OLEZA BOUTIQUE HOTEL

Project description

CyberTown
Engineering solutions

Problem statement

The customer's current accommodation facility is located in an area with poor energy infrastructure. The supplied voltage is not more than 170 volts, and the voltage at internal consumers is not more than 130 volts. This results in the equipment either not operating at all or operating improperly. The hotel does not have a grounding system for equipment, making its operation unsafe, exposing guests and hotel staff to electric shocks.

Search for a solution

To address the customer's needs, our organization has conducted a facility survey and identified several significant shortcomings in the construction of the internal consumer system of the hotel.

A solution has been developed that involves dismantling all existing power supply systems and redesigning and installing a new one

Symbols

Power supply lines:

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

In order to effectively manage the energy supply system, we have proposed a categorized energy supply scheme that includes the following components:

1. The input and distribution device are designed and implemented such that switching between main and backup inputs is done manually. This is because the power of the diesel generator at the facility is not sufficient to cover all the hotel's needs, so automatic switching using an automatic reserve input system would not be desirable.
2. The backup input consists of a three-phase diesel generator with a rated capacity of 20 kVA.
3. All buildings on the hotel's premises are divided into separate energy consumption lines.
4. A three-phase high-power stabilizer has been installed, receiving input from (E1-E3) and outputting stabilized power at (T1-T3).
5. The entire facility has been divided into 4 large consumer groups, with a separate armored cable supplying each group, as described in [6].
6. Each line within a single consumer group consists of 4 copper conductors with a minimum cross-sectional area of 16 mm², which implement the following logic: T1, T2 or T3 for the two conductors of the line N and PE.
7. “Priority” and “non-priority” loads have been allocated within each consumer group, with each electrical panel in the group using two separate phase switch sets, as well as a common neutral wire and ground loop.
8. Each group of consumers on the VRU (voltage regulator unit) side is connected via its own set of selective switches, allowing for selection of the operating mode of each of the two lines:
   a. Selection between En or Tn (in other words, the line is supplied from a stabilizer or from an input without stabilization).
   b. The selection is made individually for each of the phases of each individual consumer group (for both priority and lower priority equally).
   c. A common input phase selection switch (E1-E2, E2-E3, E3-E1) “before” and “after” stabilization for each individual group. This allows load shifting within the facility if there is a skewed consumption by phase or one of the phases is out of service or is clearly overloaded at the input.
9. A separate grounding circuit has been created using 3 vertical grounding conductors driven into the ground, welded together with a metal plate, and connected to a VRU with a separate copper cable with a cross-sectional area of 16 mm², all electrical equipment in the facility is connected to this grounding system.

Result

The result is a balanced solution that enables the following use cases:

1. Continuous monitoring of the state of the input lines at the object both in terms of voltages and current (power) consumption by the load in a visual mode convenient for the operator.
2. Individual selection (switching between) of at least two input phase variants for each of the 4 separate groups of internal consumers.
3. Possibility to supply voltage with individual selection for each of two separate lines to each of the consumer groups, either through the stabilizer or directly from the input line.
   a. The latter allows the stabilizer to be switched off if a generator is used, or to use stabilization after the generator, only for those lines that need it.
   b. Ability to disconnect and reconnect the generator for non-priority load lines (such as air conditioners and water heaters) during times of significant voltage drawdown at the input.
4. Continuous monitoring of consumption and voltage status at all energy consumer groups.
5. The reorganization of all switching systems of all facilities within the facility has allowed for the removal of old, unnecessary, or unused loads. This has effectively reorganized the load in terms of its priority of use.
6. All power supply outlets throughout the facility have been stabilized to design values of 230 V +/- 5%. There has been an increase in voltage to consumers of approximately 100 V. Currently, all equipment, lighting, kitchen equipment, pool equipment, and other devices are operating at normal supply voltages.
7. Equipment has been grounded, allowing for the use of protective disconnecting devices and enhancing safety and user comfort by preventing "electrocution".

The facility has undergone significant transformation. The kitchen is now equipped with all available appliances. The load on inputs now reaches 50 A per phase (up to 150 A overall) without any voltage drop exceeding 10 V on any phase.

Hotel staff can independently address issues with connection lines by balancing them, if necessary.

The generator has been returned to operating condition, and its configuration allows, in an emergency situation, to use only the load necessary for the hotel, without exceeding the capacity of the backup power source.

The resistance of the ground loop constructed is less than 3 ohms, meeting the most rigorous quality standards.