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ELECTRICAL INSTALLATIONS – PART 1 (ver.7)

TECHNICAL STANDARDS

LIST OF DOCUMENT REVISIONS

„Electrical installations – part 1. Technical standards”

Revision No	Revision Date	Description of changes
0	6.05.2022	First edition
1	8.02.2023	p. 3.4.2 – added information about powering emergency luminaires in warehouses; p. 3.4.5 – point removed; p. 3.5.1 – added places to use IP44 sockets p. 3.5.10 – added new point; p. 3.8.4 – additional WiFi antenna close to the manager's desk; p. 3.9.1 – added information about prohibition of use mushroom head pushbuttons; p. 3.9.5 – point removed, next points has been renumbered; p. 3.9.7 – point removed, next points has been renumbered; p. 3.9.6 (earlier 3.9.7) – added new information about ceiling LED strips; p. 3.9.7 (earlier 3.9.8) – added new temperature sensors; p. 3.9.8 – added new point;
2	11.04.2023	p. 3.4.5, 3.4.6 – changed type of programmable lighting control timers from weekly to annual and specified the preferred type of timer
3	8.05.2023	p. 3.4.5 – the switch-on times of 70%, logotypes and shopwindow lighting have been changed
4	1.08.2023	p. 3.8.3 – removed the need to lay HDMI cables to LED monitors
5	23.08.2023	p. 3.2.6 – added new point
6	11.09.2023	p. 3.9.10 – added new point
7	7.11.2023	pkt. 2 i 4 – added new point no. 4 regarding as-built documentation, some of the notes from point 2 was moved to point 4 and expanded with new content; pkt. 3.4.2 – added information about not covering emergency luminaires; pkt. 3.9.1 – added information about additional main power switch plate marking; pkt. 3.9.5 – added height exceptions in HO and MH brands;

1 Scope of standards

These standards are intended for designers and contractors of electrical installations in newly designed LPP S.A. stores. They define the content of the projects and present the technical requirements for the execution of electrical installations. Designers and contractors are required to read and apply these technical standards. Any changes must be agreed with LPP each time.

These standards consist of 3 complementary parts:

- Part 1 – description with attachments and with listed all requirements,
- Part 2 – description and drawing with indicated critical places of installation,
- Part 3 – sample designs of existing stores.

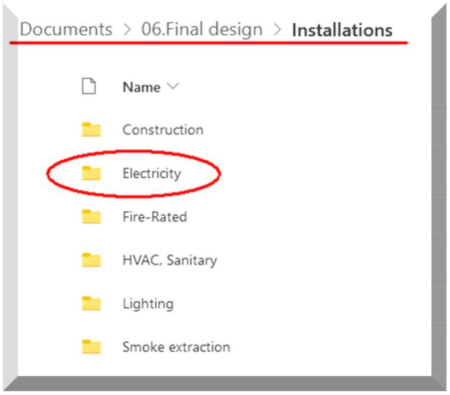
Please send any comments, questions or proposals for changes to the technical standards of electrical installations to the following address: radoslaw.bilinski@lppsa.com or pawel.zielinski@lppsa.com

2 Design content

The electrical design must include at least:

- Technical description with the cited requirements of regulations and standards required in a given country, as well as technical information for the contractor, required formal documents and all necessary arrangements and declarations,
- Legend of symbols,
- Calculations and power balance taking into account the coincidence factors and divided into lighting, sockets, HVAC devices,
- Electrical scheme of switchboard divided on main current scheme and lighting control scheme and also turning off selected circuits from the FAS (Fire Alarm System). The diagram must indicate the electrical parameters of the devices used, the power and currents of the circuits and the selection of the wiring,
- Diagram of IT circuits, locations of RJ45 sockets on the sockets plan,
- Plan of the lighting installation,
- Plan of the sockets installation.

The design must be bilingual, in English and in local language - according to country where located. The design should be additionally agreed with the management of the Shopping Center. After arrangements, print the design in at least 2 copies (unless the Project Manager decides otherwise), folding to A4 format and delivery to LPP. Upload the electronic version of the design in PDF format and the editable version to the LPP server to the appropriate directory. Do not use dates in the file names, and if a revision is necessary, overwrite the files under the same name. File names must be in English.



In the case of stores with taken over installations (e.g. lighting or switchboard), all changes in relation to the existing things should be clearly marked in the project (with red colour or clouds).

The designer is also obliged to check, based on existing documentation, any existing devices and connections to the store, and then adjust the design accordingly. For example, it may happen that the store has a meter board or a power distribution board e.g. for ventilation. In this case, it is necessary to relocate the devices or extend the cables should be analysed and introduced to the design.

3 Detailed guidelines

3.1 Electrical switchboard

Every store must have own, independent electrical switchboard. All loads/circuits will be power supplied from this switchboard. This switchboard should not be used to power supply loads/circuits of other stores (even belonging to LPP) or parts belongs to shopping centre.

3.1.1 The electrical switchboard should be located in a place indicated by the architect, paying attention to correct operational access. Next to the switchboard, locate the main UPS of the store and, if present: a meter board, a local emergency lighting battery (Russia only) and other devices,

3.1.2 Unless there are more stringent requirements, then electrical switchboards should be metal, with IP44 protection class, if they are located in the back room. In the case of switchgears located in a separate electrical room, design an enclosure with min. IP30 a protection degree. Provide the standing switchgears with a 100mm plinth. Connect the enclosure to the equipotential system,

3.1.3 Cable exit from top, equip the switchboard with cable glands,

3.1.4 Inside of the switchgear doors, attach the documentation pocket and place there the store's electrical installation design, cables laid on wall in a cable tray with a cover,

3.1.5 In the switchboard, only devices from the following companies can be used: Eaton, Legrand, ABB, Schrack, GE, Hager, Dehn, OBO Bettermann,

3.1.6 In the switchboard install a type I+II surge protection device (Up≤1,5kV, Iimp≥12,5kA, In≥40kA). Lighting and sockets circuits should be additionally protected with residual current devices,

3.1.7 The switchboard must have a main current switch with a rise shunt trip enabling switch down whole switchboard and voltage indicators on all phases,

3.1.8 The groups of circuits should be protected additionally by fuse switch disconnectors,

3.1.9 In the case of a fire alarm from the FAS system, turn off the store's ventilation, air conditioning and sound system and close dampers on the comfort ventilation. Ensure that doors controlled by the access control system are unlocked and that sliding doors (if they are) are open,

3.1.10 Select the power supply cable for the store's switchboard and the pre-meter protection with a 20% reserve for current carrying capacity,

3.1.11 Build the switchgear enclosure with at least 20% of the space reserve,

3.1.12 For 3-phase circuits design 3-phase contactors (do not use 1-phase for each phase separately). In switchboard separate the contactors with dilatation gaps (half a module wide) to better dissipate heat,

3.1.13 Prepare the switchboard for measurement by a telemetric system. For this purpose, separate one measurement systems of the entire switchboard, one for lighting and one for ventilation and air-conditioning, dividing the switchgear on the sections accordingly. Use the equipment in accordance with the telemetry diagram in Attachment no.1,

3.1.14 All devices must be clearly labelled on the protective cover as shown in the diagram.

3.2 Cables and wires

3.2.1 The power supply cable should be laid to the indicated location of the store's switchboard with at least five-meter reserve,

3.2.2 In electrical installation use 450/750 V/V wires with cross-section not less than:

- sockets: 2,5mm^2,
- lighting busbars and other 3-phases installation: 2,5mm^2,
- lighting 1-phase (also low voltage wires from LED supply unit): 1,5mm^2,
- IT cabinet, music cabinet, CCTV cabinet: 2,5mm^2,
- Intrusion and Hold-Up Alarm system central and access control: 2,5mm^2,
- Revision of anti-theft gates (gates power supply unit): 2,5mm^2.

3.2.3 Lay the cables with Eca reaction to fire class (CPR), unless a higher class is specified in the fire protection report, shopping mall or local law requirements,

3.2.4 Loosely hanging cables are not allowed, they are all to be laid on cable trays or in protective pipes / trunking profiles,

3.2.5 All cables should be laid and fasten in an orderly way, taking care not to block access to the devices,

3.2.6 Cables that must be laid on the surface in protective pipes should be routed on the wall above the skirting board. The descent of the wires only in the corners of the walls,

3.3 UPS

In each store design the main UPS located next to the electrical switchboard and UPS for the roller shutter located directly next to the roller shutter (hidden on a rack above the suspended ceiling).

If there are more than one roller shutter in the store, each of them must have its own UPS of roller shutter powered by independent circuits. The main UPS must be turning off by main current button GWP through the REPO contacts. The UPS for roller shutter cannot be turned off by the REPO contacts.

Protect cables from the switchgear to the main UPS with protective pipes, wire connections should be done in surface-mounted boxes.

Minimum parameters of the main UPS:

- Phases: 1/1,
- Equipped with a REPO contact,
- Power adapted to the calculated load,
- Working on battery: not shorter than 10min at 80% load,
- Technology: Online,
- No expansion cards.

Minimum parameters of the roller shutter UPS:

- Phases: 1/1,
- No REPO contact (is not used),
- Power not less than 1,5kVA/1,2kW,
- Working on battery: not shorter than 5min at 100% load,
- Technology: Line interactive or Online,
- No expansion cards.

It should be remembered that in the case of large roller shutters (wider than 7,5 m), 1-phase power supply must be replaced with a 3-phase power supply. In this case, the UPS for roller shutter should be done as 3/3 placed at the store's switchboard, next to the main UPS or in a separate room near the store window (in agreement with the architect).

The main UPS should be used to power coded (red) sockets at the cash desk, the store manager's desk and the "defrost" position, as well as the telemetry system and the IT Rack cabinet above the manager's desk in the back office. It should not be used to power the alarm system, access control or music system.

3.4 Lighting

The lighting luminaires are designed by the architectural designer. They should be copied to the electrical design, divided into circuits and add lighting control. Lighting luminaires should be mounted at a height of 3 to 3,5 m from the floor, depending on the standard of a given brand.

3.4.1 All luminaires must be equipped with reactive power compensation,

3.4.2 Emergency lighting should be done with LED luminaires (separate from the basic lighting) with built-in batteries, auto-test and 1h runtime, as well as appropriate certificates. The required backup time may be bigger in some shopping centres depending on the fire operation, in which case it is necessary to comply this requirement. Emergency luminaires in warehouses should be powered from the main lighting circuit (before switch) – install, in the switchboard, switch-disconnectors and lay a new wire. Emergency luminaires cannot be covered by other elements and devices,

3.4.3 Lighting in toilets control by motion sensors. Set the motion sensor for 5 minutes of operation time from the moment of motion detection,

3.4.4 Lighting in storehouses and back office control by lighting switches, in the case of more entrances use stair switches (two way switches) or bistable buttons/switches,

3.4.5 The main lighting in the sales room and fitting rooms must be managed by a control system. This system should be divided into the following parts:

- Lighting of the "entry route": Lighting should be separated from the main lighting to illuminate the road from the entrance to the store (roller shutter) to the back office - a minimum of luminaires allowing employees to pass safely. At the entrance (roller shutter) a lighting switch should be placed to turn on this lighting (without a timer) and duplicate it in the back office next to the lighting switch board TW (control this lighting from two places);
- 30% lighting: From the main lighting of sales room should be taken approximately 30% of luminaires (including spotlights in the corridor of the fitting room) evenly distributed. This lighting is for cleaning work in the store after opening hours of the store for customers. This lighting should be controlled from the lighting switch board (TW) located at the entrance to the back office (no timer - only manually);
- 70% lighting: Other lighting (including luminaires above fitting rooms, lighting for signboards, decorative lighting) should be controlled by an annual timer set for 15 minutes before the opening of the store for customers (on) and 15 minutes after the closing time of the salon (off). Additionally, in the case of night work, it should be possible to manually control this lighting from the lighting switch board (TW);

- Logo lighting above the entrance to the store (including semaphores): In the place of the external logos of the store, there should be cable outlets powering the logo. These circuits should be controlled by an annual, astronomical timer. In Retail Parks, the activation of external logotypes should be set to the point of sunset of the store's operation, and switching off 15 minutes after the store closes for customers. In stores located in shopping centers, switching on 15 minutes before the opening of the store and switching off 15 minutes after closing for customers. No manual control;
- Illumination of the showcase and the entrance zone: The busbars illuminating the showcase and the luminaires of the entrance area should be controlled by another annual, astronomical timer. In Retail Parks, switching on should be set to the sunset point of the store's operation, and switching off 15 minutes after closing the store for customers. In stores located in shopping centers, switching on 15 minutes before the opening of the store and switching off 15 minutes after closing for customers. Control of possible circuits of the floor-boxes should be also connected to the same time switch. No manual control.

3.4.6 Annual clocks should be used, with the possibility of setting each day separately (preferred model F&F PCZ-528.3). All control timers should be programmed taking into account not only the store's working hours, but also non-working days, holidays and non-business days. The lighting cannot turn on automatically on days when the store is closed.

3.5 Sockets

Locations of socket are indicated by the architect. They should be copied to the electrical design and divided into circuits.

3.5.1 Sockets in social zone and toilets should be in IP44 standard, and outside IP65,

3.5.2 In the sales room, do not supply one circuit to more than 3 sockets. In addition, due to the possible simultaneous energy consumption, the sockets in the sales room should be divided into alternating circuits, so successive sockets in the sales room are powered alternately from another circuit,

3.5.3 Cables for floor-boxes, for a cash desk and all vertically cables after leaving from the cable trays, should be laid in protective pipes,

3.5.4 Each cash desk is equipped with 4 white electric sockets, 4 red, coded, electric sockets (powered from the main UPS) and 6 RJ45 sockets. In SINSAY stores, put a set of cables for 2 reserve positions to the cash desk furniture (connected to the two extreme sides of the cash desk). Each cash desk must be powered from separate circuits. Install sockets in installation trunking (separate for electrical sockets and separate for RJ45 sockets) mounted in the front of the cash furniture,

3.5.5 Sockets in the back office at the manager's desk and at the social part locate in accordance with the details of the furniture in the architectural drawings,

3.5.6 For a wall revision of anti-theft gates at the entrance, two circuits should be laid and terminated with surface sockets. In case of more than 1 revision, lay to each of them separate sets of circuits,

3.5.7 Lay 2 electrical circuits for each LED display,

3.5.8 Lay out 1 electric circuit for each LED monitor,

3.5.9 All sockets must be clearly marked with the circuit number in accordance with the scheme and labelled on the switchboard cover,

3.5.10 All double USB sockets at the manager's desk should be done as 1x USB-C + 1x USB-A.

3.6 Cable routes

All cables should be laid in dedicated cable trays, protective tubes or installation trunking. Separate electric wires from low-current wires. From switchboard and Rack cabinet into cash desk use separate electric trays and low-current cable trays.

3.6.1 Before execute of cable routes, verify their height and route in relation to other installations (sanitary, ventilation, electrical, etc.) and check their compliance with the architectural design (no conflict with architectural details),

3.6.2 Use hot-dip galvanized cable trays with a metal sheet thickness of min. 0,5mm,

3.6.3 Select cable trays with min. 20% of the space reserve,

3.6.4 In the floor, in plasterboard walls and on surface of walls, all cables should be laid in protective pipes,

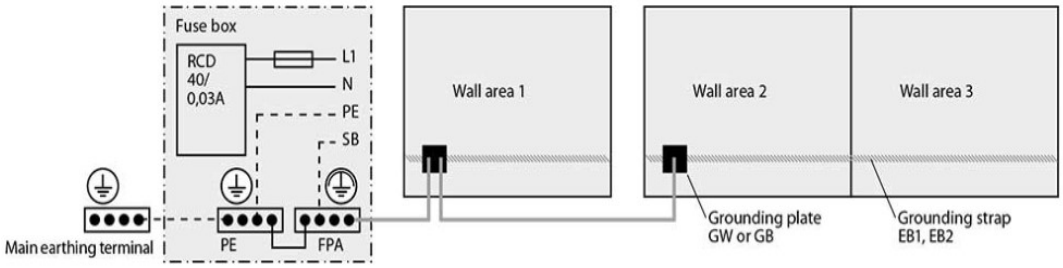
3.6.5 On the roof, laid full cable trays with covers on the supports.

3.7 Lightning installation and equipotential bonding

3.7.1 Devices on the roof (air conditioners, fans, etc.) should be protected with lightning masts connected to the existing lightning protection system of the whole building, applying the principle of the protective angle of 45 ° (IEC 62305 or equivalent),

3.7.2 Install the main equipotential busbar above the store's switchboard and connect to it all metal masses that may be under voltage, e.g. switchboards, cable trays, IT cabinets, roller shutter supports, external devices cabinets. Connect the bar with the equipotential system of the shopping centre,

3.7.3 The walls of back office and storage rooms, in order to reduce the emission of low-frequency electric fields, should be shielded for the purposes of RFID (a double layer of conductive paint, together with a conductive tape and earthing plates). Connect the paint, storage racks and metal doors to the equipotential bonding system with a cable with a cross-section of 4mm^2 connected to equipotential bar in accordance with the following recommendations of the paint manufacturer:



3.8 Low-current installation

The following low-current installations should be done in the store: IT, CCTV, AC, I&HAS, AV. CCTV, I&HAS and AV installations are topic of separate guidelines. All IT cables must be Category 5e or higher unless the instruction are different. Lay all cables with a 5-meter reserve to telecommunication cabinets above the manager's desk.

3.8.1 Wall revision of anti-theft gates at the entrance - for each revision lay two U/UTP cat.5e cables terminated with surface sockets,

3.8.2 LED displays – to every LED display lay two F/UTP cat.6a cables,

3.8.3 LED monitors – to every LED monitor lay one F/UTP cat.6a cable,

3.8.4 An internal WiFi wireless network should be done, consist of UniFi access points and a PoE switch in the Rack cabinet. To each access point should be laid a U/UTP cat.5e cable (up to 100m distance there is no need to use an additional power source, above use repeaters with additional power supply). Place one UniFi antenna in each warehouse, in the social area and one for every 500m^2 of the sales room. In addition, another antenna should be provided on the ceiling within a radius of 3 m. above the manager's desk (even if there is already another antenna nearby) for a dedicated WiFi network for the store manager. Lead the U/UTP cat. 5e cable to the Rack IT cabinet.

3.8.5 Above the manager's desk in the back office, place the IT Rack 19" 15U cabinet with transparent door and a lock equipped with a power terminal and the appropriate number of 1U Cat.6 patch panels,

3.8.6 Cable from IT main supply connect to patch panel in Rack cabinet,

3.8.7 Next to Rack cabinet locate separate cabinets music system and CCTV,

3.8.8 Between CCTV cabinet monitor at the desk lay HDMI wire,

3.8.9 The anti-burglary system control panel and access control power units should be installed above the entrance door in the back office. The alarm installation (like CCTV and AV) should be executed based on separate LPP standards regarding the type of devices and their arrangement,

3.8.10 The intercom power supply should be located in the main switchboard of the store. Install the uniphones at the cash desk and the second one in the back office at the manager's desk. Perform the installation with the YTKSY 3x2x0,5 cable (or equivalent),

3.8.11 At the cash desk, mount a condenser desktop microphone (type: Monacor EMG-500P), table microphone with battery power, with a switch, with a 40 cm long gooseneck and with a 13x13 cm cast iron base (type: Monacor DMS-1). From the cash desk to the sound system cabinet in the back office, lay a shielded F/UTP cat. 5e cable.

3.8.12 In HO, CT and SI stores, additionally, in the music cabinet, install a microphone preamplifier module with volume control and music mute function for the duration of the voice message,

3.8.13 All RJ45 sockets should be clearly marked by a description with ports numbers in patch panel. Additionally, describe the location of the socket on the patch panel (K-cash register, D-defrost, Z-back office / manager, A-anti-theft gate, M-Monitor/LED screen).

3.9 Other devices and guidelines

3.9.1 At the main entrance to the store, place the main power switch button (GWP) that cuts off the power supply to the store's switchboard and the main UPS (the second UPS-roller shutter cannot be turned off due to the safety of the escape route). To the button, lead a cable of E90 fire class from the switchboard. Do not use mushroom head pushbuttons. If the premises are equipped with a fire protection switch made by the Lessor, add a description to the GWP plate that this button is used to turn off the UPS device,

3.9.2 For service purposes, for each device located outside the building (air conditioners, fans), place the maintenance (service) switch in an insulating casing (IP65),

3.9.3 Fans in toilets should be powered from the lighting circuit,

3.9.4 Design the electrical installation in the TN-S network system,

3.9.5 Standard mounting heights of electrical equipment and wires (counted from the finished floor to the symmetry axis of the equipment):

- sockets in the sales room and in the shopwindow - 30cm,
- sockets in wet rooms and near the sink - 120cm,
- power cable for anti-theft mate (verifier) in the fitting room - 110cm,
- LED displays or monitors - height according to the architecture design,
- access control keypad - 120cm (in MOHITO – 110cm),
- main power switch button - 140cm. If there is a need to install two switches - the lower one at a height of 140cm, the upper one directly above it or flush aligned,
- emergency exit button - height 140cm,
- the lighting switches should be installed at a height of 120cm calculated from the axis of the upper switch (additional switches below or flush aligned),
- roller shutter controller (inside) - 120cm,
- roller shutter key controller (outside) - 30cm (in HOUSE – 10cm),
- lighting switch board (TW) – bottom in height 160cm,
- air-conditioning controller – in the back office, height 140cm,
- sockets 220V-230V, IT sockets, wires for powering devices and technical cabinets in the back room at the manager's desk - according to the details in the architecture design,

Location and height of the equipment should always be compared with the architectural arrangement and drawing details witch are more important.

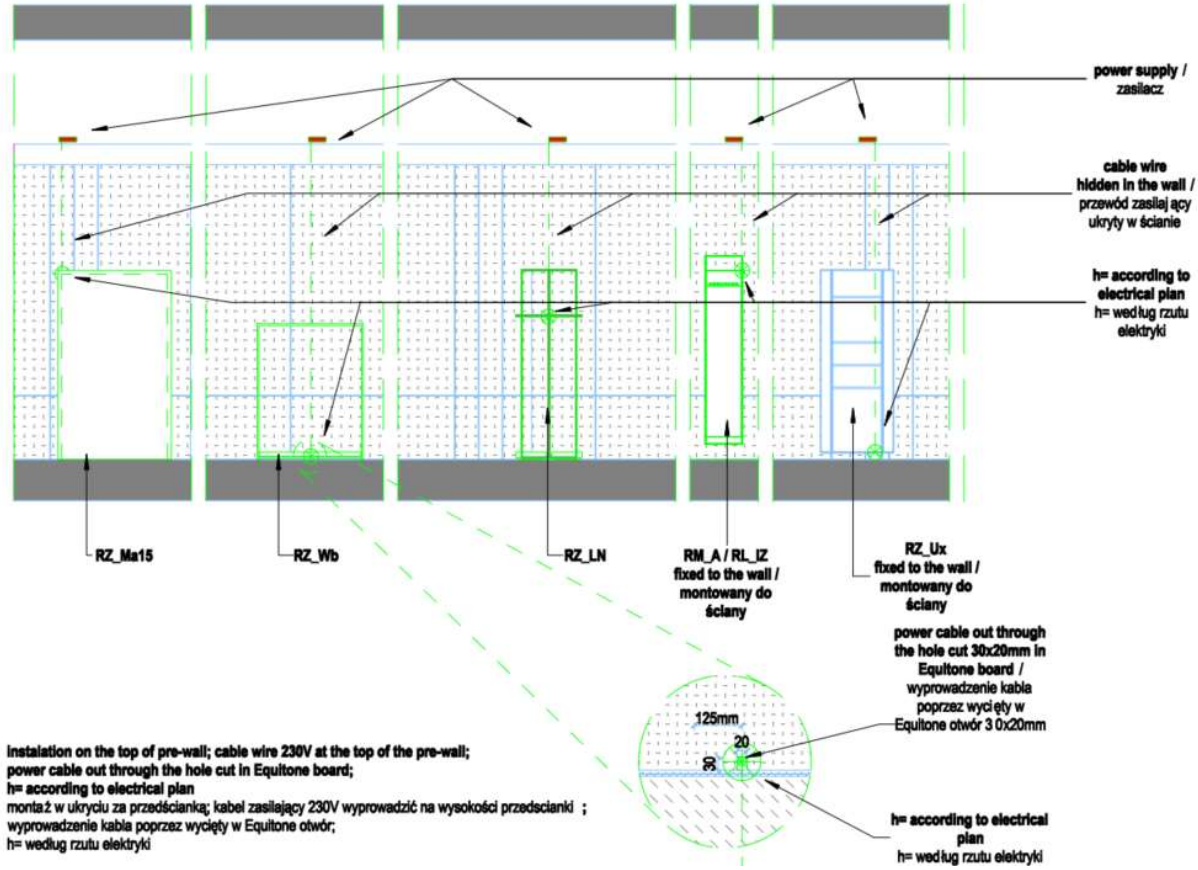
3.9.6 LED power units should be selected with the reserve of power, the power supplies should be hermetic, hidden in the ceiling space. Long LED strips on ceilings should be powered mid-length to reduce voltage drops,

3.9.7 In the sales room and next to the manager desk, a temperature sensors should be located at a height of 1,8m, mounted on a pole or wall, if possible in the central part of the sales room, away from sources of cold and heat. In large stores with 2 or more levels, place additional temperature sensors on every level,

3.9.8 In the case of designing dampers for comfort ventilation, while passing through the fire walls, they should be supplied from the store's switchboard with an ordinary cable ensuring disconnection from the FAS system,

3.9.9 All single-phase loads (including lighting luminaires on busbars) should be evenly distributed over the phases. During the tests, check the uniformity of the load on the phases in the switchgear, switching the loads if necessary,

3.9.10 Power supply units of wall or furniture LED strips should be mounted above wall structures, according to example below.



4 As-built documentation

General Contractor, after completing the installation, need to prepare as-built documentation with all changes (marked in red colour), print it in accordance with the quantity given by the project manager, and copy all documents to the LPP server.

Attach to as-built documentation:

a) copies of the construction site manager's authorizations,
b) copies of the qualifications of the persons performing the measurements,
c) all certificates, attestations, declarations, material cards, operating manuals, calibration certificates, guarantees, etc.,
d) statements:
   - construction site managers about the completion and execution of works in accordance with the current design, technical knowledge and applicable regulations,
   - checking the operation of the main power switch (GWP),
   - checking the operation of emergency lighting, including the required operating time during a mains voltage failure,
   - testing the operation of residual current circuit breakers,
   - testing the correct phase sequence of all three-phase circuits,
   - checking the uniformity of load on the phases of three-phase lighting circuits,
   - programming control clocks taking into account non-business days in a given country and checking basic lighting control in accordance with LPP standards,
   - checking the disconnection of the power supply to the HVAC loads and the sound system in the switchboard and the unlocking of the doors under access control during an alarm from the FAS system,
   - checking the heating of devices and their connections in the switchgear with a thermal imaging camera and presenting the printout from the camera,
   - checking the correct operation of the telemetry installation in accordance with a separate manual,
e) measurement protocols from tests:
   - insulation resistance of wires and cables,
   - short-circuit loop impedance and checking the effectiveness of protection against electric shock,
   - primary and emergency lighting intensity in accordance with the grid according to the standards (norms),
   - tripping times of residual current circuit breakers,
   - continuity of protective wires, equipotential and lightning conductors,
   - electrical and propagation parameters of structural network cables.
f) confirmation of training of the salon staff in the scope of operation and use of devices, confirmed by a protocol signed by the store employees.