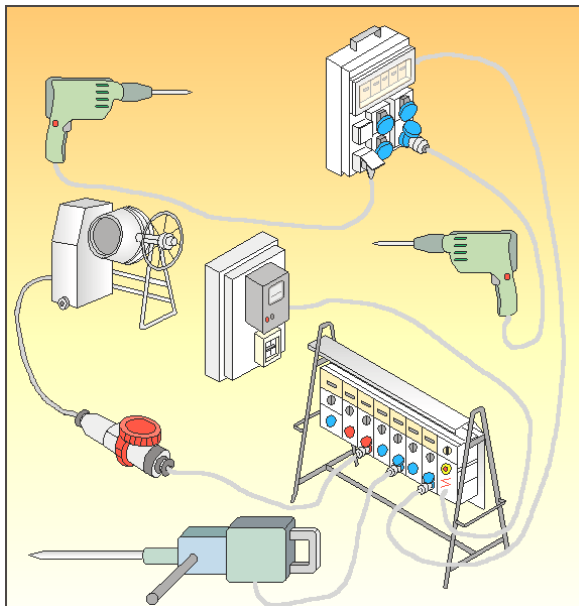


ANNEX A- MINIMUM REQUIREMENTS FOR TEMPORARY ELECTRICAL INSTALLATIONS OF WORKSITE



1. GENERAL INFORMATION

1.1 Premise

The worksite is considered one of the most dangerous place for electrical hazards because it is under continuous changes, but also for the presence of different employees which are often not trained from the electrical risk point of view.

For the realization of an electric plant it is fundamental to take in account the presence of employees and work vehicles with a risk of a collision or contact with live parts, variable weather conditions (in particular rain, but also strong wind and high / low temperature) presence of dust and water, areas with potential risk of fire or explosion increase by presence of electrical installations.

A site electrical installation, even if considered as provisional since it is designed to be removed in short time, can have a duration of months or years depending on the characteristics of the project. Therefore, it is fundamental that it is planned and made in a proper manner using materials and industrial electrical components and it is maintained efficiently over the time duration by trained personnel in order to ensure the proper functioning of the equipment and employees integrity.

The laying of the main cables, panel and junction boxes, electrical panels, jacks and plugs, the lighting system, the grounding connections and all maintenance activity must be performed by qualified personnel.

1.2 Scope of document

Define the minimum requirements for the electrical elements of the electrical system at worksite in order to ensure the safety standard for the personnel which operate or is located on site.

1.3 Responsibilities and obligations

The responsibility for correct implementation and efficient system operating status of electric plant on the site, shall be assigned to the Engineering, procurement, and construction manager (CONTRACTOR).

2. PLANT INSTALLATIONS

2.1 Electrical panels

- The electrical panel have to be waterproof for preventing raining water infiltration. The electrical panel have to be made with insulated material. If structure made in metallic material, that have to be properly grounded.
- Input and output wires have to be installed from the bottom side in order to prevent the entry of rain water into the electrical panel.
- Main and secondary electrical panels have to be equipped with magneto thermic switch. The set point has to be defined in advance and based on the electrical load.
- At least the main electrical panel has to be equipped with differential relay set at 30 mA. If the main electrical panel has lower sensitivity protection (not more than 300 mA) it is necessary to arrange the secondary electrical panel with the differential relay aet at 30 mA for all utilities or plugs till 32 A;
- In order to allow the maintenance activities, the electrical system has to equipped with a disconnection point before the main feeder
- The electrical panel has to be properly secured in order to avoid not authorized access. It has to be equipped with external emergency bottom (red colour) to use in case of emergency disconnection.
- On the electrical panel a dedicate safety sign has to be showed indicating the electrical risk and live part presence a number or letter for its identification.
- Inside the electrical panel a list (numbers or letters) of sub-panel connected has to be reported. The list must be in line with the electrical scheme and should be updated in case of modification in order to have proper and dedicated disconnection point.

Good examples: Fig: 1-2



Bad example: Fig: 3-4-5**2.2 Plugs – Socket – Adapters (converter)**

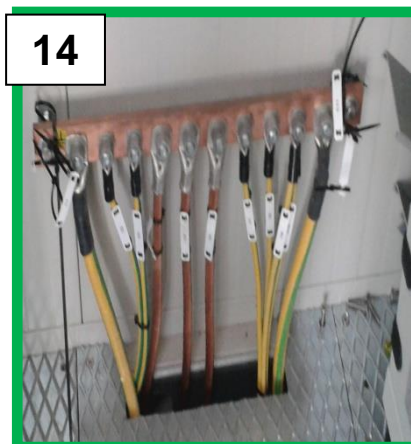
- The Insulation has to be damages free
- Clean and free of visible damage on the external casing
- Grounded
- The cable has to fully enter in the casing and it has to be blocked with the cable press that should be part of the plug / socket;
- Each plug has to be connected to one socket. Avoid improper connections with multiple plugs as derivation from the main cable;
- Derivations are allowed only with suitable adapters, with casing free of damage including that one due to overload, electric arc or short-circuit;
- The number of plugs suitable for the adapter must take in account the load electricity. it is forbidden connect plugs that can create overload due to adapter limit
- If used in outdoor environment the plugs have to be watertight and protect from the rain water or dust. Avoid to place the plugs directly on the ground.

Good examples: Fig: 6-7-8

Bad example Fig: 9-10-11-12

2.3 Grounding system for metallic casing

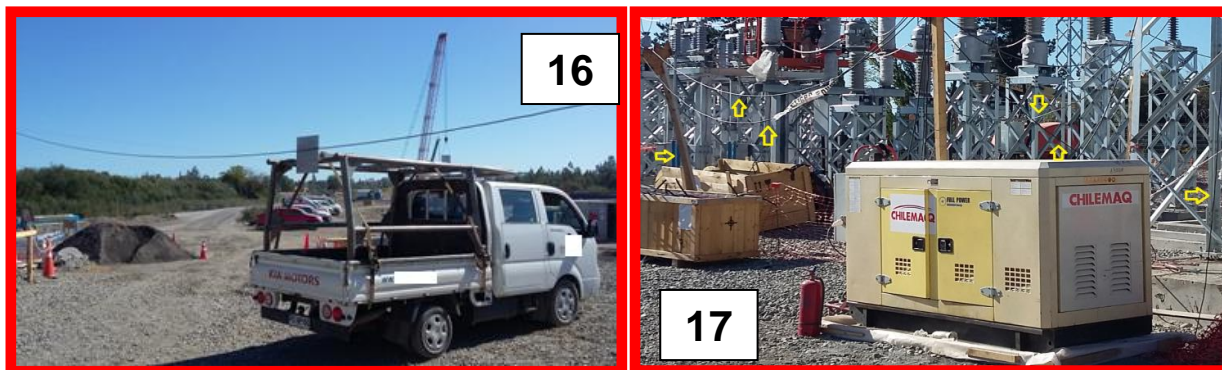
- The metallic casing of the electrical panel or junction box have to be properly grounded (section of the grounding cable should as follow: 16 mm² for cable till 25 mm², 25 mm² for cable till 50 mm² or 50 mm² for cable with more than 50 mm²)
- Cable terminals and lugs have to be properly tightened and grounded in order to avoid increasing of earth resistance. Ground connections with cables wound on the contact point are forbidden.
- The contact surfaces must be clean and free of paint or rust that increases the value of ground earth resistance;
- If in place use the pre-installed earth point located on the casing by using a ground cable with headed lugs
- If the earthing system is in place utilize as ground rod. If not possible the ground rod has to located at least 50 cm deep.
- For construction containers positioned closer, ensure the grounding connection and in equipotential condition.

Good examples: Fig: 13-14**Bad example: Fig: 15**

2.4 Cables for electric lines at worksite

- Double insulation and proper cable section
- For trunk lines, where is possible, identify paths around the construction area in order to minimize the interferences and crossings line;
- Underground and located in protected tunnels by using tubes or corrugated which allow their potential recovery without reopen the excavation;
- Overhead cables located to the correct height in order to minimize interference with the work activities and work vehicles
- In proximity of crossing aerial line, the cables have to be marked with signs or colored tape;
- The cable support of aerial line have to be realized for failure preventing considering the total load (weight, throw, wind shear, etc.);
- Avoid to submit the cable to excessive mechanical stress. Contain as far as possible the distance between the supporting points and adopt fastening systems which do not damage the cable;
- Case and Junction box should be waterproof in order to prevent raining water infiltration. The panel has to be made with insulated material. Metallic panel has to be properly grounded.

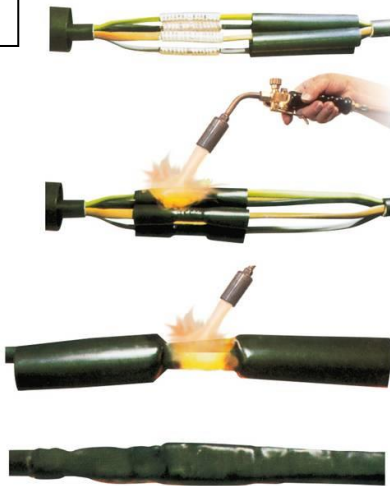
- In case of junction box or iron frame, input / output cables must be protected with corrugated or PVC tube. The same principle is valid also for the contact points of the cable with the metallic frame;

Bad example: Fig:16-17-18-19-20**2.5****Extension cables**

- Double insulation, free from damage and deterioration point due to friction, accidental contact or crushing;
- Adequate cable section in relation to the applied electrical load
- The junction point if any, should be clearly visible. Therefore, at the junction point should be adopted a different colour tape
- Usually joints should be avoided. In case a junction is needed, the same must be done with self-amalgamating tape or heat shrink kit. Homemade junctions arranged with materials that do not guarantee the water resistant of the cable are forbidden;

Good examples: Fig: 20-21-22

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Bad example: Fig: 23-24

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2.6 Fixed mobile and portable lighting system

- Fixed mobile and portable lighting system, especially if placed outdoors, should be suitable to external conditions (rain, humidity). They have to be positioned in order to avoid interfere with the normal site activities and protected against accidental bump. They have to be arranged in an appropriate way in order to ensure a good level of illumination of the perimeter areas, access routes and transit;
- For transportable equipment, before each use, and in particular as a result of each movements, check the light and cable integrity;
- Portable devices must have the handle made by insulating material, the electrical parts fully protected and mechanical protection for the light bulb. Before each use, perform a visually inspection of device and wires for verify the integrity
- Portable equipment must be made with sturdy material considering that are exposed to continuous movements
- Lamp holder made of porcelain or insulating material: unprotected metal parts are prohibited
- As a general rule the number of lighting system and their placement must consider the environmental conditions (working during night shift or indoor) and they have to ensure adequate lighting of transit and work places, avoiding the glare effects (especially if you use headlights) or shading area because represent a possible causes of accident.

Good examples: Fig: 25-26-27-28

