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İşin Adı : Mersin-Adana-Osmaniye-Gaziantep Yüksek Standartlı Demiryolu Hattı
The Name of the Job : İnşaatı ile Elektromekanik Sistemlerinin Temini
Construction of Mersin-Adana-Osmaniye-Gaziantep Hight Standard Railway Line With Supply Of Electromechanical Systems

Rapor Adı : ELECTRICAL SAFETY PROCEDURE
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1. PURPOSE

is to determine the minimum requirements for the control of electrical hazards and risks and the basic control requirements for the control during the execution of the activities carried out in the Mersin-Adana-Osmaniye-Gaziantep High Standard Railway Project.

2. SCOPE

It includes people (employees, interns, etc.) involved in the Mersin-Adana-Osmaniye-Gaziantep High Standard Railway Project, all operating consultants, consultants, intermediary persons and companies, and subcontractor employees.

The content of this document has been developed to determine the minimum requirements for the Mersin-Adana-Osmaniye-Gaziantep High Standard Railway Project; It can be developed according to the legal regulations of the working area, employer expectations and international standards.

3. IMPROVEMENT

Persons who detect ambiguity and inconsistency in this document can report their requests and suggestions by using the "ANNEX 1 – FEEDBACK FORM" in APPENDIX1.

4. REFERENCES

MAOG-RECU-GN-GNL-IS-GNL-PRG-0002-0 Hazard and Risk Management Procedure

MAOG-RECU-GN-GNL-IS-GNL-PRG-00021-0 Hazardous Energy Control Procedure

2014/34/EC ATEX Directive

IEC 60309 Plugs, Sockets - Outlets and Couplers for Industrial Purposes

The Regulation for Internal Electrical Installations,

Regulation on Duties, Authorities and Responsibilities of Electrical Scientists

The Regulation on Electrical High Current Installations

TCDD No. 641 Circular

5. RESPONSIBLES

5.1. Project Management:

MAOG Project Management is responsible for the implementation of this document in all work sites / activities and ensuring that the subcontractors it works with work in accordance with this document.

5.2. Department / Department Managers / Chiefs

Department / Department Managers / Chiefs are responsible for the implementation of this document and ensuring that their subcontractors work in accordance with this document in their activities in their work area.

5.3. Project HSE Units and Responsibles

OHS - O Unit (Manager, Manager, Engineer, Supervisors and other HSE Personnel) and Operations Managers / Managers appointed as OHS - O Responsible are responsible for the coordination and monitoring of this document for its implementation in all field and operational activities.

5.4. Electrical Works Manager (Electrical Section Chief etc.)

The Electrical Works Manager carries out the following activities:

To plan the temporary electrical installation of the project with all its sub-details.

Ensure that all electrical equipment and facilities to be supplied, installed or in use are fit for purpose and meet safety requirements.

To ensure that the requirements of this document are fulfilled together with the Electrical Team.

To ensure that only competent employees are employed in the electrical team.

To apply the requirements of the MAOG-RECU-GN-GNL-IS-GNL-PRG-00021-0 Hazardous Energy Control Procedure for working under energy.

5.5. Electrical Engineer

The Electrical Engineer carries out the following activities:

To determine the work permit that will be required for the work and to carry out work permit studies with the "Electrical Team".

Leading risk assessment studies on electrical works in the field.

To ensure that employees involved in electrical works use appropriate PPE.

Ensuring the existence and feasibility of adequate contingency plans (including rescue instructions/procedures) for electrical work.

Coordinating the electrical works in the field and guiding the Electricity Officers.

To appoint an Electricity Officer for the management of all power sources for which he is responsible and to ensure that only this person intervenes in such power sources for connection / disconnection, inspection, maintenance or any similar purpose.

To continue his duties in the absence of the Electrical Works Manager.

Control of electrical equipment, cables and panels within the period specified in the MAOG-RECU-GN-GNL-IS-GNL-PRG-00027-0 Color Coding Procedure by the electrical officer, and related checklists (Annex-2, Annex-3, Annex-4 To ensure that it is recorded through Annex-5).

To apply the requirements of the MAOG-RECU-GN-GNL-IS-GNL-PRG-00021-0 Hazardous Energy Control Procedure for working under energy.

5.6. Electrical Responsibilities

Includes Electrical Supervisors, electrician, electrician and electrical technicians. The duties of the electrical controllers are as follows:

Electrical connection, disconnection, maintenance, repair, control, etc. in the field. To continue the electrical works according to this document in parallel with the assignment of the Electrical Engineer.

Participating in the risk assessments of electrical works and implementing the risk reduction measures specified in the risk assessment.

To ensure that the insulation of the hand tools used is suitable and undamaged.

To provide all the conditions of the work permit before starting to work in works that require a work permit.

To ensure adequate order in the working area, to limit the work area in order to protect other workers against electrical hazards.

Controlling electrical equipment, cables and panels within the period specified in MAOG-RECU-GN-GNL-IS-GNL-PRG-00027-0 Color Coding Procedure, and to register via related checklists (Annex-2, Annex-3, Annex-4, Annex- 5)

To perform the periodic checks of all electrical equipment correctly according to the requirements of this document.

To keep control records of all electrical equipment it controls. To regularly share relevant records with the project HSE Unit.

To properly affix the color code indicating the suitability of the electrical equipment it controls.

To report situations that he cannot control to the Electrical Engineer.

Using all job-specific PPE.

To use personal protective equipment of the standard and class specified in the MAOG-RECU-GN-GNL-IS-GNL-PRG-00019-0 Personal Protective Equipment Procedure in the works to be carried out on and / or near the railway line.

To check all PPE that is specific to the job it is responsible for using before use. To inform the Electrical Engineer, to whom he works, about the unsuitable PPE.

5.7. Headquarter E&S Manager:

Responsible for managing infrastructure and superstructure projects regarding environmental and social governance issues and member of the Executive E&S Committee on behalf of the REC

5.8. PIU (Project Implementation Unit)

PIU Department Manager (Superstructure / Civil Engineer) will be responsible for overseeing the implementation of all health, safety and social measures, as specified within the disclosure package of the Project, and regular reporting to AYGM PIU.

PIU Physics Engineer who is responsible for supervising health and safety for the Project.

5.9. Executive Environmental and Social Management Committee

Executive E&S Committee Project Manager (Department Head / Branch Manager /Head of Department) will be ultimately responsible for overseeing the activities undertaken by the AYGM/TCDD specialists (listed below), overseeing the implementation of mitigation measures and management procedures specified within the disclosure package of the Project, and overseeing the preparation and implementation of a CESMP, which will be based on this ESMP.

Executive E&S Committee Environmental, Health and Safety, and Social (EHSS) Manager (Specialist / Engineer) will be responsible for overseeing all matters that relate to environment, health, safety and social aspects of the Project. Also, s/he will be appointed to be responsible for supporting the implementation of the SEP, by conducting regular consultation with affected communities on any concern regarding the Project. CLOs will also have responsibility for disseminating the Project disclosure package as described in the SEP. They will also conduct regular inspections of records relating to grievances received and their resolution. S/He will report regularly to AYGM PIU.

Further technical staff may be required during the course of the Project, who will be assigned internally by the AYGM, either by means of permanent or temporary basis until the completion of relevant tasks under the Project whilst they undertake their current responsibilities

6. DEFINITIONS AND ABBREVIATIONS

ATEX (Atmosphere – Explosive): Explosive Atmosphere

Low Voltage: A voltage with an effective value of 1000 volts or less than 1000 volts.

Disconnectors/ Breakers: Disconnectors, one of the main items of primary equipment used in high voltage, are used to isolate the system from voltage.

Busbar: It is a prefabricated and modular system designed for the distribution and transportation of electrical energy. It has many advantages such as high performance, fire resistance, fast assembly and low cost.

Low Voltage:It is the voltage up to 42 (0-1 KV) volts (50V is the starting limit of dangerous voltage.).

Electric Equipment:Equipment including materials, fittings, appliances, tools and apparatus used as part of or in connection with an electrical installation.

The Regulation on Electrical High Current InstallationsIt can be dangerous for people, other living things and things in some situations (approach, touch, etc.) and it causes the generation, change of its properties, accumulation, transmission, distribution and conversion of electrical energy to mechanical energy, light, chemical energy, etc. are the facilities that enable them to be used by converting them into energies.

EKED (Tag, Lock, Secure, Try): It is the process of controlling dangerous energy during the maintenance and repair of machines, equipment or processes, and during transportation.

Overhead Line (Air Line):It is the whole of the facility consisting of support points, poles and their foundations, conductors drawn above ground, conductor equipment, insulators, insulator connection elements and grounding that provide strong current (low or high voltage) transmission and distribution. 25.000 Volt, 50 Hz. high voltage electrical energy is available on teh catenary line used in power transmission to the electric drfiven vehicles used in regions where electric driven trains for railways are being operated.

IP CodeInternational Protection Code

Leakage CurrentIf the conductive parts that are not under voltage are connected to the midpoint of the current system, directly to a grounded network point or to the ground as a conductor, it is the current passing through the insulating material to these parts of the plant that are under voltage. Residual current protections used to control the hazards arising from leakage current consist of the following types:

- RCD: Residual current relay
- ELCB: Earth -Fault Circuit Breaker
- GFCI: Ground Fault Circuit Interrupter

Heavy current:The current level used for operating machinery and lighting.

Protection Grounding:It is the direct connection of non-voltage conductive plant parts to earthing or grounded parts to ensure that the electrical circuit is opened by overcurrent protection devices in case of an insulation fault (full body contact).

Control:Inspection to evaluate the conformity of equipment or system with a specified standard.

Monophase:It is expressed as a single phase. It is the electricity supply consisting of a phase and a neutral line together with alternating current. It is known as 220 volt voltage type in Turkey, it has a frequency of 50 hz.

Polarity testIt is a test performed to confirm the primary and secondary polarity mark and verify that it matches the drawing, to perform the protection and measurement function correctly and to give an idea about how to connect the devices.

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Continuity TestIt is a test performed to measure the continuity between two conductors to prove the integrity of the conductor.

Portable Appliance Testing (PAT): A term used to describe the inspections carried out to ensure that electrical appliances and equipment are safe to use.

Grounding: A system that ensures that the leakage electricity is delivered to the ground with a conductor for the purpose of precaution against the damages that may arise from a possible electrical leakage that may occur in the electrical installation.



Dangerous Voltage:It is the voltage whose effective value is above 50 volts at low voltage and varies depending on the fault time at high voltage.

Three-phase: It is used for 3-phase systems. It is the combined state of more than one single-phase structure with a phase difference between their voltages. It is known as industrial electricity with a voltage of 380 volts in Turkey.

High VoltageIt is the voltage whose effective value is above 1000 volts. 1kV – 154 kV high voltage, 154 kV and above are called very high voltage.

Weak currentIt is the current level used to operate the sound, video, telephone, alarm, data, CCTV, security systems of facilities and buildings.

7. IMPLEMENTATION

7.1. Competence Requirements and Evidence and Acceptance of Competence

At Ronesans, only employees with the competency specified in this document can work in electrical works. The minimum competency requirements for the designated tasks are defined below.

Table Competency matrix

Position	Professional competence	Experience / age	Technical Training
Electrician	High School + Ministry of National Education Apprenticeship Education (Certificate of Mastery) or certificate of mastery / vocational training / qualification issued or valid by the legal authority in the country of study.	Experience: At least 3 years of electrical operation.	In the field of electrical hazards, at least 1 day of theoretical and practical training received from an institution approved by the relevant project or enterprise in the last 2 years, and at least 1 day of theoretical and practical training related to the control of dangerous energy and EKED in the last 2 years, from a relevant national / internationally recognized institution. daily theoretical and practical training.
Electrical technician	Certificate of electrical technician / vocational training / qualification certificate issued or valid by the legal authority in the country of study or graduated from the Department of Electrical Of Vocational High School.	Experience: At least 3 years of electrical operation.	In the last 2 years in the field of electrical hazards, at least 1 day of theoretical and practical training received from an institution approved by the relevant project or enterprise, and at least 1 day of training from a national / internationally recognized institution in the last 2 years related to the control of dangerous energy and EKED theoretical and practical training.
Electrical Technician	Electrical technician certificate / vocational education / qualification certificate issued or valid by the graduates of Vocational Schools of Universities, Electrical Department or the legal authority in the country of study.	Experience: At least 3 years of electrical operation.	In the last 2 years in the field of electrical hazards, at least 1 day of theoretical and practical training received from an institution approved by the relevant project or enterprise, and at least 1 day of training from a national / internationally recognized institution in the last 2 years related to the control of dangerous energy and EKED theoretical and practical training.
Electrical Engineer	Graduates of the Department of Electrical Engineering or Electrical and Electronics Engineering of Universities	Experience: At least 3 years in the field of electricity.	In the last 2 years in the field of electrical hazards, at least 1 day of theoretical and practical training received from an institution approved by the relevant project or enterprise, and at least 1 day of training from a national / internationally recognized institution in the last 2 years related to the control of dangerous energy and

			EKED theoretical and practical training.
Electrical Works Manager	Graduates of the Department of Electrical Engineering or Electrical and Electronics Engineering of Universities	Experience: At least 5 years in the field of electricity.	In the last 2 years in the field of electrical hazards, at least 1 day of theoretical and practical training received from an institution approved by the relevant project or enterprise, and at least 1 day of training from a national / internationally recognized institution in the last 2 years related to the control of dangerous energy and EKED theoretical and practical training.

Table1 Authorization Matrix¹

Position	Group (applies to Turkey)	Electrical facility plan preparation and signing works	Electrical interior plant construction works	Operation and maintenance work
Electrician	Group 3,	16 KW	75 KW 400 V	500 KW 400 V
Electrical Technician	Group 2	30 KW	125 KW 400 V	1000 KW 35 KV
Electrical Technician	Group 2	30 KW	125 KW 400 V	1000 KW 35 KV
Electrical Engineer	Group 1	50 KW	150 KW 400 V	1500 KW 35 KV
Electrical Works Manager	Group 1	50 KW	150 KW 400 V	1500 KW 35 KV

For proof of competence and acceptance by MAOG Project Management, the following must be provided.

Vocational Qualification:

The original or certified copy of the relevant secondary or higher education diploma or graduation certificate.

The original or a copy of the relevant professional qualification or vocational training certificate.

Technical Training:

It has been prepared in accordance with Article 4 of the Regulation on the Authorities, Duties and Responsibilities of Electrical Scientists.

The original or certified copy of the certificate containing the content, duration, date, name of the participant, information of the training provider organization, or the letterhead of the training provider institution, containing the same information and confirming the participation in the training, by the training provider institution, stamped and signed by the authorized person .

7.2. Planning of Electrical Works

7.2.1. Risk Assessment:

Risks to electrical work are assessed before work. Although this assessment is not less than the following;

- Electrical equipment to be used,
- Work to be carried out under energy,
- Status and layout of electrical cables,
- Special PPE requirement,
- Grounding requirement,
- Presence of ATEX media,
- Employee competence,
- Presence of underground facilities,
- Overhead lines
- Above issues are taken into account.

Risk management tools related to electrical safety are created in accordance with the content of hol-HSE-PRO-004 Hazard and Risk Management Procedure

7.2.2. Plant Electrical Infrastructure Plans

Infrastructure drawings containing all the following details in the project are prepared during or after the mobilization phase and are updated with each change. These are;

- Transformer locations,
- Power generator locations,
- Locations of field electricity main and sub-distribution panels,
- Locations of main and secondary electricity supply lines,
- Outdoor lighting,
- Lightning Protection Installation
- Overhead power lines
- Existing underground facilities.
- Existing live catenary lines,
- The drawings in question will be accessible to the relevant persons and units in the project.

7.2.3. Registration and Numbering of Electrical Equipment

All electrical equipment supplied or supplied by the subcontractor is numbered according to the registration system defined in the project for recording and tracking, and the relevant number is hung/attached on the equipment. Equipment without this numbering is not allowed for use in the field.

The type, brand, model, unit and, if applicable, the location of each electrical equipment used are kept up-to-date in a register.

7.3. Safe Working Requirements

7.3.1. General Requirements

The following general precautions are taken during electrical work. These are;

Materials related to electrical works are selected by the Electrical Works Manager in accordance with international standards. The installation of materials of unsafe quality, which may cause electric shock or fire risk, is strictly prohibited.

All parts of electrical installations are manufactured, assembled and protected to prevent electric shock, fire and explosion.

Appropriate type fire extinguishers and response equipment are available for all temporary electrical installations and equipment, and their controls are followed in writing.

All subcontractors forward the list of electrical equipment to be used in the work area to the Electricity Department and HSE Department for the electricity distribution planning before mobilization.

Electricity distribution in each area is done with an insulator that can cut all currents from the conductor at once. This system is designed in two main qualities: the switch can be locked in the “off” de-energized position (“0” position) and the switch is not locked in the “on” energized position (“1” position).

The electricity is configured in such a way that in the event of an emergency where its energy may be harmful, all power supplies and conductors can be cut off.

-All electrical appliances and electrical outlets are marked to indicate their purpose and voltage

No strong current connection can be made before the load calculation is made, recorded and approved by the Electrical Engineer or other managers assigned to the project. No work can be done under voltage without taking adequate safety precautions and using special tools.

Control, repair, maintenance and repair of electrical equipment only Table 1: It is done by people whose titles are specified in the competency matrix. All work to be done in places where there are strong current devices is done under the responsibility, control and supervision of an Electrical Engineer.

All parts of the electrical installation shall be of sufficient quality for the power requirements. Especially :

It is ensured that it is resistant to working conditions in construction works and has sufficient mechanical strength,

It is ensured that they are not affected by any of the water, dust, chemical substances, electricity and thermal factors that they may be exposed to during construction works.

A single employee is never assigned for malfunctions, at least 2 or more competent employees are provided to intervene in the malfunction.

No one is allowed to work on or near loaded power lines, regardless of voltage, without adequate occupational safety precautions.

In the machine and electrical circuits to be controlled, maintained and repaired, the energy is cut off and the requirements of the MAOG-RECU-GN-GNL-IS-GNL-PRG-00021-0 Hazardous Energy Control Procedure are applied.

Electrical installations, devices or bare conductors are considered to be always live, and electrical repairs are not made under voltage unless there is a technical necessity. In alternative or direct current installations with a potential difference of 250 volts or more with the ground, no work is carried out without removing the voltage and cutting the current. The voltage is cut off before any work to be done on the alternative or direct current installation with a potential difference of less than 250 volts with the ground. However, in case of necessity, necessary measures are taken and current-proof devices; personal protective equipment such as suitable work clothes and gloves, rubber mats and non-current screens, stools and platforms are used and employees are employed under the supervision of an Electrical Engineer. The bare conductors under voltage being worked on are protected by suitable cages, screens or insulating enclosures.²

Protective systems and equipment in accordance with the 2014/34/AT ATEX Directive are used where explosive atmospheres are likely to occur.

Only non-combustible equipment and conductors are used when laying lines in the tanks of explosives and flammable liquids or in explosive atmospheres.

In order to prevent possible hazards, the employee using electrical equipment is informed in detail about the equipment.

To avoid danger, the facilities are protected against lightning.

Mobile or fixed electrical conductors and cables are protected against mechanical and chemical effects.

Appropriate warnings are provided in places where there is contact with or very close to an electrical equipment that may cause danger.

When working on or near railway lines containing energized catenary systems, preparation and planning will be made in accordance with the MAOG-RECU-GN-GNL-IS-GNL-PRG-00029-0 Safe On Line Working Procedure. Action is taken in accordance with the security measures specified in the relevant procedure and the instructions and orders of the relevant institution (TCDD).

In the works to be carried out on or near the railway line, the requirements of the MAOG-RECU-GN-GNL-IS-GNL-PRG-0008-0 Work Permit Procedure are fulfilled and the work permit system is operated.

In the works to be carried out under low and high voltage, it is ensured that the precautions shared in Table 3 are taken by the MAOG Project Management.

These are;

Table Precautions to be taken when working under low and high voltage

Low Voltage:	High Voltage
<p>For work under voltage, the requirements of the MAOG-RECU-GN-GNL-IS-GNL-PRG-00021-0 Hazardous Energy Control Procedure are applied.</p> <p>All cables are laid in such a way that they are protected from external factors (by burying them in the ground or in shields).</p> <p>If there are blown fuses in the panels, energy will not be supplied without fault scanning.</p> <p>All panels are cleaned periodically after the power is cut off.</p> <p>Before starting work, it is checked whether pliers, side cutters, screwdrivers, stylus and other hand tools are intact and suitable for use. Non-insulated hand tools are not used.</p>	<p>For work under voltage, the requirements of the MAOG-RECU-GN-GNL-IS-GNL-PRG-00021-0 Hazardous Energy Control Procedure are applied.</p> <p>Before working on high voltage devices or areas, the disconnector at the beginning of the line is opened and the energy is cut.</p> <p>In order to ensure the protection of employees, visible forms of energy cut-off are applied as much as possible.</p> <p>In order to prevent anyone other than the attendant from intervening in the separator, the separator control lever is lockable.</p>

²İlgi: Repealed Occupational Health and Safety Regulation Art. 303.

<p>During the commissioning of vibrators, water pumps and similar electrical appliances, all connections are definitely checked after making sure that the system is working safely.</p> <p>General electrical installations, including lighting circuits, are checked by the Electrical Engineers to be authorized at certain intervals and the unsuitable situations are reported and the MAOG Project Management is informed immediately.</p>	<p>High voltage gloves are used when opening or closing the disconnector, changing fuses, or doing any high voltage related work.</p> <p>After the power is cut off by opening the disconnector, work cannot be started without making sure that the line is grounded.</p> <p>If the fuses on the disconnector blow for any reason, fault scanning and reporting is provided. The line is not energized until the cause of the fault is found and reported.</p> <p>It is not possible to work with high voltage in rainy weather.</p>
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7.3.2. Electric Equipment:

The following considerations apply to all power tools:

Mobile installations, even for temporary purposes, cannot be passed through the fields and facilities belonging to 3rd private and legal persons without obtaining permission.

Every day, before use, employees visually inspect sockets, extension cords, cables and equipment connected to the plug to detect any external damage. If any damage is detected, the damaged equipment is removed from the field and not used.

Portable device testing (PAT) is performed on all cables, outlets, and equipment that are not part of the permanent electrical network. All electrical equipment connected to these cables and sockets has a grounding line. These tests are carried out under the supervision of an Electrical Engineer, recorded and the results are kept.

Equipment that does not pass the continuity test is not used.

The handles of portable power tools are covered with a current-proof material of sufficient type and thickness, or are made of such material, and these tools have spring-loaded circuit breakers on them that must be pressed continuously to keep the circuit closed.

Metal body tungsten – halogen bulb projectors cannot be used as mobile. These lamps are always used by being fixed to high places. In cases where it is necessary to be used as a mobile, the projector is mounted on an insulating stand and a residual current relay is provided on it.

Electrical equipment with bare metal parts operating with alternating or direct current is properly grounded.

The main breaker points in the workshop / manufacturing areas are placed in easily visible and accessible places. There are also breaker points on the sides of the machines.

Electrical appliances operating with rated voltage are double insulated.

The equipment enclosure is intact and free of any loose or damaged parts.

The sockets used are of industrial type, approved according to IEC 60309.

The power tool is generally in good condition and subject to preventive maintenance routines.

Handpiece cords are flexible and connect effectively to socket connectors.

A power tool with a damaged cord is immediately replaced.

Portable lights become 24 V. (Portable projectors can be used in cases where sufficient illuminance cannot be achieved.)

All equipment, tools, cables, connections used in the field are selected in accordance with at least IP55 norms for outdoor use.

Grounding is provided according to the electrical equipment manufacturer's instructions.

The following precautions are taken while working with generators. These are;

The generator is maintained in good condition by performing scheduled maintenance according to the manufacturer's instructions.

Fuel tanks have an overflow pool of up to 110% of their total fuel capacity. Underground tanks are double-walled, equipped in such a way that the leakage between the walls can be noticed, and an overflow pool is built under the tanks within the scope of local requirements.

The area around the generators is cleared of oil and diesel spills.

It is protected by suitable guards for rotating parts.

Grounding is provided.

The following precautions are taken when working with an electric welding or cutting set. These are;

Electrical welding machine connections and sockets are made and changed only by suitably qualified employees, and competent welders are employed for welding works.

The following precautions are taken when using electric welding machines. These are;

- Welding machines and equipment must be insulated and grounded, welding tongs must be gripped and their outer faces insulated.
- The switch of welding machines should be on or very close to the machine.
- In automatic or semi-automatic sewing and spot welding machines, a closed guard is applied to the operation point or double-handed control method is applied.
- Supply and supply cables are protected in such a way that they will not be damaged or deteriorated in the event of a vehicle passing over them.
- Electricity is not supplied near flammable materials.
- During the cleaning, repair and maintenance of electrical welding machines or changing the workplace, the machines are disconnected from the mains and their electricity is cut off.
- It is ensured that the connection point of the cable ends providing the current and the electrode clamps are insulated and that the electrode clamps are properly protected against welding heat.

It is ensured that the non-insulated parts under voltage in electric welding or cutting machines are protected against touching and that the metal frames of the electric welding machines are properly grounded.

It shall be ensured that the output ends of the electrical welding and cutting machines or one pole of the welding circuits are grounded against leakage currents.

7.3.3. Residual Current Protection

The requirement for residual current protections in the MAOG Project, as GFCI (Ground fault circuit breaker), ELCB (Earth leakage circuit breaker) or RCD (Residual current relay), is determined, provided and provided by the Electrical Engineer according to the legislation requirements in the country of work and the nature of the electrical equipment used in the project. assembly is performed. All distribution boards, power tools, lighting and other power points are equipped with 30 mA threshold residual current protections for human protection. In the main panels, 300 mA residual current relays are also used for fire protection. The following equipment is subject to the use of residual current protection:

Distribution Panels

Generators

Transformers

Welding machines

Field cables

Portable tools

Lightings

Pumps

There is a residual current protection tester in the whole project and it meets the following conditions:

The tester meets the EN 61010-1 standard and meets at least CAT III safety requirements.

A manufacturer's booklet is provided and all tests are performed in accordance with the manufacturer's instructions.

7.3.4. Earthing

If all electrical equipment has contactable conductive parts in the MAOG Project and/or if it is specified in the operating instructions of the electrical equipment and/or if required by the legislation in the country of residence, the electrical equipment shall be grounded. At least one earthing measuring device is available to be increased when needed in the project and measurements are carried out at regular intervals. All measurements are made or made by authorized persons or organizations as required by the legislation in the country of residence and recorded by the MAOG Project Electricity Department. Measuring devices are used only by employees of the Electrical Department. Calibrations are regularly performed, monitored and recorded in accordance with the manufacturer's instructions or national legislation or the local legislation of the region where the project is located.

Ground conductor continuity testing and electrical continuity on all equipment are performed in the following cases. These are;

Before using the equipment for the first time,

During the monthly periodic control,

Before the repaired equipment is sent to the work area for use,

Before the first use of equipment after a damaging accident.

If the applicable legislation in the country of operation does not stipulate a safer method, the minimum measurement periods for inspection, measurement and inspection of all grounding facilities during the operation period are given below:³

For electricity generation, transmission and distribution facilities (excluding energy transmission and distribution lines), 2 years

For power transmission and distribution lines, 5 years

For industrial facilities and trade centers:

- Inspection and measurement of grounding resistances, 1 year
- Other inspections, measurements and controls related to grounding facilities, 2 years

For non-fixed installations:

- For fixed operating elements, 1 year
- For relocatable operating elements, 6 months

Inspection, measurement and inspection periods of grounding facilities in workplaces working in wet environments cannot exceed one year.

Measurements and inspections should be tested periodically according to the legislation of the region / country where the project is located. If there is no local legislation or if the periods are longer than the periods above, the periods specified in this document are followed.

7.3.5. Distribution Panels

The following precautions are taken in electrical distribution panels:

³İlgi: The Regulation on Groundings of Electrical Installations,

Mobile panels used outside the building will be at least IP54, in addition, the panels will have IP codes to be determined by the Electrical Engineer in accordance with the ambient conditions. Protection classes are shown in Table 3.

Table2 Protection classes⁴

	IP 20	IP 43	IP 44	IP 54	IP 55	IP 65	IP 67
Areas to be Used	In dust-free dry areas	In open damp and wet areas	In open damp and wet areas	In damp and dusty areas	in damp and wet areas	in damp and wet areas	Under water
Water Protection		Protection against water coming in at an angle of 60° to the vertical	Protection against water from all directions	Protection against splashing water from all directions	Protection against gushing, rapid water from all directions	Protection against gushing, rapid water from all directions	Protection against pressurized water
Protection Against Dust and Objects	Protection against objects larger than 12 mm.	Protection against objects larger than 1 mm.	Protection against objects larger than 1 mm.	Protection against dust	Protection against dust	Dust resistant	Dust resistant

Uncontrolled intervention of different people to the electrical panels is prevented (locking, etc.). The contact information of the responsible persons is indicated on the board.

A 30 mA residual current relay is placed in the last circuits of all distribution boards. In all panels (including 220V and 380V), each line output is fed with a 30 mA residual current protection relay (with fuse + residual current protection combined fuses).

Residual current protection of at least 30 mA is used in all electrical circuits, including portable electrical power supplies. At the main entrance, 300 mA can be used for fire protection. The determination of whether the leakage current protections are working correctly is tested / made by competent persons within the scope of monthly inspections. It is forbidden to disable residual current protections, otherwise the Zero Tolerance policy will be applied.

Ground lines are not fused in any way.

The end points, the passages of the supply and output cables from the body are housed in a body made of rubber / plastic sleeve.

Switches and conditionals in distribution boards are marked / labeled to which circuit they belong to, in a way that can be easily understood by the Electricity Officers.

On the distribution boards in a way that will not be affected by the weather conditions; electrical hazard warning signs, panel number and authorized personnel contact numbers.

Distribution panels are kept closed and locked at all times, keys are only available to authorized personnel. Line drawings are inside the board, and daily checklists are inside the distribution boards.

Panels are checked regularly (weekly, monthly, etc.) according to the EK-4 Electricity Distribution Panel Monthly Checklist. This range is determined by the Electricity Unit.

⁴İlgi: TS 3033 EN 60529 Protection degrees provided by enclosures (IP code) (in electrical equipment)

If the fuse blows for any reason, the situation is reported to the Electricity Unit / Responsibles. Electricians first investigate the reason for the fuse blown, and then the fuse is opened. If the fuse blows again, the machine, bench or device is taken for maintenance or repair in a non-operational state and is allowed to be operated after the fault is eliminated.

There is a protective panel in the original panel so that there is no accidental contact inside the distribution panels.

A sufficient number of distribution boards are kept in the working areas.

There is an insulating grid or rubber mat wide enough for two people to stand comfortably in front of the electrical distribution panels.

The distribution panel is protected from adverse weather conditions by considering the IP level.

Alternating voltage electrical panels with a potential difference of more than 50 volts with the ground are kept in special places and it is ensured that the floors of these places are made of current-proof material or covered with this type of material.

Distribution boards and control equipment and similar installations in the workshop or in places accessible to employees are placed in locked cabinets or cells, or it is ensured that their floors are covered with electrical current-proof material. When the insulation of the installation under voltage needs to be removed due to maintenance and repair, these parts are protected with screens or protectors.

Current-proof grids are placed on the floors where the voltage parts of the alternating current circuits with a potential difference of 50 volts or more with the ground must be kept constantly exposed, such as behind the main distribution boards.

Alternating current conductors with a potential difference of 50 volts or more with the earth are insulated in accordance with the voltage value, and these conductors and their connection and control equipment are suitably protected against external influences.

All distribution boards and metal housings are grounded.

Residual current relays are also used in temporary structures.



Figure1: Distribution board applications.

7.3.6. Cable Security

The following precautions are taken when using electrical cables:

Sufficient and properly grounded electrical outlets are used where portable conductors must be used. Portable electrical cables are covered with durable rubber and a metal that can be bent and bent if necessary to increase their durability and their coatings do not deteriorate and their connections are kept in good condition.

Extension cables are used without a joint, without being spliced end to end. It is not allowed to draw energy from extension cords with multiple sockets and not of industrial type. Electrical extension cables are protected by suitable protective hose.

In cases where the distribution panel cannot be located at the point where the energy needs to be drawn and it is inevitable to use more than one extension cable to reach that point, the situation is submitted to the opinion of the Electrical Works Manager and a drawing is made of the proposed solution. If this exception occurs, extension cords can reach greater distances by allowing only one connection.

Do not use patched, oily, corroded or frayed electrical cables.

Care is taken to ensure that the cables are properly laid in order not to cause a tripping hazard or a barrier to passage. This laying method is developed in a way that does not affect the integrity of the cable and does not damage the cables.

Traveling conductors are enclosed in elastic cable guides as far as possible. All kinds of conductors are taken on poles or stands without being dragged on the ground, and necessary measures are taken to prevent vehicles from crushing the conductors. If the poles and stands used pose a fire risk, different alternatives are used. In road crossings, underground cables are used or poles of sufficient height are erected.

There are no external joints in electrical installations, conductors, mobile installations; Broken, cracked or insulated parts are immediately replaced with new ones.

Cable and connections will be made using industrial connectors; cables, plugs and sockets are in industrial standards.

It is forbidden to walk, stand on electrical cables and place objects on the cables.

Cables come in sizes and classes suitable for their intended use.

All single-phase mobile cables min. 3-line (1P+N+T), all three-phase mobile cables min. It has 5 lines (3P+N+T).

Cable cross-sections; may vary depending on amperage, cable length, and voltage. In this context, the following example has been prepared according to the American Wire Gauge (AWG) standard. For cable cross-section measurement and length, Table 4 can be referenced as needed.



Table3 Cable cross-sections reference table

Metric System	CIRCUIT TYPE		VOLTAGE FLOW RATINGS (AMPS)															
	Noncritical 10% Voltage Drop	Critical 10% Voltage Drop																
	0 - 20 ft	0 - 6 ft	5A	10A	15A	20A	25A	30A	40A	50A	60A	70A	80A	90A	100A	120A	150A	200A
CIRCUIT LENGTH	0 - 20 ft	0 - 6 ft	16 AWG	16 AWG	14 AWG	14 AWG	12 AWG	10 AWG	8 AWG	6 AWG	6 AWG	6 AWG	4 AWG	4 AWG	4 AWG	2 AWG	1 AWG	2/0 AWG
	30 ft	10 ft	16 AWG	14 AWG	12 AWG	12 AWG	10 AWG	8 AWG	6 AWG	4 AWG	4 AWG	4 AWG	4 AWG	2 AWG	2 AWG	2 AWG	1 AWG	2/0 AWG
	50 ft	15 ft	14 AWG	12 AWG	10 AWG	10 AWG	8 AWG	6 AWG	4 AWG	4 AWG	4 AWG	4 AWG	2 AWG	2 AWG	2 AWG	2 AWG	1 AWG	2/0 AWG
	65 ft	20 ft	14 AWG	12 AWG	10 AWG	8 AWG	6 AWG	4 AWG	4 AWG	4 AWG	4 AWG	2 AWG	2 AWG	2 AWG	2 AWG	2 AWG	1 AWG	2/0 AWG
	80 ft	25 ft	12 AWG	10 AWG	8 AWG	6 AWG	4 AWG	4 AWG	4 AWG	4 AWG	2 AWG	2 AWG	2 AWG	2 AWG	2 AWG	2 AWG	1 AWG	2/0 AWG
	100 ft	30 ft	12 AWG	10 AWG	8 AWG	6 AWG	4 AWG	4 AWG	4 AWG	4 AWG	2 AWG	2 AWG	2 AWG	2 AWG	2 AWG	2 AWG	1 AWG	2/0 AWG
	130 ft	40 ft	10 AWG	8 AWG	6 AWG	4 AWG	4 AWG	4 AWG	4 AWG	4 AWG	2 AWG	2 AWG	2 AWG	2 AWG	2 AWG	2 AWG	1 AWG	2/0 AWG
	165 ft	50 ft	10 AWG	8 AWG	6 AWG	4 AWG	4 AWG	4 AWG	4 AWG	4 AWG	2 AWG	2 AWG	2 AWG	2 AWG	2 AWG	2 AWG	1 AWG	2/0 AWG
	200 ft	60 ft	10 AWG	8 AWG	6 AWG	4 AWG	4 AWG	4 AWG	4 AWG	4 AWG	2 AWG	2 AWG	2 AWG	2 AWG	2 AWG	2 AWG	1 AWG	2/0 AWG
		70 ft	8 AWG	6 AWG	4 AWG	4 AWG	4 AWG	4 AWG	4 AWG	4 AWG	2 AWG	2 AWG	2 AWG	2 AWG	2 AWG	2 AWG	1 AWG	2/0 AWG
		80 ft	8 AWG	6 AWG	4 AWG	4 AWG	4 AWG	4 AWG	4 AWG	4 AWG	2 AWG	2 AWG	2 AWG	2 AWG	2 AWG	2 AWG	1 AWG	2/0 AWG
		90 ft	8 AWG	6 AWG	4 AWG	4 AWG	4 AWG	4 AWG	4 AWG	4 AWG	2 AWG	2 AWG	2 AWG	2 AWG	2 AWG	2 AWG	1 AWG	2/0 AWG
		100 ft	8 AWG	6 AWG	4 AWG	4 AWG	4 AWG	4 AWG	4 AWG	4 AWG	2 AWG	2 AWG	2 AWG	2 AWG	2 AWG	2 AWG	1 AWG	2/0 AWG
		110 ft	8 AWG	6 AWG	4 AWG	4 AWG	4 AWG	4 AWG	4 AWG	4 AWG	2 AWG	2 AWG	2 AWG	2 AWG	2 AWG	2 AWG	1 AWG	2/0 AWG
		120 ft	8 AWG	6 AWG	4 AWG	4 AWG	4 AWG	4 AWG	4 AWG	4 AWG	2 AWG	2 AWG	2 AWG	2 AWG	2 AWG	2 AWG	1 AWG	2/0 AWG
		130 ft	8 AWG	6 AWG	4 AWG	4 AWG	4 AWG	4 AWG	4 AWG	4 AWG	2 AWG	2 AWG	2 AWG	2 AWG	2 AWG	2 AWG	1 AWG	2/0 AWG

AWG CABLE SIZE CHART



* 1 ft = 0.304 meters

It is not allowed to join the ends of the cables, the cables are extended or repaired with suitable fasteners. Cable connections are made with suitable connectors.

Cable repair is not done with electrical tape.

No materials or hand tools are placed on the electrical panels and tables in working condition.

Pouring or spraying water on a working electrical panel or table, even in the event of a fire, is prevented.

Electrical panel fires are extinguished with suitable fire extinguishers.

All distribution boards and metal bodies are grounded, there is no fuse on the grounding lines.

Low standard (domestic) cables and connectors are not allowed for use in the field. All cables are in construction standards and resistant to damage / wear and tear.

Temporary electrical cables are kept away from heat, liquids, sharp edges and traffic.

Extension cables are kept as short as possible, checked daily by the user for errors and damages, and raised above ground level as much as possible. The electrical cable is protected at road crossings.

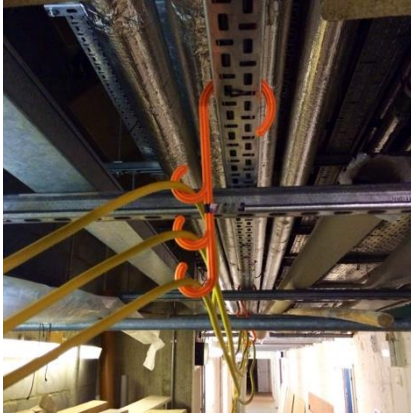


Figure2: Cable protection methods

7.3.7. Underground Facilities

Before all underground works such as excavations, the following checks are applied:

Excavation permit is applied in accordance with the MAOG-RECU-GN-GNL-IS-GNL-PRG-0008-0 Work Permit System Procedure.

"As-built" application project drawings are provided for the detection of known lines.

Cable locator (underground line scanning devices for detecting lines) is used.

All known lines are isolated.

The laid lines are marked appropriately so that they can be identified later.

The excavation method (hand excavation or mechanical excavation) to be made is determined by the Electrical Works Manager.

7.3.8. Overhead Lines

Electrical Works Manager identifies all overhead lines within the project boundaries, near or on machine / equipment transfer routes and learns the voltage and current in the line from the relevant authorities and informs all relevant people.

In cases where there are overhead power lines on or near the project or access roads, the Electrical Engineer provides a briefing on the method to be applied to prevent contact with these lines.

As a general rule, the following checks are made:

Risk assessment with the method specified in MAOG-RECU-GN-GNL-IS-GNL-PRG-0002-0 Hazard and Risk Management Procedure,

Planning the work to be done to prevent accidental contact and approaching the transmission lines as far as possible in practice,

In cases where working around power transmission lines is in question, all activities are kept under control, including but not limited to the following activities:

- Scaffolding erection and transport of scaffolding pipes
- Use of long ladders
- Use of elevated mobile platforms
- Use of dump trucks
- Use of backhoe loaders and any other lifting / carrying arm machinery and equipment
- Use of cranes
- All kinds of infrastructure and superstructure work to be done near the live catenary line

Electrical Works Manager determines the opening amounts according to the voltage values. It is not allowed to bring vehicles, facilities or equipment closer than the specified distances. The aperture (approach) distances vary according to the voltage. Safety distances cannot be exceeded. Safety distances for overhead lines are given in Table 6. The safety distances in Table 5 are maintained unless the legislative requirements in force in the country of work specify safer distances.

Insulating barriers or insulating warning posts (goal posts) are used to prevent the approach to power transmission lines. Mobile crane, earthmoving machinery, dump truck etc. No part of the vehicles can come close to live transmission lines. These poles are placed on the safe approach distance limit horizontally and vertically for warning purposes.

It is not permitted to store any materials or equipment under energized busbars, energized lines, or near energized equipment.

In the works that must be done near the overhead lines, first of all, the power cut is requested from the relevant authorities. After making sure that the energy is cut off (by measurements with the voltage detector), the operation is started.

In case of contact with overhead lines, the following conditions are to be acted upon:

If the equipment comes into contact with the line, do not leave the equipment and wait, informing the emergency team, unless the equipment has caught fire due to the contact.

If there is a fire in the equipment;

- Jump off the equipment without touching the equipment and make sure you land on both feet at the same time
- Move away from the equipment by shuffling at least 8 meters away from the equipment, perpendicular to the equipment (tires may burst, rim and tire parts may be damaged due to explosion)
- After reaching the safe distance, do not return to the equipment and inform the emergency team.

Operators perform this application at regular intervals as part of emergency drills.

Table 4: Minimum working distance to overhead power lines

Voltage	Minimum Required Distance (m)
0 - 300V	Avoid contact
300V – 50KV	3
50KV – 200KV	5
200KV – 350 KV	6
350KV – 500 KV	8
500KV – 750KV	11
750KV – 1000KV	14

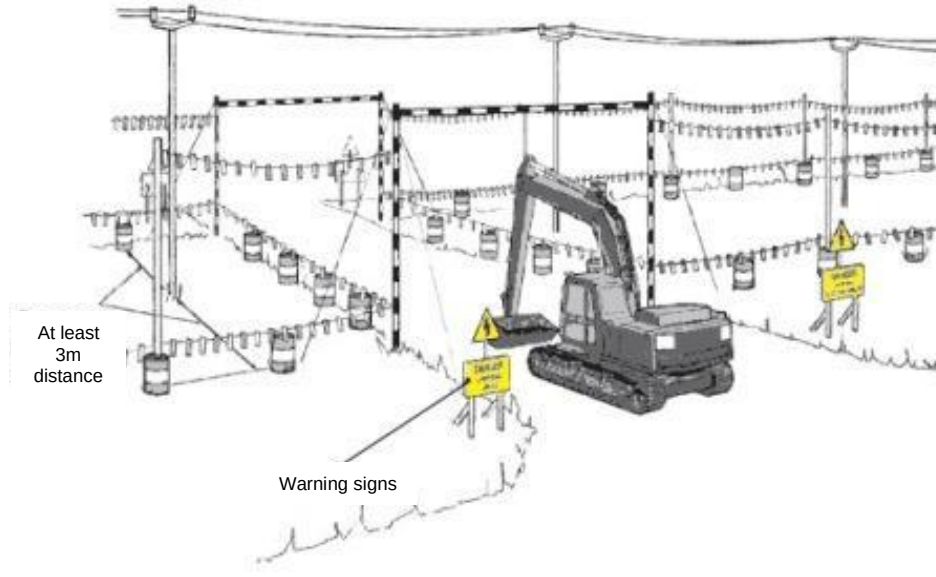


Figure3: Example of warning posts (goal post) application.

7.3.9. Personal Protective Equipment

Before starting to work in electrical works, helmets, work safety glasses, reflective work clothes and work shoes are provided and used in accordance with the project rules. MAOG-RECU-GN-GNL-IS-GNL-PRG-00019-0 Personal Protective Equipment Procedure will be taken into account in the selection of work-specific PPE. Below are the conditions for the selection of personal protective equipment specific to electrical work and the instructions for use / maintenance:

Head protection is selected in accordance with EN 397, EN 50365 standards.

Foot protection is selected in accordance with EN 20345 and EN 50321-1/AC standards. Before and after each use, it is definitely checked and damaged ones are not used.

Hand protection is selected in accordance with EN 60903 standard. It is definitely checked before and after starting work.

100% cotton clothes are preferred instead of synthetic clothes with acetate, nylon, rayon or polyester mixture that can easily melt in heat contact.

Jewelry such as watch bands, bracelets, earrings, rings, chains, necklaces, and conductive clothing are not to be worn while performing electrical operations.

Personal protective equipment is selected according to the equipment to be used and the work to be done. Personal protective equipment to be used in the works to be carried out on the live line is selected in accordance with the MAOG-RECU-GN-GNL-IS-GNL-PRG-00021-0 Hazardous Energy Control Procedure.

The above-mentioned covers the minimum requirements. Additional measures are determined by the Electrical Engineer to eliminate the hazards identified in the risk assessment made before the work to be done or to reduce the exposure.

All personal protective equipment delivered to the employees are embossed against signature to the electrical team employees, with embossment reports, indicating all technical features.

7.3.10. Lightning protection

In the project, lightning protection measures are carried out by taking into account the legal regulations in the country and region and the guidelines of the designer/manufacturer of facilities or equipment with lightning risk.

Projects in Turkey apply the issues specified in the local legislation. In accordance with the provisions of the Regulation on Health and Safety Conditions in the Use of Work Equipment in accordance with the local legislation, the periodic controls of the electrical installation, grounding installation and lightning rods, if any, of the workplaces are carried out in accordance with the following regulations:

The Regulation on Groundings of Electrical Installations,

The Regulation on Electrical High Current Installations

The Regulation for Internal Electrical Installations,

Controls are made once a year according to the issues specified in TS EN 60079 and TS EN 62305-3 standards.

7.4. Control and Maintenance Requirements of Electrical Equipment

7.4.1. Control Requirements

Controls of electrical equipment are made according to the following principles:

For all electrical equipment (electrical tools, generators, switchboards, extension cords, grounding, RCD / ELCB / GFCI and any other electrical equipment), a control is carried out by the Electrical Works Manager, taking into account the legal requirements in the country of operation, manufacturer's guides and the requirements of this document. and a test plan is prepared.

According to the prepared plan, the controls and tests of the relevant equipment are carried out by the authorized person, department or institution and the records are kept.

PAT Test: PAT tests, which are carried out to ensure that the use of electrical devices and equipment are safe, are carried out by the Electricity Officers during the controls carried out every 3 months. The test is performed with a device called the PAT Tester. Device; It is selected to perform earth continuity test, insulation resistance test and functional checks (earth leakage and load test) of the electrical equipment to be examined. The use of equipment that does not qualify as a result of the PAT test is not permitted.

All electrical hand tools, panels, electrical cables, generators are checked by Electricity Officers no less than once every 3 months, regardless of the legal regulations and manufacturer's instructions in the country of operation. The following checklists are used in the controls. A written control record of each controlled equipment is kept. In the matching of the checked equipment with the checklist, the numbering attached to the equipment specified in Section 7.2.3 is taken into account.

Electrical equipment that has been checked is coded so that it can be easily seen with the color code of that month (see MAOG-RECU-GN-GNL-IS-GNL-PRG-00027-0 Color Coding Procedure).

7.4.2. Maintenance Requirements

All electrical equipment (electrical tools, generators, panels, extension cables, grounding and any other electrical equipment) is maintained by persons and organizations authorized by the manufacturer, in accordance with the legislation in the country of operation and the instructions of the manufacturer, and at the frequency defined by the manufacturer. In energized equipment maintenance work, the MAOG-RECU-GN-GNL-IS-GNL-PRG-00021-0 Hazardous Energy Control Procedure is applied without exception. In addition, the following measures are taken:

Before starting the repair and maintenance work, the electricity is cut off and work is not started without making sure that it is cut.

A warning letter is left stating that the work is being done, and if deemed necessary by the Electrical Engineer, an observer is made.

Electrical devices cannot be interfered with by anyone other than the authorized person and their covers are kept locked.



8. MONITORING, ASSURANCE AND VERIFICATION

Key success indicators (KPIs) of this procedure will be monitored, verified and evaluated by the relevant parties in accordance with their responsibilities set forth in the E&S Governance document, within the scope of the MAOG-RECU-GB-GNL-IS-PRG-0007-0 HSE Monitoring, Assurance and Verification Procedure.

9. RELATED FORMS

APPENDIX 1 – Feedback Form

APPENDIX-2 Electrical Extension Cables Monthly Checklist

APPENDIX-3 Power Tools Monthly Checklist

APPENDIX -4 Electricity Distribution Board Monthly Checklist

APPENDIX -5 Fixed Generator Monthly Checklist

APPENDIX -6 Mobile Generator Monthly Checklist

APPENDIX 1 – FEEDBACK FORM

User Feedback Page			
<p>When the user identifies an inaccuracy, error or uncertainty in the document, he notifies the person responsible for the document so that the necessary action can be taken. The user is asked to clearly state the changes he proposes and to return by filling out this page completely.</p>			
User Name			
Document No		Date	
Page Ref.	Brief Description of Required Changes / Corrections and Reasons		
Submit this Page:	Person in Charge or Corporate HSE Management Department		