OLZADIA BOUTIQUE HOTEL

Project description

CyberTown
Engineering solutions

Problem statement

The customer's hotel, under construction, consists of 11 separate bungalows spread over two floors, as well as a common building containing 12 individual rooms, a standalone SPA salon, private areas for owners' residences, a reception area, and a separate dining facility. The property is situated in a location with an exceptionally low level of energy supply. The hotel is divided into two distinct groups based on its connectivity to the electrical grid. The facility offers various electricity supply options for domestic users, including two maximally separated three-phase input connections. The voltage supplied by the external network at both locations is no greater than 140 volts. Internal consumers' voltage is also limited to 140 volts provided that each building is properly connected to the respective input and distribution devices. Unfortunately, the hotel lacked a proper grounding system for its equipment, making its operation hazardous. Guests and staff were at risk of electric shock.

Search for a solution

To address this issue, it is necessary to implement a comprehensive grounding system to ensure the safety of all occupants. This should include proper grounding for all electrical equipment and systems within the premises. Additionally, safety measures should be taken to prevent electrical shocks and other potential hazards. To address the customer's requirements, our organization carried out a survey of the site and proposed a solution to establish an energy supply system for the under-construction hotel.

The proposed solution involved the installation of two separate voltage regulation units (VRUs), connected by a standby power cable. A backup diesel generator was also installed, along with voltage stabilizers to raise the voltage to calculated values on all six input phases. Ground loops were built for each VRU in accordance with the TT connection scheme.

Symbols

Power supply lines were designated as follows:

1. Input lines (P1,P2,P3) P1 is phase #1, P2 is phase #2, P3 is phase #3.
2. Electric generator phases (U, V, W).
3. The phases of the electrical generator are U, V, and W.The input distribution device after the source selector (E1, E2, E3) includes the following lines: E1 can be P1 or U respectively, and the remaining lines correspond to P2-V, P3-W.
4. Deaf-connected neutral N.
5. Ground loop line PE.
6. Stabilized lines (T1, T2, T3).

Search for a solution

To ensure effective management of the energy supply system, a categorised energy supply scheme has been proposed, comprising the following components:

1. The input and distribution system has been designed and implemented such that switching between primary and backup inputs is carried out manually. This is because the quality of external input is such that automatic activation of the diesel generator backup would occur even in situations where it is unnecessary. Therefore, automated switching using an automated reserve input system is not desirable.
2. The backup power source is a three-phase, 60 kVA diesel generator.
3. All buildings within the hotel premises have been divided into separate electrical circuits.
4. A VRU (voltage regulator unit) is connected to intermediate electrical panels using armoured copper cable, acting as a switching mechanism from which individual building electrical panels are connected.
5. Six single-phase, high-power voltage stabilizers are installed, each receiving power at the input (E) and outputting it at a stable voltage (T).
6. The entire facility is divided into sixteen large consumer groups, each with its own armored cable described in [7].
7. Each line in a consumer group consists of four copper conductors with a minimum cross-sectional area of 16 mm^2, which implement the logic T1-T3 or E1-E3 for the first two conductors and the line N1-N2, as well as an additional PE conductor.
8. “Priority” and “non-priority” loads are assigned to each consumer group, and each electrical panel in the group uses two sets of phase switches, a common neutral, and a grounding loop.
9. From the VRU (voltage regulator unit) side, each group of consumers is connected through a set of selective switches that allow for selecting the operating mode of each of the two lines:
   a. A guaranteed line that always connects through a voltage regulator.
   b. An unguaranteed line that may connect through a voltage regulator or remain unregulated or disconnected.
10. Two separate grounding systems have been installed, each consisting of three copper vertical grounding wires, which have been hammered into the ground at a depth of 6.4 centimeters. These grounding wires are connected to each other through a copper cable with a minimum cross-sectional area of 32 millimeters squared, and are also connected to a separate copper wire with a minimum cross-sectional area of 16 millimeters squared. All electrical equipment at the site is connected to this grounding system.

Result

The result of this installation is a balanced system that enables the following features:

1. Continuous monitoring of the voltage and current (power consumption) at the input lines of the facility in a visually convenient format for operators.
2. Continuous tracking of the consumption and voltage levels for all groups of electrical consumers.
3. High-quality installation of power supply cables has minimized internal electricity losses.
4. All power supply sockets in the facility have been stabilized to the design voltage of 230 V ± 5%. There was an increase in voltage to consumers of more than 100 V, but all equipment, lighting, kitchen equipment, pool equipment, and other devices are currently operating at normal supply voltage.
5. To ensure the safety of equipment, grounding has been implemented, allowing the use of protective disconnection devices. This has increased safety and user comfort by preventing electrical shocks.

The generator has been returned to working order, and its connectivity allows for emergency use in central mode only of the equipment necessary for hotel operation in an emergency, without overloading backup power systems.

Both constructed grounding systems have resistance less than 2 ohms, meeting the most stringent quality standards.

At present, due to the poor quality of external power supply, the hotel is exploring the possibility of transitioning to solar energy generation. A small-scale solar power plant has been installed at the hotel in order to ensure the uninterrupted operation of the data center, communications facilities, and the local network.