Universe Scientific Publishing

REVIEW ARTICLE

Common Fault Analysis and Prevention Measures in Building Electrical Installation

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ABSTRACT Since the building of electrical facilities became more common, people paid more attention to the quality and safety of electric equipment, which led to a stricter requirement for building electrical installation. The installation of electrical engineering is closely related to the quality of the building itself, if too much carelessness is seen during the process of building the electrical facility, it would be prone to some quality problems and hence cannot ensure the safety of the user's life. This study will expound the cause and prevention measures of common faults in building electric installation engineering through common fault analysis of building electrical installation. Therefore, it is of great significance to pay special attention to the quality management of electrical installation engineering and develop electrical installation engineering by applicability, reliability, economy, beautiful appearance and convenience.

KEYWORDS
Building electricals
Electrical installation
Prevention measures

1. Introduction

Quality of building electrical installation engineering directly affects the safety and comfort of the building. Therefore, the common quality faults of engineering should be given sufficient attention, in order to achieve effective control and to ensure engineering quality. I have encountered a lot of problems in building electrical design and installation. Based on my working practice of many years, I will introduce some common problems in the process of building electrical installation engineering and their prevention measures briefly, with the hope of giving directions to the person conducting the study hope the personage inside course of study to give directions.

2. Overview on building electricals

Building electricals include heavy current and weak current. The design content of heavy current mainly includes: power transforming and distributing system, power and lighting system and lightning proof grounding system, etc. Generally speaking, the power transforming and distributing system of building mainly includes: high and low voltage system, transformer, standby power supply system, etc.; power system mainly includes power distribution and control of power system; lighting system includes indoor and outdoor various types of lighting; lightning proof grounding system includes prevention of thunder electric wave invasion, protection of lightning induction, grounding, equipotential connection and local equipotential connection, auxiliary equipotential connection, etc. Within a short span of twenty years, the technology and products of these systems have changed greatly, hence significant changes have taken place in many design concepts. For example, in high voltage switch cabinet in high pressure systems, the earliest circuit breaker was oil circuit breaker, which then gradually developed to minimum oil circuit breaker with large size and no fire retardancy. The high voltage switch cabinet volume is large, hence it must be independently set in a cubicle and it also occupies a lot of construction area. The vacuum circuit breaker and sf6 circuit breaker adopted at present do not only have small volume, but also have a high short circuit capacity. The size of the cabinet is much smaller than the original one, and since there is no oil in the circuit breaker, fire prevention performance is greatly improved. In addition, it can share a room with other low-pressure equipment, thus saving space and more convenient management [1].

3. Common faults in building electrical installation

3.1. Lack of professional and technical personnel

The issue of lack of professional and technical personnel is

doi: 10.18686/wcj.v4i3.2
Received: August 2, 2015; Accepted: September 4, 2015; Published online: September 17, 2015

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particularly prominent in the current civil building electrical installation engineering. Now, the requirements of electrical installation project have a certain gap with the overall level of technical strength. Although some electrical installation personnel have rich experience, they lack professional theoretical knowledge. Their specialty is only in the operation process,, and they have insufficient understanding of construction drawings and professional technical content.

3.2. Problems of equipment and materials

In building electric installation engineering, equipment and materials, the following problems are commonly encountered: firstly, there is no production license, product certificate, test report and technical specification and other documents; second problem is poor mechanical properties, high conductor resistance rate, cross section which is less than nominal value, low melting point, large temperature coefficient, poor insulation; thirdly is the small cable insulation resistance, low resistance to pressure, low temperature resistance, poor corrosion resistance, poor rigor between insulation and wire core, lots of internal joint; the fourth problem is poor appearance of power, socket box and lighting, insufficient steel plate thickness, unqualified strength and corrosion resistance of box, unqualified geometry size; fifth, all kinds of wire and tube have poor folding resistance, thin wall and poor strength, the quality of galvanized layer does not meet the requirements, etc.

3.3. Problems in indoor wiring installation

(1) Unqualified raw materials. For example, there are too many burr on the internal surface of steel tube, the pipe diameter does not conform to the requirements of the design, the thickness of steel tube wall is insufficient, etc.

(2) Since the trough or wires through the floor, there are gaps between upper and lower fire zone.

(3) Wire pipe installed in the concrete will be exposed to the outside when the mould is removed. The pipe is not smooth and there is insufficient protective layer, as two or more catheters cross at the same place.

(4) Use black iron pipe instead of galvanized pipe, thin-walled tube instead of thick-walled tubes, PVC pipes instead of metal pipes. However, PVC pipe has low oxygen index and the diameter does not meet the design requirements.

(5) Extremely small conduit bending radius will result in crimping, dents, etc., In serious cases, it may even cause "dead pipe" phenomenon. There is no translation box set up for the turning of tube.

(6) Directly welding the metal nozzle without removal of burr. When passing the middle junction box and joint, there is no bridging welded for metal pipe threaded connections. The length of reinforcement is insufficient or without welding. Welding through the pipe and "spot weld" phenomenon is more serious. Thin-walled steel pipe and galvanized pipe which needs threaded connection does not use threaded connection but uses welding [2].

(7) There is unstable or no grounding for steel pipe. When passing settlement joint and expansion joints, no crossing box is provided for the pipe.

(8) Shading tubes into the cartridge or box is not straight. They extrude into a bundle or pipe outcrop length is inappropriate.

3.4. Problems of lightning protection and grounding in electrical installation

Using non-galvanized steel bar as lightning conductor, the positioning is unreasonable and the perception of quality is poor. The cross-sectional diameter of leading down conductor is smaller than that of the lightning conductor, the weld quality is poor, lightning protection device is not reliably connected to metal body or the structure is above the roof. Grounding interval or depth is insufficient, the preventive treatment is poor, grounding terminals expose spring pads, welding surface is insufficient, the grounding line flat steel is not straight, the stud used by disconnect card is less than m8 and there is no compensation devices in deformation joints.

4. Cause analysis and prevention measures of common faults in building electric installation engineering

4.1. Indoor line laying

4.1.1. Problems

Substandard materials widespreadly exist in piping engineering, such as insufficient pipe wall thickness, low oxygen index of PVC pipe and unqualified pipe diameter. When adhering hard plastic pipe, adhesive was uneven, there was even no adhesive; when bending big pipe, there are recessed fan, cracks bake injury, rusted color and so on. Metal conduit and metal box does not form a reliable electrical path. Metal bridge and bracket is ungrounded or there is unreliable ground.

4.1.2. Preventive measures

During piping construction, we should strengthen the sampling and test of pipe and fittings. For example, we should examine the certificate, warranty and chemical properties of the pipe, bending performance; diameter, wall thickness exceeds the size of allowed tolerance. As for adhering hard plastic pipe, apply a small brush to evenly paint the matching adhesive, force it to rotate into place; when simmer bending, adopt an electric furnace used for pouring sand to bake indirectly or roast by fire. The area should be large, heat should be uniform and complete it in one time. The protective layer of wiring pipe in the concrete is generally not less than 15 mm. The protective layer of fire pipeline is not less than 30 mm; we should ensure all the tubes are smooth in construction. The upward nozzle should be plugged temporarily by plug; it is forbidden that three or more tubes cross at the same place. If necessary,

strengthening measures such as increasing steel mesh in the conduit, metal tubes should be adopted when conduit diameter is greater than 20 mm. Metal tube and metal box must have reliable electrical connections with the protection line (PE line), making it become a reliable electrical pathway. The whole length of metal bridge and its metal stents should have no less than two points connected to the grounding or null line [3].

4.2. Distribution box installation

4.2.1. Problems

Coordinates and elevation of distribution box is not accurate or recessed into metope, has displacement and deformation. There are debris inside the box cover and anti-corrosion is not conducted in a timely manner. Box panel is not clingy with metope, loop dose does not have a number and the wiring is not neat. The wire is not bonded, multi-strand cable is not tinning or crimping, and some are even cut, the tube into the box by knockouts and inside the null line, ground wire splice, box has no dedicated ground bolts. After the distribution box is installed, it will transmit power with no check of line and no examination; the insulation resistance between wires or between wires and ground in distribution box is not measured.

4.2.2. Preventive measures

Before construction, technical management personnel should introduce the boxes coordinates and elevation in detail. After positioning the box, it is welded and fixed with steel rings to prevent displacement. A rigid cross support was made inside the box to prevent deformation. After form removal, debris should be promptly removed. We should perfect the box and complete anti-corrosion work. Distribution box should have a nameplate, complete, clear and correct loop number, the installation location should meet the design requirements, the inside and outside of the housing should be clean and not damaged. Cover plate is close to the wall and the opening and closing is flexible. Openings of box is suitable, with one hole for one tube, and we should use knockouts or mechanical openings. Do not use electric welding or gas cutting openings. During construction, if the wire is cut, it should be pulled off and re- threaded. There should be a dedicated grounding bolt of no less than m8 in the box. After the distribution box is installed, we must carefully check all lines, tighten all bolts, screws, to prevent poor contact between the wires. Ensure that there are no joints between wires, measure and record the insulation resistance between wires and between wire and ground in a timely manner.

4.3. Substandard wiring, connectors, insulated treatment quality of wire

Wiring, connection, insulation treatment process of conductors does not meet the requirements and have incorrect operation, leading to break off or leakage, thus affecting its function.

4.3.1. Causes

(1) Wire operating process does not meet the requirements, the operations are not familiar and are unskilled.

(2) When conducting soldering process, the power and temperature of the electric iron is not properly controlled, thus resulting in unsatisfactory quality.

(3) Crimp cap does not match the crimping tool, thus resulting in weak wiring.

(4) There is no required null line and PE protection wire bus in the distribution box.

(5) Failure to tightly wrap the joint of wires according to standard requirements causes drainage.

(6) Galvanized copper fittings are not used for the lap joint of copper and steel and humid places.

4.3.2. Pre-control means

(1) The operator should enhance learning norms and standards, familiar with the process standard, master the tin lining methods and crimp technology.

(2) According to specifications, wire connection on the terminal screw or terminal should be one wire and a maximum of two. When connecting two wires on the bolt, the intermediate flat gaskets and fasteners (spring washer or double nuts) should be added.

(3) Multi-strand wire connection should be crimped by galvanized copper connection. When processing molding (sheep eye socket), the lining of tin should match with the diameter of the bolt connection. Lining of tin parts should be uniform, plump, smooth and damage to wire insulation is strictly prohibited.

(4) As for the connection joint between wires after the application of the lining of tin, the lining of tin of wire should be wrapped uniformly and tightly using yellow wax ribbon or plastic (PVC). The outside should be closely wrapped with black insulating tape.

(5) Bus is set for PE protection wire and null wire in civil lighting distribution boards. PE protection wire and null wire should be connected on the bus and we must not conduct lining of tin on a plurality of hinge or connect a plurality of wires together by copper fittings. An additional copper fitting or galvanized steel fitting may be used as the bus terminal [4].

(6) When connecting wire by safe crimp cap, the crimping pliers must be matching products. The voltage resistance, flame resistance, tension and other technical data of crimp cap must be consistent with current national technical standards.

(7) When connecting wires by copper joints, we should use galvanized copper fittings and crimp and not use opening door copper fittings or pouring tin type copper fittings. It is forbidden to use a hammer to knock flat copper fittings for use.

4.4. Lightning protection, grounding

4.4.1. Problems

Non-galvanized steel bar is used as lightning conductor, the positioning is unreasonable and the perception of quality is poor. The cross-sectional diameter of leading down is smaller than that of lightning conductor, the welding quality is poor, lightning protection device is not reliably connected to metal body or the structure is above the roof. Grounding interval or depth is insufficient, the preventive treatment is poor, grounding terminals expose spring pads, welding surface is not enough, the grounding line flat steel is not straight, the stud used by disconnect card is less than m8 and there is no compensation devices in deformation joints.

4.4.2. Preventive measures

Lightning conductor should adopt galvanized steel bar according to the design requirements, which should be straight. If adopting ordinary steel bar, the cross section should increase a level by design consent. Lightning protection conductor should be reasonably positioned, it is symmetrically arranged in the corner, the straight line segment is treated according to 1 m equipartition principle. When embedding row of foot head stand, elastic line should be made to ensure its straightness, and all the foot head ends are flush. The cross - section of leading down should be not less than that of the lightning deflectors, lap welds should be smooth and full. It must not have gas holes, biting, slag and other defects, and multiple of overlap should be not less than 6d (d = steel bar diameter). Secondary corrosion prevention should be made for the destruction of the zinc coating. Supporting card should be fixed firmly and spaced evenly. When lightning belt across the building expansion joints, settlement, we shall set compensator. Compensation is available through bending grounding wire into an arc. Chimney, ventilation pipes and iron ladders, metal water tanks and other metal objects above the roof should be connected to lightning protection device. According to the provisions, grounding depth should not be less than 0.6 m and spacing should not be less than 5 m. Welding surface is not less than 2 times of the width of the flat steel. After welding, knock off the welding slag and secondary corrosion prevention should be made for damaged zinc coating. Flat steel is re-straightened and ground terminal and spring pad should be padded. Disconnection card connector application is not less than m8 galvanized bolts and material itself is simmer bended for compensation in deformation crack. Method for reducing grounding resistance: increasing the number of grounding; the use of chemicals, such as, salt and changing soil [5].

5. Conclusion

With the improvement of people's living standard, the requirements of electrical installation engineering are becoming stricter. It is not only to satisfy the needs of lighting, household appliances, security and others, but more attention is also paid to the use effect of aesthetic, applicability and convenience. Therefore, it is of great significance to pay special attention to the electrical installation engineering quality management and make electrical installation engineering develop toward the direction with applicability, reliability, economy, beautiful appearance and convenience.

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