

EK 35. KATODİK KORUMA PROSEDÜRÜ (CATHODIC PROTECTION PROCEDURE) ÖRNEĞİ

CATHODIC PROTECTION PROCEDURE

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1.0 SCOPE

This procedure, defines the supply of materials and equipment required for the cathodic Protection (C.P.) systems and its installation methods.

The materials and equipment for the C.P. systems shall include, but not necessarily be limited to, the following component parts:

- i) Transformer/rectifiers (T/R) (including their operation and maintenance manuals).
- ii) Anode and ground bed materials
- iii) Reference electrodes
- iv) C.P. junction boxes
- v) Manufacture and pre-despatch inspection and testing of the C.P. equipment, before dispatching.
- vi) Construction and operational spares
- vii) Technical and commercial documentation

2.0 ON SITE C.P. SERVICES

- The C.P. engineer shall be fully experienced with the installation, testing and commissioning of impressed current and sacrificial anode cathodic protection systems for the oil and gas industry. He, preferably be qualified and accredited as a C.P. specialist by NACE or equivalent European professional corrosion organisation. Evidence of experience, qualifications, and track record shall be submitted to Client, in advance.
- Where applicable, all work carried out by the Contractor, shall be in accordance with the Contract and the applicable international standards and local regulations.
- Contractor shall maintain an effective programme for quality assurance and quality control, in conjunction with all manufacturing, storage, installation and application functions necessary to meet the requirements. The quality requirements shall be met by the establishment and implementation of procedures that shall ensure that acceptable products and services are provided to Client. The programme shall ensure that quality requirements are determined prior to commencement of the work and are maintained throughout the work.
- Material Safety Data Sheets shall be provided by the materials' suppliers and be made available at the warehouses and work place, for users' attention. The volatile organic compound (VOC) content of all materials shall meet the Local and Statutory regulations.
- Electrical equipment located in hazardous areas shall be rated and constructed to comply with the Requirements.

3.0 TRANSFORMER RECTIFIER (T/R) UNITS

- All transformer/rectifier (T/R) units shall be designed, to deliver combination of output current and voltage continuously, up to and including their maximum stated rating. The units shall be rated to include the maximum heat that can be generated under any combination of output current and voltage and the maximum heat generated by the anode circuit series resistors.
- All T/R units will be installed in weatherproof electrical supply rooms (5-45°C temperature range and 30-70% (RH) Relative Humidity range).
- To provide adequate protection, the units shall be designed and manufactured to provide an IP42 degree of protection to their internal components.
- The units shall be designed and manufactured in accordance with good industrial practice and current editions of the referenced specifications and standards.
- The units shall be designed to provide ease of access to all components for maintenance, repair or replacement in service through full length opening front door.
- The maximum overall dimensions of each T/R cubicle shall be 500x500x1500mm (WxDxH). The type of anodes to be fed by the T/R's will not be susceptible to damage by the D.C. circuit fluctuation.
- Output meters shall be scaled not less than 120% and not greater than 140% of the maximum rating of the circuit they serve. All meters shall have a scale of not less than 95mm, incorporate zero adjustment and be hermetically sealed.
- All terminations shall be mounted on non-hygroscopic SRBF (synthetic resin bonded fabric) insulating panels. By this way, moisture is avoided or easily removed by passing a sufficient stream of warm air over the material.
- Terminals, washers, nuts, etc. shall be nickel plated brass or tinned high conductivity copper.
- Cables terminated on stud-type terminals shall employ tinned copper compression lugs and be secured by two flat washers and two locknuts or by two flat washers, one spring washer and one fullnut. All terminals shall be adequately hidden to prevent accidental contact.
- No more than two cables shall be terminated on any terminal. A.C. and D.C. terminals shall be segregated.
- All switches, lamps, meters, shunts, fuses, controls, etc shall be labelled according to their functions.
- A main white / black / white trafficite (brand name for multi-layered phenolic plastic sheets suitable for engraving) label with 20mm high upper case lettering shall be mounted in a significant position, at the front of the units and be engraved as following:
 - Impressed Current Cathodic Protection Transformer Rectifier
 - Project name
 - Unique identity number, e.g. T/R No:1, etc.
- The T/R manufacturer's equipment plate shall be mounted below the main label and contain the following information as a minimum:
 - Manufacturer's name and registered address
 - Input voltage, frequency, phases and maximum kVA rating.
 - Maximum D.C. output voltage and current.
 - Year of manufacture
 - Manufacturer's unique serial No.
- All labels shall be securely fixed in place by stainless steel self-tapping screws.
- The T/R cubicles shall be of robust folded sheet steel construction with facilities for both wall and floor mounting. The cubicles shall be constructed to achieve a minimum of IP42 degree of protection and shall be naturally air cooled.
- Each cubicle shall be fitted with a full height, full width lockable front door which shall provide full unobstructed access to all internal components. All doors, viewing windows, gland plates and removable panels shall be fitted with captive soft elastomeric gaskets to preserve the IP42 rating of the units. A polycarbonate viewing window shall be provided in the front door, which shall provide full unobstructed viewing of the internal meters without the need to open

the door. All doors shall be lockable using padlocks. Heavy-duty padlocks shall be provided, each complete with 3 duplicate keys.

- Top entry detachable gland plates shall be provided pre-drilled and fitted with brass cable glands sufficient to accommodate all incoming and outgoing cables.
- All non-current carrying and earthing fixing nuts, bolts, and washers shall be electro zinc plated and passivated.
- All metallic parts of the cubicle, fixtures and fittings shall be solidly connected to earth.
- Each T/R shall be fitted with 100% spare fuse cartridges clearly labelled as such.
- The cubicles and all associated steelwork shall be provided with a heavy duty painting system. The finish colour shall be subject to Client's approval.
- Prior to despatch to Site, the units shall be subject to full functional testing of all circuits and a full load heat run for a minimum period of 24 hours. In addition, the insulation resistance between primary, secondary and earth shall be proven by high voltage 'flash' testing. The Contractor shall develop a fully comprehensive detailed inspection and testing program for approval.

4.0 IMPRESSED CURRENT ANODES

Anodes will be of the high silicon iron chrome content single headed type. The body shall be mm long and mm dia. with an enlarged head.

The anodes shall comply with international standards and at the following composition:

Element	Content by Weight (%)
Silicon	14.5
Chrome	4.5
Manganese	0.75
Carbon	0.85
Sulphur	0.10
Phosphorus	0.25
Iron	Remainder

Any alternative anode materials and / or designs proposed by the Contractor shall be comprehensively described and illustrated with detailed drawings to Client's approval.

Documented track records of anode materials and designs shall also be included together with all performance data and material properties sufficient to demonstrate to Client's satisfaction that the anodes are suitable for the intended application.

Each anode shall be provided with an integral cable tail which shall be terminated in a recess in the enlarged anode head.

After removal of all sharp edges and contamination from around the outside of the anode head and insulating compound, the head shall be fitted with a mastic lined heat shrink cap. The cap shall be of a highly chemical resistant polyolefin material, purposely designed for this application to provide an impermeable barrier to the penetration of moisture and ground bed gases to the head. Heat shall be uniformly applied when fitting the heat shrink cap to ensure that it is free of wrinkles and blisters.

Following fitting of the heat shrink cap, a heavy-duty flexible neoprene sleeve shall be slipped over the anode cable tail, immediately adjacent to the anode cap and taped in place. The sleeve shall be sufficiently long and tough to prevent damage to the cable insulation by contact with the anode ground bed coke breeze.

5.0 C.P. JUNCTION BOXES

Stand-alone isolation joint test boxes and junction boxes shall be constructed in stainless steel or alternative high impact strength FRP (Fiber Reinforced Polymer) may be used at Client's discretion.

All fixtures and fittings will be stainless steel. All terminal components shall be nickel plated brass. Insulating terminal panels shall be non-hygroscopic FRP or SRBF (Synthetic Resin Bonded Fiberglass).

Each Junction Box or Isolation Joint Test Box shall contain Klippon-type rail-mounted terminal blocks into which the incoming cables shall be terminated.

All boxes shall incorporate captive elastomeric gaskets to maintain the IP 66 / hazardous area rating as appropriate, and incorporate a padlock buckle to secure the door / lid. A white/ black / white traffolyte identification label shall be fixed to the centre of the door/lid using stainless steel self-tapping screws. The label shall be engraved in 8mm high characters.

Each junction box shall be supplied complete with a 2" Dia., 3 meters long, schedule 40 carbon steel tubes, hot-dip galvanised to 85 microns thick minimum. The tubes shall be bolted to the underside of the junction box. The tubes shall act as mountings for the junction box and conduits through which the incoming cables shall be routed from below ground into the box. The free bottom end of each tube shall be formed into a 500 mm radius 90° bend.

6.0 MONITORING EQUIPMENT

Copper Sulphate (Cu/CuSo₄) half-cells designed to be permanently buried shall be supplied to monitor the polarisation potentials of the cathode surfaces. The half-cell components shall be designed and guaranteed to provide a minimum buried service life of 15 years and be contained and sealed within a large rugged porous terracotta housing. The half-cell shall contain high purity copper wire of 10 SWG at least 12m in length, immersed in a large reservoir of saturated copper sulphate gel. The half-cells shall be supplied complete with integral single core 16mm² multi-stranded copper cored cable tails of lengths, to enable them to be cabled directly into the T/R unit, junction boxes, or potential monitoring stations as appropriate. The cable insulation colour shall be yellow.

Each permanent reference electrode cable tail shall be fitted with two identical Critchley-type identification cable rings.

Portable and re-fillable copper/copper sulphate half-cells shall also be supplied. The half-cells shall be contained within a high impact clear plastic tube with a porous plug bung. Recharging of the copper sulphate crystals shall be accomplished via a screwed cap. An integral 5m long insulated cable tail shall be provided. 2 kgs of copper sulphate crystals shall be supplied.

7.0 SACRIFICIAL ANODES

Sacrificial CP anodes shall be either aluminium alloy, zinc alloy, or pre-packaged zinc alloy types, all as defined on contractual documents.

Aluminium anodes shall comply with the following requirements:

Composition / Characteristic	Composition Range by Weight (%)
Zinc	4.00 to 5.50
Indium	0.020 to 0.040
Iron	0.090 max.
Silicon	0.20 max.
Copper	0.004 max.
Others (each)	0.020 max.
Others (total)	0.050 max.
Aluminium	Balance
Closed Circuit Potential w.r.t. Ag/AgCl	≥ -1.05 volts
Capacity	≥2500 (A-H/kg)

Note : Aluminium anodes containing Bismuth shall not be permitted.

Anodes described as 'packaged' shall be supplied complete with a rapid wetting chemical backfill contained in a heavy duty cotton bag. The chemical backfill composition shall be as follows :

- 75% powdered gypsum

- 20% granular bentonite
- 5% sodium sulphate

The backfill shall be thoroughly dry mixed, to produce a graded homogeneous mixture. Each packaged anode shall be provided with an integral cable tail which shall be terminated in a recess in the enlarged anode head.

The cable tails shall be terminated using a sealed (caulked) lead technique to achieve a zero resistance connection to the anode alloy. The connection detail shall be sufficiently strong to prevent pull-out of the cable tail when a tensile force of 100 kg is applied to the cable.

The head seat shall then be filled with a hard setting, impermeable, insulating compound which shall bond to the anode alloy, sealed connection and cable tail insulation to provide a watertight encapsulation of the anode/cable tail connection.

Chemical analysis shall be carried out to prove that the anode alloy, complies with the approved composition.

A chemical analysis certificate shall be supplied with each batch of anodes supplied.