



"CATHODIC" PROTECTION



Cathodic protection systems

The image shows a large-scale industrial facility, likely a refinery or chemical plant. It features several tall, cylindrical distillation columns or towers, each equipped with multiple levels of metal scaffolding and ladders for access. The columns are interconnected by a dense network of pipes, some of which are curved into U-shapes. In the foreground, there are large, horizontal cylindrical tanks or storage vessels. The entire structure is set against a clear, light blue sky. The overall scene conveys a sense of complex industrial engineering and scale.

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► INTRODUCTION

PETUNIA's knowledge-based company with three decades of experience has been established specifically to provide engineering services, equipment, and construction for cathodic protection, earthing (grounding), and lightning systems.

This company has participated in many projects in the fields of oil, gas, petrochemical, mines, metals and the ministry of power.

This company with the cooperation of the expert team has succeeded in obtaining quality management certificates OHSAS1800, ISO14001, ISO9001 and the rank of two contracting qualifications.

We are continually developing our product range and listening to our customers to provide solutions and products that are technically compliant and commercially acceptable.

► CATHODIC PROTECTION

Cathodic protection is one of the most effective methods for preventing corrosion on a metal surface which can use for below exposed external structures;

- Pipelines – oil, gas, product, water, etc.
- Piping inside plant
- Above-ground storage tank bottom plate
- Underground storage tanks
- Well Casing
- Compressor stations
- Ship`s hull
- Marine structures, jetties, harbor, etc.
- Bridges and Concrete structures
- Marine pipelines and structures

Cathodic protection is also used to protect the internal surfaces of structures;

- Large diameter pipelines that have inside coating or cladding
- Inside storage tanks (oil and water included)
- Ship`s storage tankers (corrosive products carrier)
- Water-circulating systems

► PETUNIA CATHODIC PROTECTION ACTIVITIES

Engineering & Design Services

Our NACE-qualified engineers can provide cathodic protection design based on client specifications and recognized international standards. Other activities include investigation and conducting related tests, which are mentioned below;

- Soil resistivity testing
- Soil corrosion analysis (such as pH, Cl ions)
- CIPS (Close Interval Potential Survey),
- DCVG (Direct Current Voltage Gradient),
- AC corrosion monitoring and mitigation
- Determining the anode bed resistivity
- Determining the current required for protection
- Troubleshooting
- Detailed engineering
- Technical document preparation
- Pre-commissioning and commissioning of cathodic protection system

Training

One of the significant points of the Petunia Co. is to conduct training related to cathodic protection systems for our clients.

Procurement Services

We manufacture the full range of cathodic protection goods (transformer rectifiers, junction boxes and tests, and a wide range of high-performance, long-life anodes and high technology systems for synchronizing and remote monitoring) in the **PETUNIA** factory located near to Tehran in Abbas Abad industrial city.

Construction Services

PETUNIA's construction team can provide a full range of activities (operations) such as site investigation and installation of cathodic protection equipment.

► CATHODIC PROTECTION PRODUCTS

A. Transformer Rectifiers

A wide and varied range of high-quality transformer rectifiers is designed and manufactured in PETUNIA factory to meet the market requirement for all land and marine structures necessitating an Impressed Current Cathodic Protection system.

Petunia cathodic protection rectifiers are specially designed for operation in aggressive environments. These may include areas with corrosive, abrasive or high saline conditions, areas with high levels of dust, excess moisture or increased risk of high electrical discharge, etc.

Our transformer rectifiers are designed to meet the Standards of the International Electro Technical Commission (IEC) and Iranian Petroleum Standards (IPS), but can also be designed following the requirements of other recognized standards.

1 Phase and 3 Phase supplies to 400Volts, 50/60Hz are readily catered for within our standard arrangements.

Depending on ambient conditions and locations, air-cooled or oil-cooled units are generally used in CP systems. Petunia transformer rectifiers can be used in indoor and outdoor locations and are capable of supplying continuous, full-rated output at ambient temperatures from -25 up to +60°C (depending on their types).

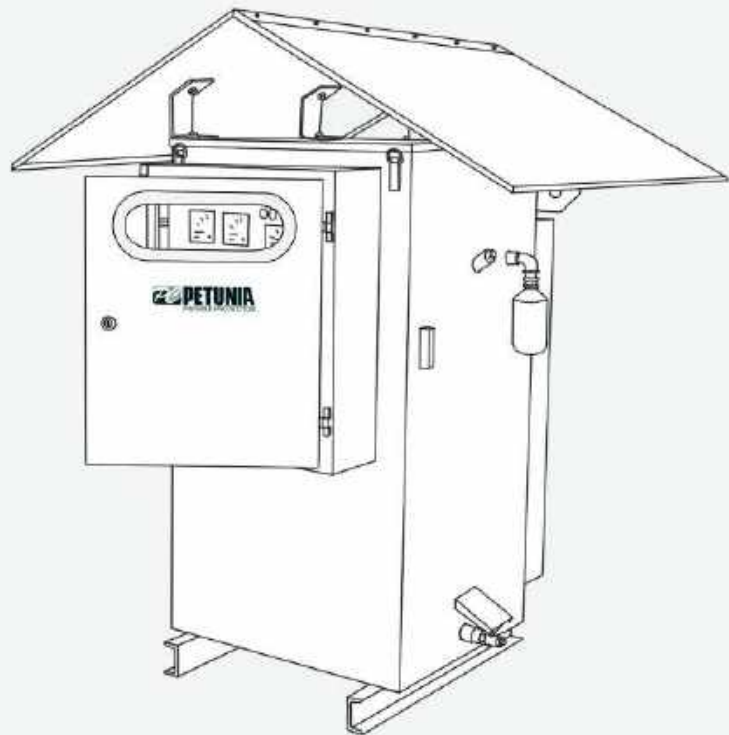
Based on client request we can produce:

- Heavy duty automatic oil-cooled CP TRs
- Automatic oil-cooled CP TRs
- Automatic air-cooled CP TRs
- Step type oil-cooled CP TRs

The transformer rectifier is supplied with a base frame and fixing bolts for plinth mounting and a sunshade for protecting the unit against direct sunlight and rain.

Features:

- Full micro-processor based control system.
- Constant voltage, constant current and constant potential operation.
- Step-less control over the full range of nominal output parameters.
- Precision control with fire angle control of power thyristors.
- 3 external one-turn potentiometer for setting output voltage, output current and potential.
- Cooling by the natural convection of transformer oil.
- Suitable to be supplied by 400V/50Hz/3P+N or 220V/50Hz/1P+N.
- Short circuit and overload protection on AC side & DC side.
- Surge protection & lightning protection on AC side & DC side.
- Input over-voltage, Input under voltage & phase failure protection.
- Continues and timer mode operation.
- AC input voltage, DC output voltage, DC output current & potential monitoring.
- Suitable for use at -25°C to +55°C ambient temperature and up to 90% humidity.
- Weatherproof enclosure and degree/UV-resistant coating



Remote Monitoring

The Remote Monitoring Unit (RMU) is designed primarily for monitoring of impressed current Cathodic Protection (CP) systems to ensure proper performance.

Remote monitoring units (RMU) provide the ability to monitor CP system performance data from remote locations using modem-equipped personal computers. They can provide their data to a central location through existing supervisory control and data acquisition (SCADA) systems or other wireless monitoring systems.

CP data is transmitted from the field units to an operational center. The widely used communication methods are GSM/SMS in areas that have cell phone coverage and satellite in areas that do not. In either case, data is transmitted automatically and wirelessly into a software package where it is displayed, archived and available for regulatory reporting. Alarms are generated automatically so that supervisory staff is constantly aware of the status of their CP system.

B. Impressed Current Anodes

For larger structures, or where electrolyte resistivity is high, galvanic anodes cannot economically deliver enough current to provide protection. In these cases, impressed current cathodic protection (ICCP) systems are used. These consist of anodes connected to a DC power source, often a transformer-rectifier connected to AC power.

Anodes for ICCP systems are available in a variety of shapes and sizes.

Common anodes are tubular and solid rod shapes or continuous ribbons or wires of various materials.

I. High Silicon Cast Iron Anode

Rod type silicon cast iron anodes are probably the most common anodes used in groundbed construction and the high corrosion resistance environment.

Application

- Vertical Groundbeds, Horizontal Groundbeds and Distributed Anodes.
- Suitable for Use in Soils, Mud, Carbonaceous & Petroleum Coke Backfill.

II. Canistered Anodes

Canisters are pre-packed anodes. Anodes are installed in a spirally wound galvanized steel canister. The canister is packed firmly with metallurgical coke or calcined petroleum coke to ensure even current transfer from the anode.

III. Mixed Metal Oxide Tubular Anodes

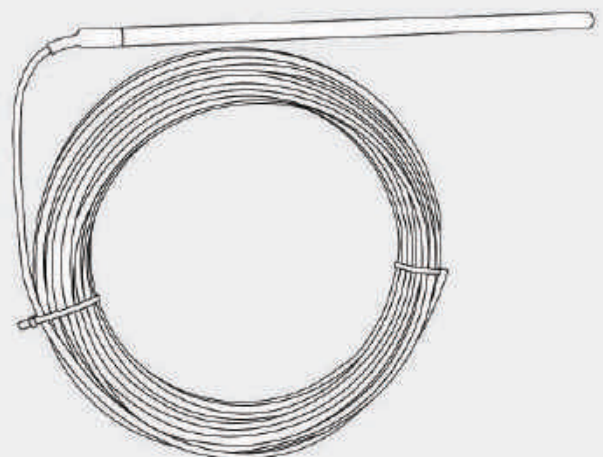
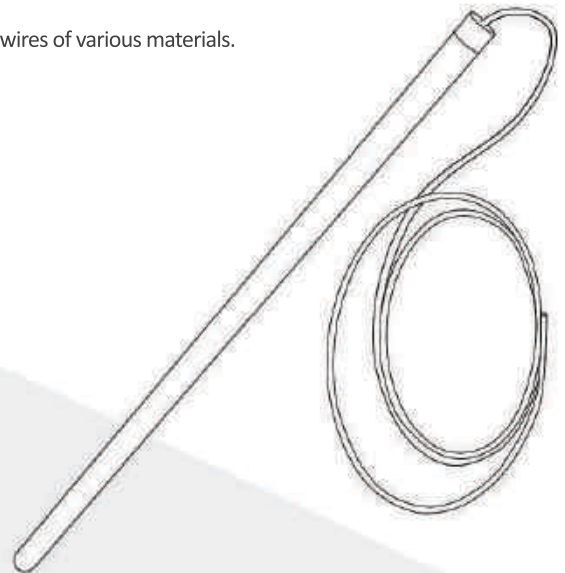
MMO Anodes are manufactured using titanium, which has been coated with Mixed Metal Oxide coating.

This permits greater current output in all types of ICCP anodes and provides the longest life.

Application

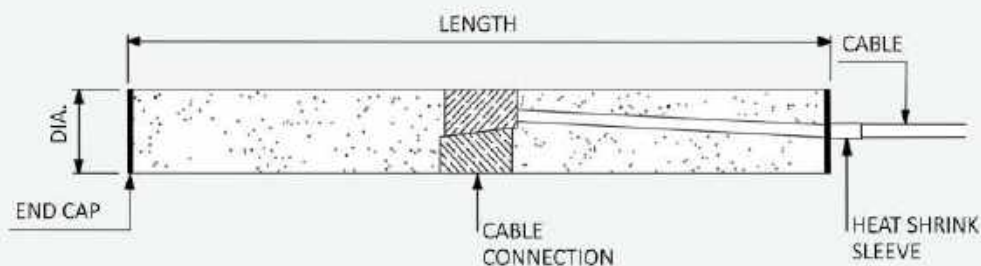
The more demand for this product is in

- Deep well Groundbeds
- Horizontal Groundbeds
- Marine Structures
- Seawater Intakes
- Distributed Anodes
- Tank Internals
- Soils
- Mud
- Carbonaceous & Petroleum
- Coke Backfill
- Fresh, Brackish and Sea Water



Item	Environment	Length Cm (inch)	Diameter Cm (inch)	Maximum Current Output (Amp)
1	Calcined petroleum coke breeze	50	2/5	4
	Fresh water			25
	Sea water	(19/7)	(1)	4
	Mud / Brackish water			
2	Calcined petroleum coke breeze	100	2/5	8
	Fresh water			50
	Sea water	(39/4)	(1)	8
	Mud / Brackish water			

Maximum Output Current of MMO Tubular Anode



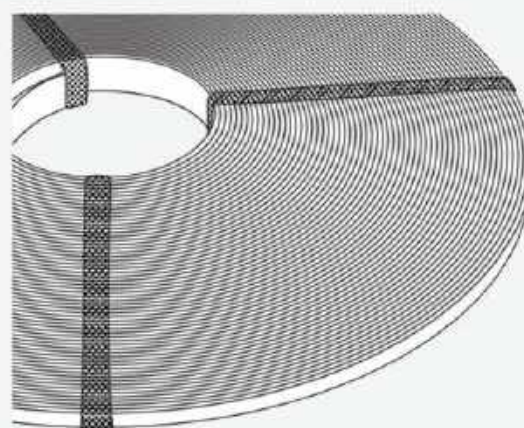
• **MMO Ribbon Anode:**

PETUNIA ribbon anodes for using in under tank and Reinforced concrete structures are manufactured in titanium substrate, which has been coated with Mixed Metal Oxide.

The ribbon mesh anode is field assembled with titanium conductor bars and a resistance welder. The design life of the anode varies with the operating current.

Application

Reinforced Concrete Structures & Above Ground Storage Tank Bottoms



Configuration	Status
Width	6.35mm (0.25")
Thickness	0.635mm (0.025")
Maximum Current Density in Fine Sand	42mA/m (12.8mA/Ft.)
Maximum Current Density in Concrete	1.5mA/m (0.45mA/Ft.)

MMO Ribbon Anode Characteristics

• **MMO Mesh Anode:**

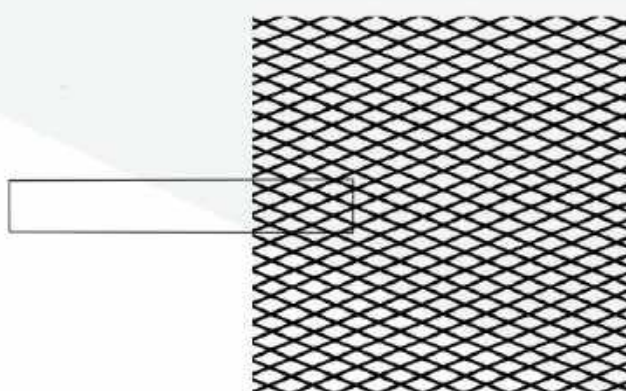
PETUNIA mesh anodes are manufactured in titanium substrate, which has been coated with Mixed Metal Oxide.

The diffusion of chloride ions into the concrete leads to the corrosion of steel rebars. The best way to prevent steel-reinforced concrete corrosion is cathodic protection.

The Anode Mesh is used in the Cathodic Protection of Reinforced Concrete Structures.

Application

Bridges, Decks, Harbors, Cooling Towers and Other Concrete Structure.



• **MMO Wire Anode:**

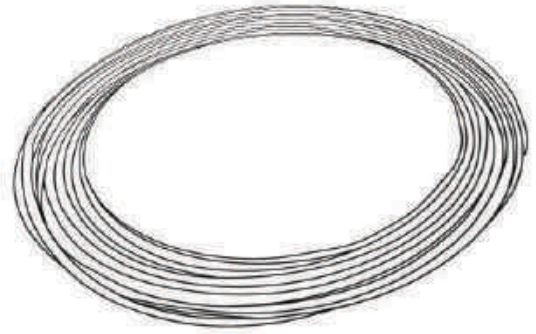
MMO Wire Anode consists of solid titanium substrate wire which has been coated with Mixed Metal Oxide.

PETUNIA wire anodes are manufactured in two diameters: 1.5 mm and 3.0 mm.

PETUNIA wire anodes can be used in a wide variety of cathodic protection applications.

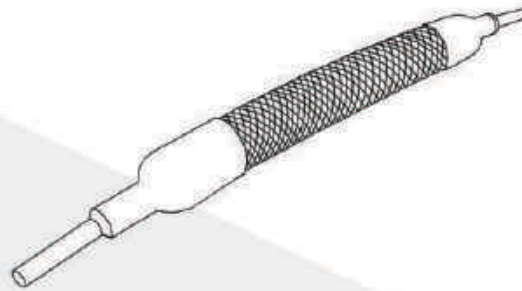
Application

Tank Internals, Continuous Horizontal Groundbeds, Discontinuous Horizontal Groundbeds.



• **Piggyback Wire Anode Systems:**

For use in pipelines, the product comprises Mixed Metal Oxide Wire Anode material “piggybacked” to a cable at predetermined intervals (to aid convenient current distribution and avoid attenuation and decreased driving voltage). The MMO wire and cable are contained within a cotton sock filled with calcined petroleum coke breeze backfill. The Piggy back Anode is placed alongside the pipeline with a suitable length so that the carrier cable at each end of the anode loop can be connected to a junction box.

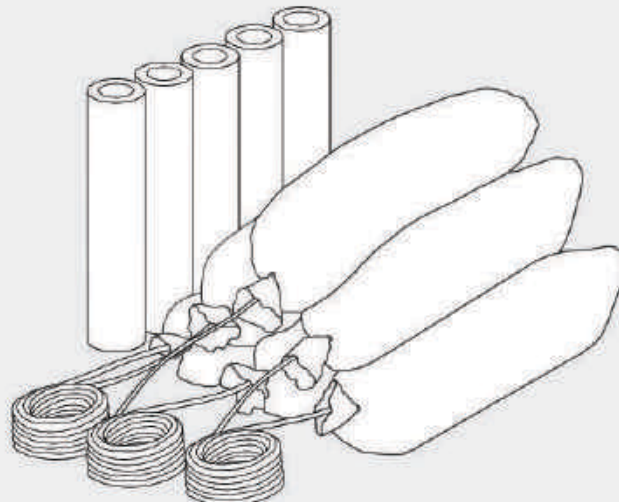


C. Sacrificial Anodes

I. Magnesium Anodes

Magnesium anodes are the most common sacrificial anodes used for the protection of buried structures in the soil and fresh water.

A magnesium anode is typically made up of an alloy composite of magnesium and other metals. They are available in a selection of prefabricated designs and weights to suit a wide range of installation requirements.



II. Zinc Anodes

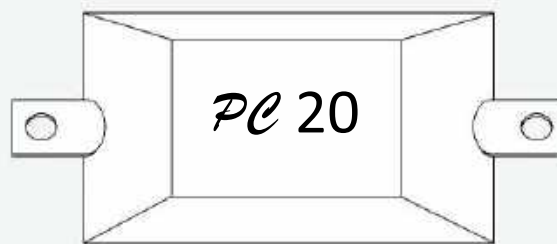
Zinc is generally utilized as a sacrificial anode material. Zinc anodes used for Cathodic Protection are cast from high-purity zinc (99.99%) alloyed with aluminum and cadmium with limitations on the level of lead, iron and copper.

Application

Submarine pipelines, ballast tanks, offshore structures, storage tank internals, quay walls, water tanks, marine applications and ships hulls.

Anode Alloy Type	Open Circuit Potential Negative Volts (Cu/CuSO ₄)	Current Efficiency % (min)	Energy Capability Amp-hr/kg (min)	Consumption Rate Kg-Amp-year (max)
Zinc	1/1	90	780	11/2

Sacrificial Zinc Anode Characteristics

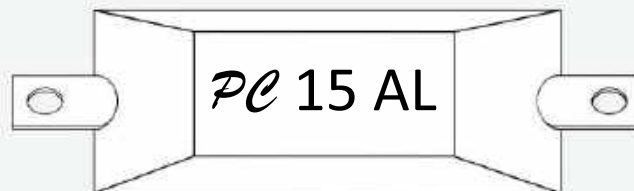


III. Aluminum Anodes

Aluminum alloy anodes have been formulated primarily for use in seawater. Alloys are also capable of achieving high output capacity in mud and brackish water. Aluminum anodes have approximately three times the capacity of zinc alloys.

Application

- Jetties
- Harbours
- Platforms
- Ship hulls
- Ballast tanks
- Drill rigs
- Pipelines
- Offshore windmill parks
- Tank internals



Element	Composition, % by Weight
Silicon	max 0.1
Iron	max 0.1
Copper	max 0.006
Zinc	5-3
Indium	0.05-0.02
Other elements, each,	max 0.02
Other elements, total,	max 0.05
Aluminum	Reminder

Sacrificial Aluminum Anode Characteristics



D. Cathodic Protection Junction Boxes

I. AC Box

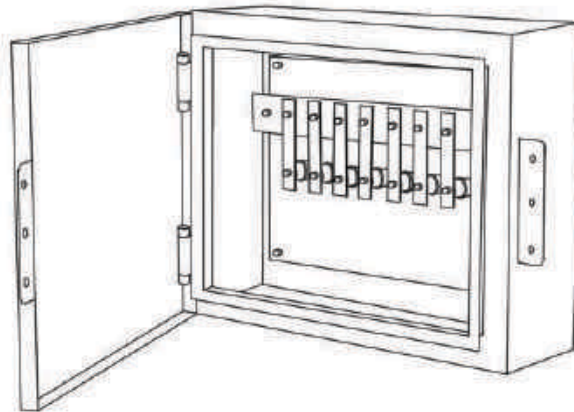
AC boxes are used to protect and divide the input power of transformer rectifiers. Two types of AC boxes consist of single phase and three phases manufactured by Petunia Company. The plate of the AC boxes is made of 2 or 3 mm thick sheet steel according to the project needs.

II. Bond Boxes

Cathodic protection multi-purpose junction boxes are designed to provide flexibility to the user for connecting different types of structures/equipment suitable for onshore and marine environments in safe and hazardous areas.

Bond boxes are made from 2 or 3 mm thick steel sheets with different ingress protection (IP).

Petunia Co. is ready to design and manufacture all types of bond boxes based on the requests of project needs.



III. Test Station

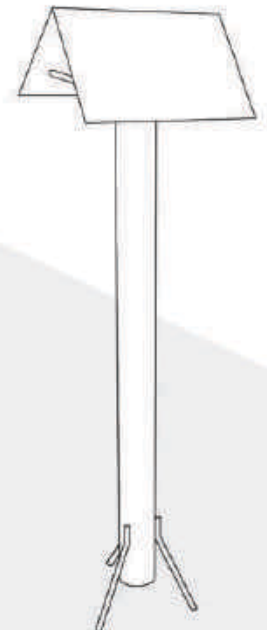
Test boxes and test boxes markers are used for the measurement of structure to electrolyte potentials, current flow, testing of insulated flanges, etc.

Concrete or carbon steel test stations are available according to the client's request or project needs.

IV. Markers

Markers are used to mark the path of the anode groundbed and the path of the pipeline.

Concrete or carbon steel markers are available according to the client's request or project needs.



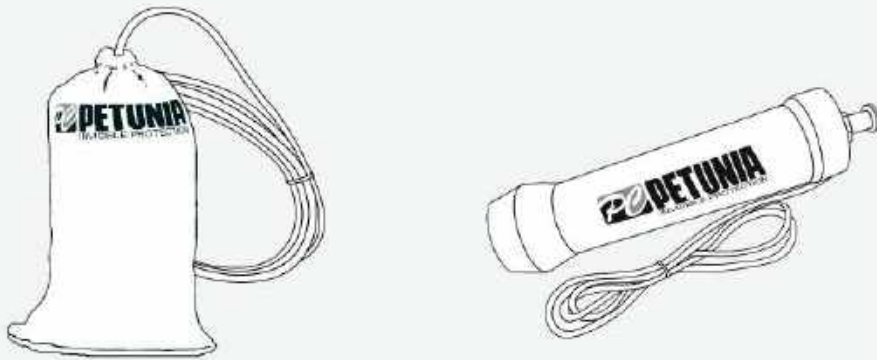
E. Test & Measurement Equipment

I. Cu/CuSO4 Reference Cell

Copper sulfate reference electrodes (CSE) are the most commonly used reference electrodes for measuring potentials of underground structures and also for those exposed to fresh water. It is not suitable for use in a chloride electrolyte as the chloride ions will migrate through the porous plug and contaminate the CSE.

Permanent Cu/CuSO4 reference electrodes provide accurate and reliable potential measurements on buried metallic structures particularly aboveground storage tanks. Their placement in close proximity to protected structures permits readings which are more exact and less affected by fluctuating soil conditions than those obtained by portable electrodes. This is a permanent copper/copper sulfate reference electrode with a proven track record for stability. Long-life performance is achieved through a rugged design, which includes impact resistant PVC tubing. The tubing houses a 99.99% pure copper element and a supersaturated solution of copper sulfate.

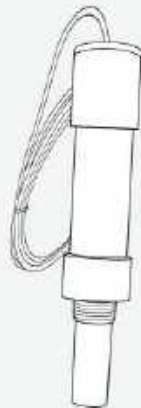
Portable reference cells can be used to take electrical potentials on buried structures, such as pipelines, underground storage tanks, and reinforced concrete structures.



II. Ag/AgCl Reference Cell

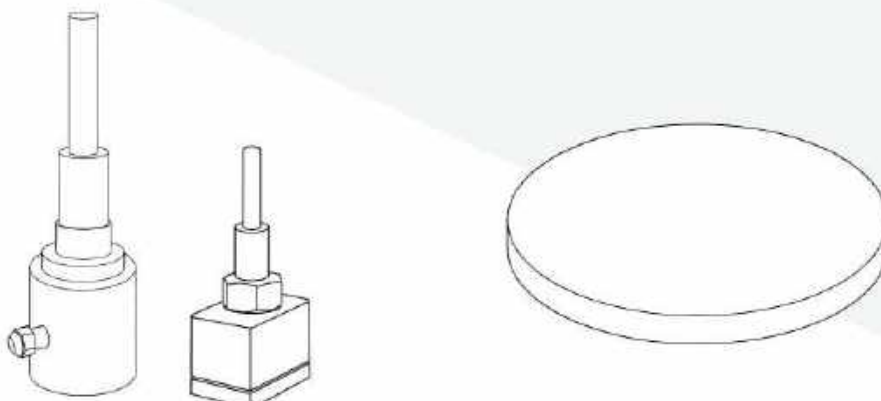
Ag/AgCl reference cell is designed to obtain potential readings on structures located in brackish or salt waters. The cell is made from a silver element, which is contained in an inert tube and surrounded by a supersaturated gel of silver chloride on structures located in aqueous environments containing high chloride concentrations, such as salt water, reference cell has the proven electrical stability for long-life performance.

Silver-silver chloride (Ag-AgCl) reference electrodes are used for potential measurements of tank internal and also in concrete structures.



III. Zinc Reference Cell

Zinc is sometimes used as a reference electrode since the potential of zinc is relatively stable. A zinc reference electrode can be used packaged in a cloth bag containing as same backfill as used around zinc anodes and also used in the bare type. Rod and disk types of the zinc reference electrodes are manufactured at PETUNIA factory.

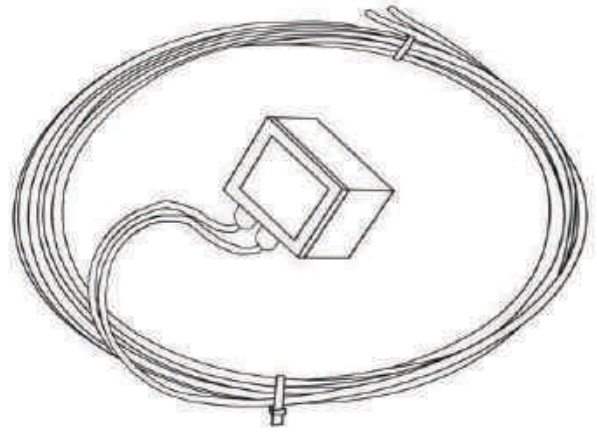


IV. Cathodic Protection Coupon

CP coupons can also be used to monitor cathodic protection criteria.

This is particularly useful on well-coated structures where few coating holidays exist. The coupon serves as a surrogate holiday and polarizes to the same structure potential.

The advantages of using CP coupons are that IR-drop-free potentials can be obtained without interrupting multiple power sources, structure-to-reference potentials can be measured on structures with direct-connected galvanic anodes, and depolarization tests can be conducted on the structure without de-energizing the CP system.



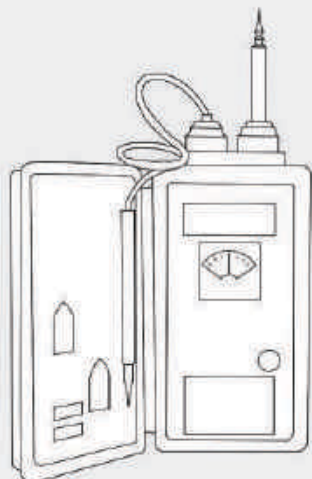
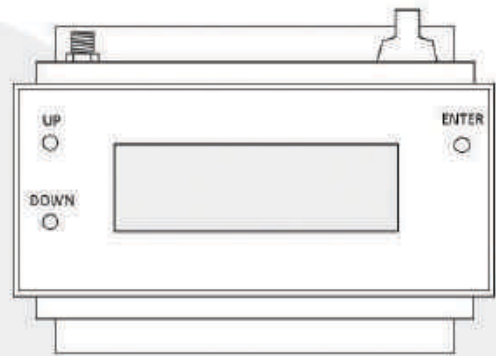
V. Data logger

Data loggers are electronic devices which automatically monitor and record data for cathodic protection systems such as potential with higher accuracy and speed.

VI. GPS Interrupter

For most pipelines extend over extremely long distances, or piping in plants with several transformer rectifiers the Cathodic Protection system needs to be switched on and off simultaneously during testing in order to measure the instant off potential. The internal time can be calibrated by GPS satellite, the Cathodic Protection Systems can be synchronized on and off from the pre-prescribed dates.

By setting the time parameters, the instrument automatically performs a periodic on/off control process.



VII. Flange Insulation Kit Tester

The correct performance of flange insulation kits can affect the cathodic protection system.

So, all types and sizes of insulators –flanges can be checked by using Radio Frequency technology to distinguish between insulation shorts and shorts associated with interconnected piping. It works by connecting two probes to the two flange sides and the percentage shown on the device is read.

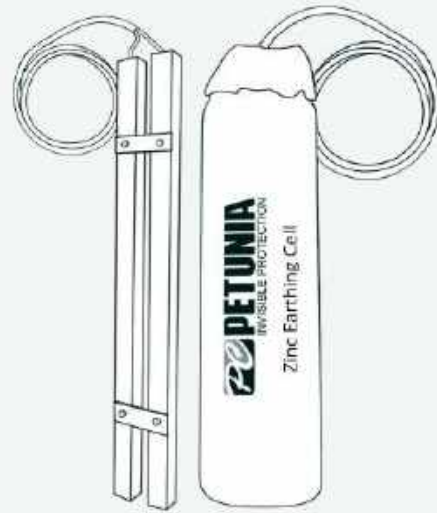
The high percentage shown on the device indicates that the leakage of the flange insulation kit is less, usually if the number shown on the device is less than 50%, the insulation kit needs to be checked and replaced.

F. Accessories

I. Zinc Earthing Cell

Zinc Earthing Cell consists of two zinc electrodes, insulated from one another. One electrode would typically be connected to the protected structure, the other to an unprotected system.

The electrodes are surrounded by low-resistivity backfill allowing large stray currents to pass between them. This enables the structure to be earthed on the ground.



II. Polarization Cell (PC)

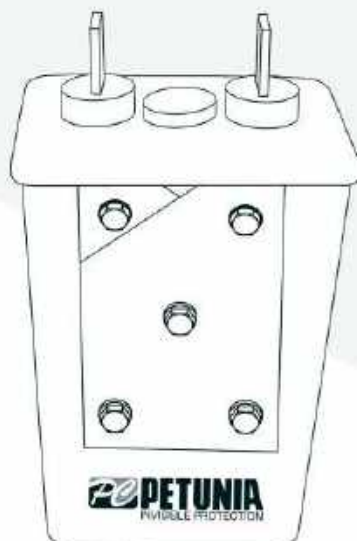
Electrolytic cells, known as polarization cells, are designed to protect personnel and equipment from electrical disturbances.

PC consisting of nickel plates immersed in an aqueous solution of potassium hydroxide was measured and its performance was determined for power–frequency fault currents.

The main characteristic of the polarization cell is not to oppose AC flowing and to stop the DC. In the cathodic protection field, polarization cells are used to protect insulating joints on pipes, to discharge the voltages induced in pipelines by atmospheric discharges toward grounding systems, and against eventual AC interferences induced by railways on protected structures. The electric conduction fires at a voltage higher than 1.2 V and to obtain higher tensions, more than one cell has to be connected in series while to obtain higher currents has to be connected in parallel.

Parameter	Magnitude
Leakage current up to 1.5 volts	< 30mA
DC current tolerable	30A
Tolerable short circuit current	5KA
Tolerable lightning current	100KA

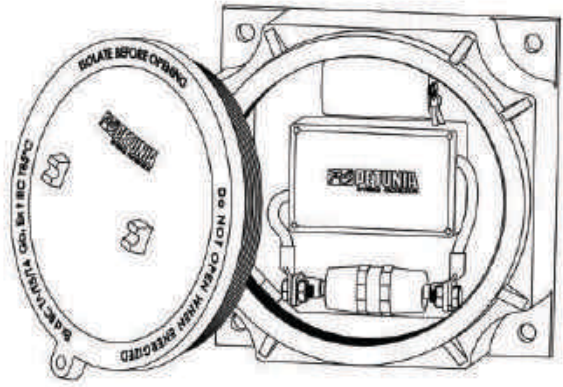
Polarization Cell Characteristics



III. Polarization Cell Replacement (PCR)

The PCR is a solid-state device designed to simultaneously provide DC decoupling and AC continuity /earthing when used with cathodically protected structures, such as pipelines, tanks, and earthing systems.

By decoupling the cathodic protection system from earthing systems and other structures, the CP requirements can be minimized while maintaining an effective ground or bond rated for AC faults and lightning current.



Parameter	Magnitude
Blocking voltage Range	-18V _ +18V
Leakage current in the blocking voltage range	< 30mA
DC current tolerable	25A _ 100A
Tolerable short circuit current	5KA _ 50KA
Tolerable lightning current	100KA

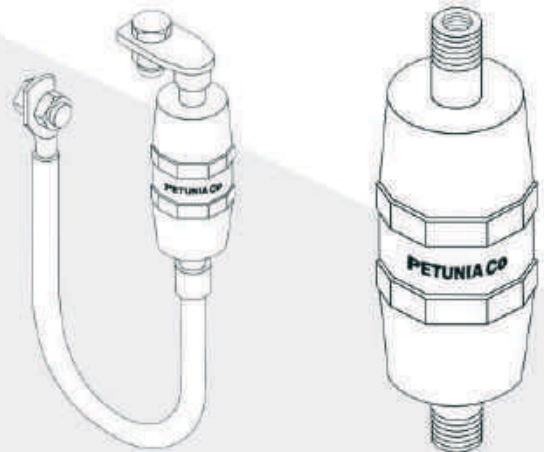
Polarization Cell Replacement Characteristics

IV. Spark Gap

A spark gap consists of an arrangement of two conducting electrodes separated by a gap filled with a gas, designed to allow an electric spark to pass between the conductors. Normally, the two circuits on either side of the spark gap are isolated. When the potential difference between the conductors exceeds the breakdown voltage of the gas within the gap, a spark forms, ionizing the gas and drastically reducing its electrical resistance.

The spark gap is available for bridging insulating flanges in cathodically protected pipe sections in hazardous and safe areas in case of surge and lightning currents.

Spark gaps are manufactured in two types of conventional and explosion proof with different current ranges.



Parameter	Magnitude
Dimensions	120mm×42mm (LxD)
Tolerable lightning current	100KA
Tolerable AC voltage	240V
DC voltage tolerable	500V
Overvoltage shock	< 1.2KV
Protection voltage	< 2.5KV

Spark Gap Characteristics

V. Thermite Welding

Thermite welding is a simple, inexpensive, and efficient method of attaching a copper conductor cable to steel or cast iron. It is particularly useful for connecting cathodic protection cables to pipelines including test leads, and negative and bonding cables.

The welding process uses a high-temperature reaction charge of powdered copper oxide and aluminum which ignites and produces aluminum oxide and super-heated copper.

- **Graphite Mould**

PETUNIA moulds are made of heat-resistant semi-permanent graphite and are used for making the Petunia Welding Powder "PetWeld" connection.

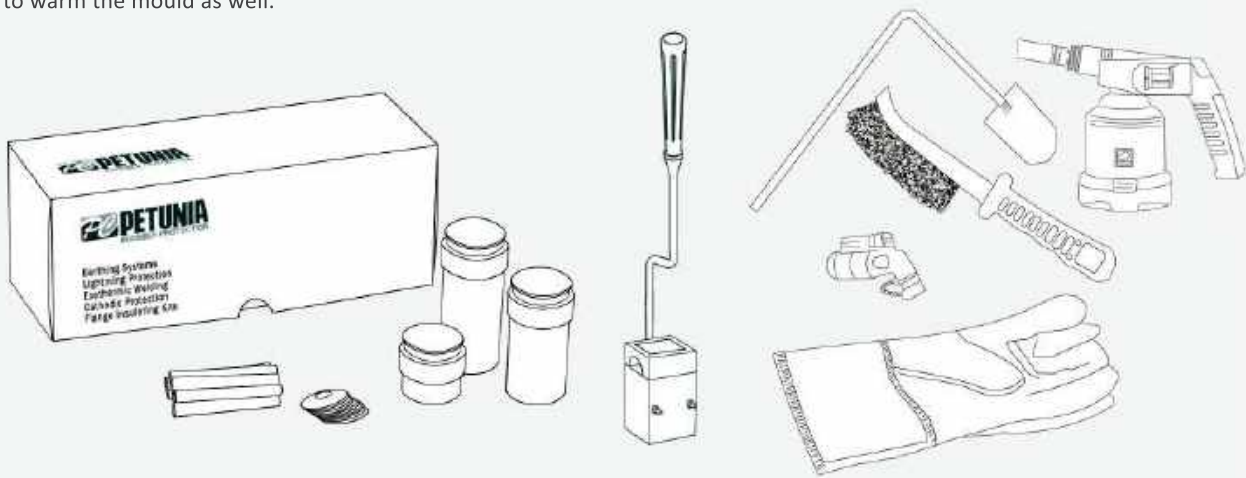
The high-temperature thermic reaction takes place in the crucible of the moulds allowing molten copper to flow through the tap hole into the weld cavity, producing a solid joint. They can be used for over 50 connections under normal usage.

- **PetWeld" Cartridge**

Petweld" powder, a mixture of copper oxide and aluminum, comes in plastic tubes. Each tube contains a measured quantity of weld-material powder. The powder supplied is sufficient to make the appropriate joint. Powders are available in two types for both general and cathodic protection purposes.

- **Tools Kit**

A set of cleaning tools, a flint gun, and a fire flame are required to clean the conductors and moulds to start the reaction and to warm the mould as well.



VI. Pin Brazing Set

The brazing process is initiated by depressing a trigger on the brazing gun. This is passed as most forms of electrical welding simply complete a circuit through which a DC current.

Within a CP system, there are multitude of connection requirements for anode cables, measuring posts, etc, being extremely versatile, the pin brazing system can be used.

Two basic types of connection can be made:

- Threaded Type Connection using an M8, M10 or M12 Threaded Brazing Pin. A normal copper crimp lug (supplied separately) is attached to the stud and secured in place with locknuts and washers (included with pin).
- Direct Type Connection using an 8mm Direct Brazing Pin and a Pin Brazing cable lug, available to suit cable sizes 10 mm² to 50 mm² For each type of connection a ceramic ferrule is required for each braze in either 12mm (threaded connection) or 8mm (direct connection) size.



VII. Cathodic Protection Cables

The cables used in cathodic protection systems are single-core type insulated coating. The cable conductor shall be annealed of copper thread and the strings shall be of circular cross-section. Cable coating usually consists of two insulation and sheath segments.

Primary insulation of the cable shall be made of materials physically and chemically resistant to the environmental impact of the service in a buried or submerged state.

The cable sheath shall also be continuous, uniform thickness and meet the minimum required thickness. The cable sheath shall be such that it can be removed without damaging the insulation. Cable coating (insulation and sheath) shall be completely free from any cracks, gaps, scratches, or other discontinuities.

• Cable With Polyvinylchloride Coating (XLPE/PVC)

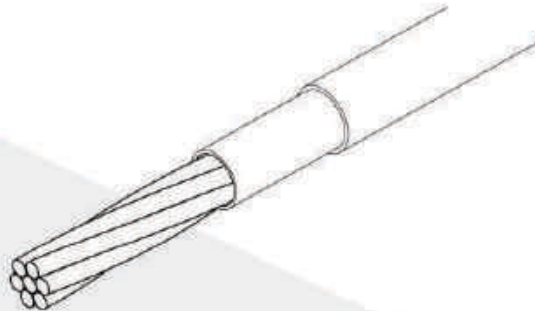
XLPE stands for cross-linked polyethylene material and PVC stands for polyvinyl chloride insulation.

Single core XLPE insulated/PVC sheathed 600/1000V with copper conductor is used in common cathodic protection applications, including buried structures in chlorine-free soils and fresh waters.

• Cable With High Molecular Weight Polyethylene Coating (HMWPE/PVDF)

This cable is used in common cathodic protection applications, in this type of cable, the insulation and sheath are made of polyvinylchloride or the chemical compound of vinyl chloride and vinyl acetate.

This cable is mostly used in environments containing high chlorine and corrosive, including soils containing chlorine, saline, seawater and low pH acidic environments.



VIII. Cathodic Protection Backfill

The composition of backfill shall be determined such that the local resistivity is lowered and the buildup of self-corrosion of the anode surface is prevented. In cathodic protection generally, two types of backfill are used.

1. Backfill for Impressed Current Anodes

Coke breeze is a carbon backfill which is used around impressed current anodes for underground cathodic protection applications.

It is used to:

- Reduce the resistivity of the environment surrounding the anode to increase the amount of current the anode can discharge
- Extend the anode surface area, thus increasing the amount of current the anode can discharge
- Reduce consumption of the anode since the carbon becomes part of the anode consumed before the anode itself.

Particle size and shape are also important when specifying a backfill. Both parameters determine the contact area between anode and ground while influencing the porosity of the column, which is important for gas ventilation. A general-purpose coke breeze is for use in shallow horizontal and vertical groundbeds.

For deep well applications, a special calcined petroleum coke breeze is used.

Generally carbonaceous backfill material usually is one of the following types:

Type 1: Coal coke breeze

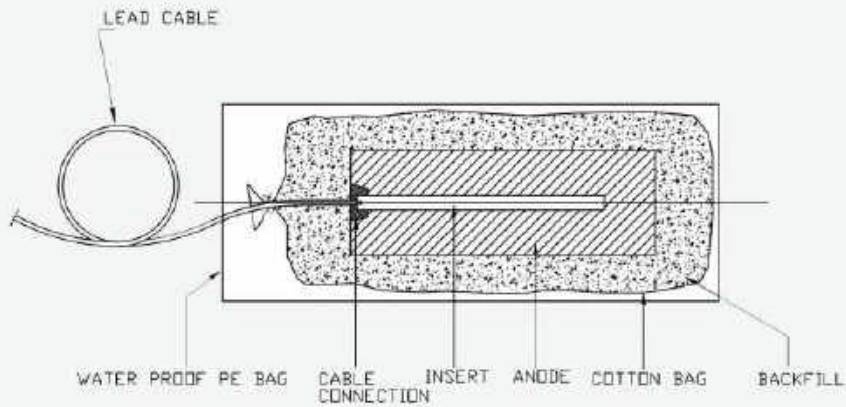
Type 2: Calcined petroleum coke breeze

Type 3: Special calcined petroleum coke breeze



2. Backfill for Sacrificial Anodes

A special backfill will be used in soil for reducing the resistivity of the environment and also increase the uniformity of anode current output.



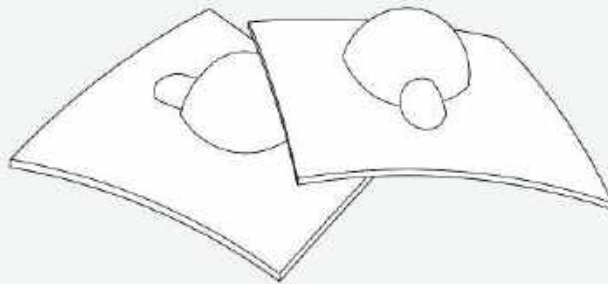
Item	Gypsum (CaSO ₄) %		Bentonite Clay %	Sodium Sulfate %	Approx. Resistivity in Ohm-Cm
	Hydrated	Molding Plaster (Plaster of Paris)			
A	25	---	75	---	250
B	50	---	50	---	250
C	---	50	50	---	250
D	75	---	20	5	50

Sacrificial Anode Backfill Characteristics

IX. Handy Cap

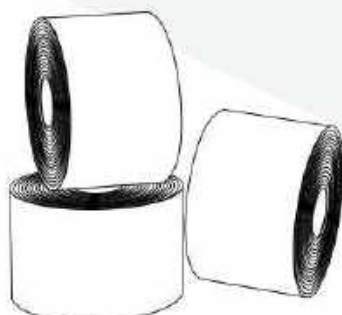
Handy Cap is the complete weld connection sealer. It is designed to fit any welded connection and is installed simply by pressing firmly into place.

A strong wire connection to the structure is important for all cathodic protection systems. A properly sealed weld connection will last for many years, PETUNIA supplies easy-to-use Handy caps, primer & related tapes.



X. Tapes

When a wire splice or repair has to be made to a cathodic protection system you want to use a tape that works. Vinyl tapes are commonly used to repair or seal aboveground cathodic protection, they are also employed over buried wire splices as a secondary cover. They can be stretched easily and are resistant to UV rays. Rubber and mastic tape is thick and extremely moisture resistant.



XI. Flange Insulating Gasket Kits

Flange insulation kits for metallic pipelines are available in two types for all flange sizes and pressure ratings. Flange insulation kits are commonly installed at the end of a pipeline to electrically isolate the pipe for other buried foreign metallic structures and plant earthing systems, therefore, limiting the amount of cathodic protection current required to protect the pipeline.

TYPE E

Type E is a full-faced gasket with the same outside diameter as the flange and precision-cut bolt holes.

Type E gaskets are available in the plain face or Neoprene face phenolic, as well as a variety of high-temperature materials.

TYPE F

Type F gaskets are made to fit the raised face portion of the flange only. As there are no bolts holes in the F gasket, the inside diameter of the bolt hole circle is slightly smaller than the outside diameter of the gasket, assuring an exact, automatic positioning of the gasket. Available in the plain face or Neoprene faced phenolic, as well as a variety of high-temperature materials.



Insulating Sleeves & Washers

Insulating sleeves manufactured of high density polyethylene are available in a full range of sizes. Also available are one-piece integral sleeves and washers which are made of phenolic, providing superior compression strength. Integral sleeves are available in all sizes.

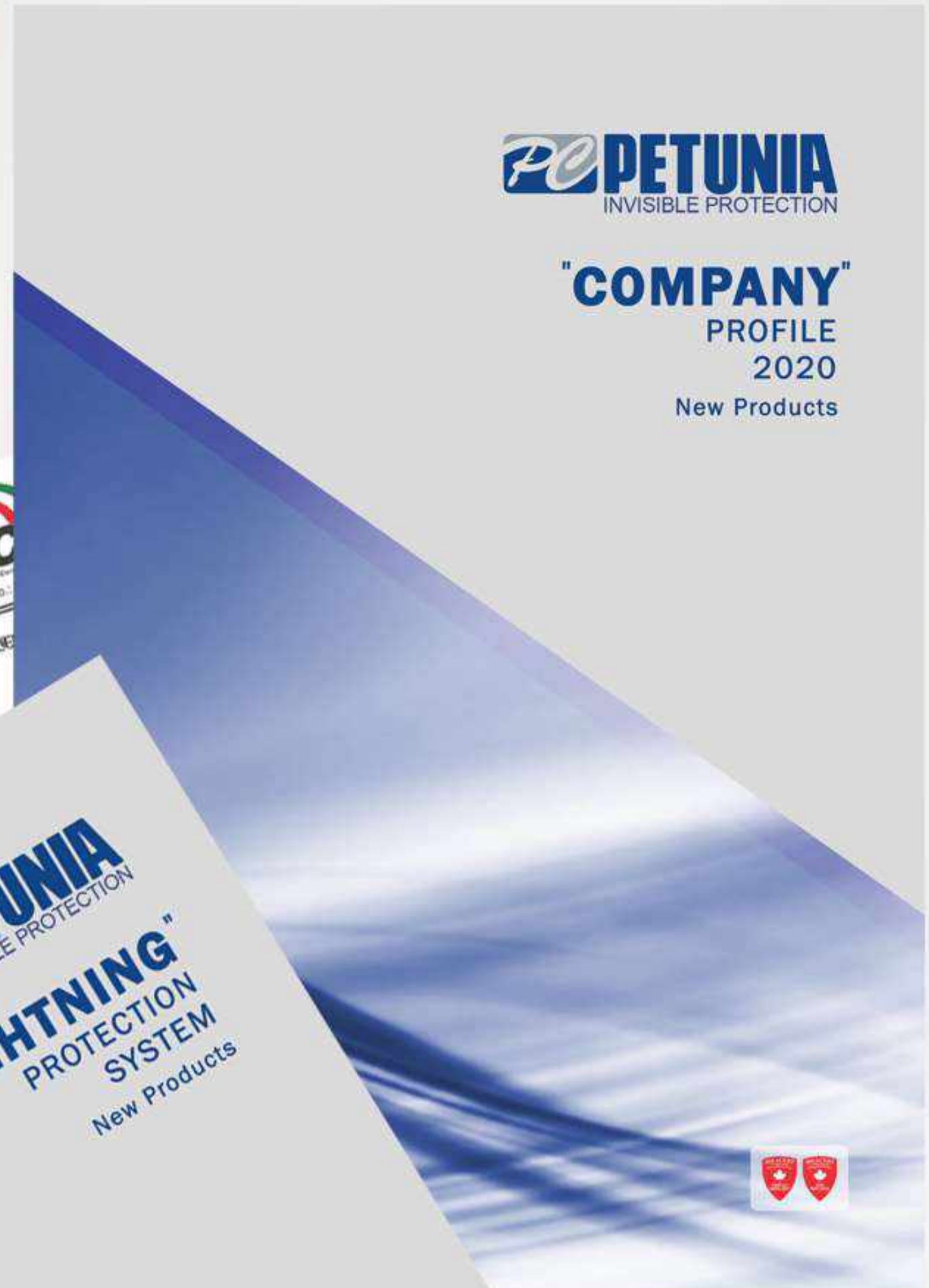
XII. Cable Splicing Kits

Cable splicing kits are manufactured from durable plastic suitable for either 2 or 3-way cable splicing of low current (LV) cables. These splice kits protect the cable joint from moisture ingress.

Splice kits have proven to be very strong in many environmental conditions. They are moisture-resistant for above or below-ground applications.

They are used in cathodic protection systems to protect the cable joints.







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