the following 4 concerns from a view point of solving problems of conventional cabinets.

A) Light weight and compact B) Energy saving C) Environment friendly D) Reliability improvement “Light weight and compact” was achieved by adopting a heat exchanger with a Peltier device, which is a semi conductor type cooler. The operating method based on, switching two types of heat exchangers mounted on the cabinet, saves energy. From an environmental friendliness, the heat exchanger with Peltier device which does not use cooling medium such as Freon is adopted and the operation method is optimized. Also reducing moving parts improves reliability.

### 4. BASIC SPECIFICATION OF THE SMART CABINET

Internal temperature of the cabinet cannot be cooled to temperature lower than outside air, only by an air-cooled heat exchanger, especially in summer. Therefore the Smart Cabinet uses heat exchanger with Peltier device on the back side, in addition to the air to air heat exchanger on the top of the cabinet as shown in Figure 1.

A heat exchanger with a Peltier device adopts thermoelectric conversion elements made of Bismuth Tellurium. The heat transfer from the heat absorption part to the heat dissipation part occurs by applying direct current, and the heat absorption part temperature can be lowered than the heat dissipation part by removing the heat from the heat dissipation part. In addition, the Crimped fin heat sink which has excellent heat dissipation performance is applied to the high temperature side of the heat exchanger with the Peltier device. Then the heat from the heat exchanger with the Peltier device can be dissipated efficiently. The Crimped fin heat sink is an environment friendly heat sink because it consists of fin materials crimped to the grooves provided in the base plate since solder and brazing materials are not used for jointing of parts.

Temperature inside the cabinet is controlled by switching the air to air heat exchanger on the top of the cabinet and the heat exchanger with the Peltier device on the back side, as shown in Figure 2. The heat exchanger with the

Peltier device can exchange heat dissipation side and heat absorption side by current flow direction, and the Smart Cabinet performs cooler operation and heater operation by switching the current direction in the controller.

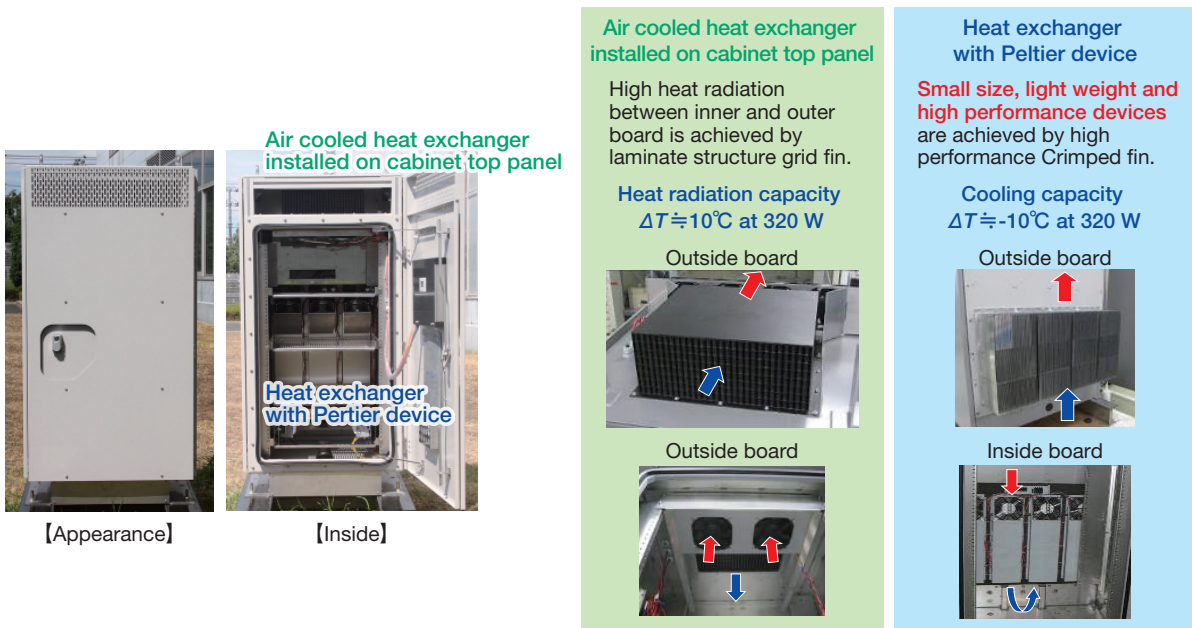


Figure 1 Configuration of the Smart Cabinet.

The operation mode is automatically controlled, based on the external ambient environment and the cabinet inside temperature.

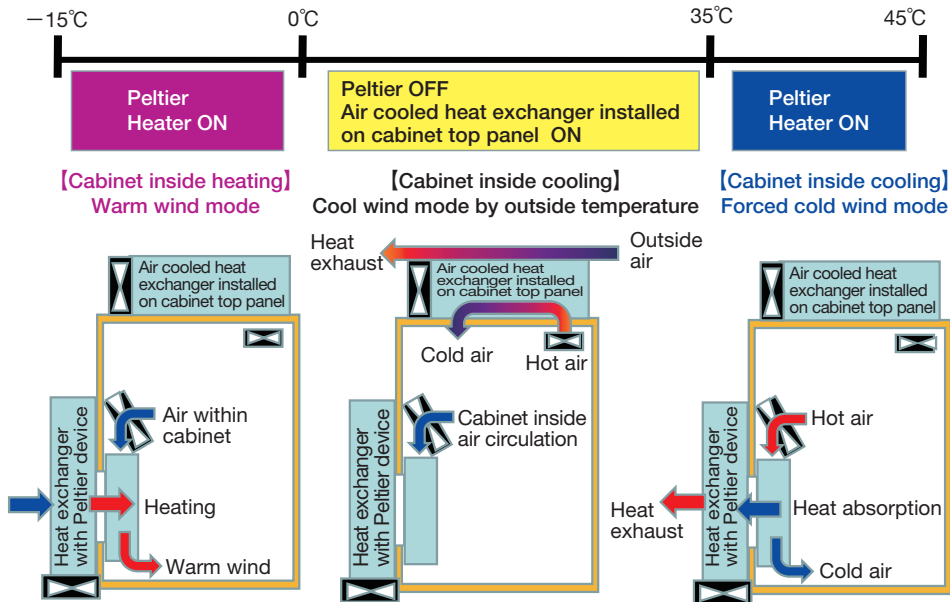


Figure 2 Smart Cabinet operation methods.

Figure 3 shows typical results of out door test in summer.

The result verifies that inside cabinet average temperature can be maintained at 35°C by the Peltier cooler ON, within the range of 320 W of load in an extremely hot under the scorching sun (ambient temperature 34°C).

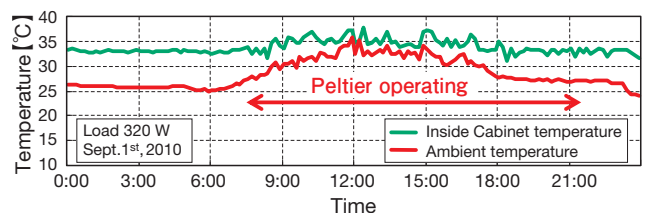


Figure 3 Smart Cabinet outdoor summer season verification test result.

## 5. THE SMART CABINET PRODUCT LINEUP

The Smart Cabinet has two types of products depends on total heat generation by accommodated equipments.

Though, outdoor test verified that inside cabinet average temperature can be controlled to 35°C in extremely hot days under the scorching sun, the specified inside cabinet controlled temperature is 0 to 40°C.

### 5.1 The Smart Cabinet L

The type L can accommodate heat generating equipments up to 320 W in total, and is basically a freestanding installation. Also, the heat exchanger with the Peltier device is installed on the back of the cabinet, and is a one side door system.

### 5.2 Smart Cabinet M

The type M can accommodate heat generating equipments up to 230 W in total and, a freestanding installation and a pole-mounted installation are available. Two sides door system is adopted, and selected equipments can be maintained both from front and rear side.

**Table 1 Main specifications of The Smart Cabinet L.**

Cabinet outside dimension (mm)	W 667 × D 839 × H 1,294
Equipment installation	19 inch rack specification
Max. heat from selected equipments	Up to 320 W in total
Cabinet inside controlled temperature	0 to 40°C (Ambient temperature -15 to 45°C)
Max. power consumption	Less than 1100 VA
Input power source	AC single-phase two-wire system, 85 to 240 V (50, 60 HZ)



Front appearance

Inside

**Figure 4 Appearance of The Smart Cabinet L.**

**Table 2 Main specifications of The Smart cabinet M.**

Cabinet outside dimension (mm)	W 610 × D 762 × H 900
Equipment installation	19 inch rack specification
Max. heat from selected equipments	Up to 230 W in total
Cabinet inside controlled temperature	0 to 40°C (Ambient temperature -15 to 45°C)
Max. power consumption	Less than 450 VA
Input power source	AC single-phase two-wire system 85 to 240 V (50, 60 HZ)



Inside

Two sides door appearance

**Figure 5 Appearance of Smart Cabinet M.**

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