DATA SHEETS

MIXED METAL OXIDE ANODES FOR CATHODIC PROTECTION APPLICATIONS
TELPRO TUBULAR ANODES DATA SHEET

Titanium Electrode Products Companies, “TELPRO,” are manufacturers of mixed metal oxide anodes for cathodic protection.

**TELPRO Tubular Anodes** are manufactured using titanium, which meets ASTM B338 Grade 1 or Grade 2 standards, which has been coated with **TELPRO Mixed Metal Oxide** coating.

**TELPRO MMO** coating consists of IrO2/Ta2O5 and is suitable for use in all cathodic protection applications. Because mixed metal oxide anodes have an extremely low consumption rate, the titanium substrate remains constant throughout the design life of the anode.

Based upon accelerated life testing, conducted by an independent laboratory, **TELPRO MMO** coating has been proven to be equivalent or superior to other mixed metal oxide coatings which are currently being used; a copy of this test report is available upon request.

Strict quality control procedures are followed throughout the entire coating process, to guarantee proper coating adhesion and loading. Also, **TELPRO** products are tested using an X-Ray Fluorescence Spectrometer, to ensure production of the highest quality product, which is fundamental in every step of the manufacturing process.

<table>
<thead>
<tr>
<th>APPLICATIONS</th>
<th>CURRENT OUTPUT</th>
<th>DESIGN LIFE</th>
</tr>
</thead>
<tbody>
<tr>
<td>CANISTERED ANODES</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ABOVE GROUND STORAGE TANKS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>UNDERGROUND STORAGE TANKS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>WATER STORAGE TANKS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>HORIZONTAL GROUNDBEDS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TUBULAR AND SHEET PILES</td>
<td></td>
<td></td>
</tr>
<tr>
<td>VERTICAL GROUNDBEDS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DEEP WELL ANODE GROUNDBEDS</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**PERFORMANCE DATA AND RATINGS**

<table>
<thead>
<tr>
<th>COKE, SOIL AND FRESH WATER</th>
<th>CURRENT OUTPUT</th>
<th>DESIGN LIFE</th>
</tr>
</thead>
<tbody>
<tr>
<td>3/4” x 48” (19mm x 1,220mm)</td>
<td>7 Amps</td>
<td>20 years</td>
</tr>
<tr>
<td>1” x 19.7” (25mm x 500mm)</td>
<td>4 Amps</td>
<td>20 years</td>
</tr>
<tr>
<td>1” x 39.4” (25mm x 1,000mm)</td>
<td>8 Amps</td>
<td>20 years</td>
</tr>
<tr>
<td>1” x 48” (25mm x 1,220mm)</td>
<td>3.5 Amps *</td>
<td>20 years</td>
</tr>
<tr>
<td>1” x 60” (25mm x 1,500mm)</td>
<td>4.5 Amps *</td>
<td>20 years</td>
</tr>
<tr>
<td>1.25” x 48” (32mm x 1,220mm)</td>
<td>12 Amps</td>
<td>20 years</td>
</tr>
</tbody>
</table>

* Current outputs are de-rated for use in metallurgical coke breeze - 50Am²
TELPRO TUBULAR ANODES DATA SHEET

<table>
<thead>
<tr>
<th>SEAWATER</th>
<th>CURRENT OUTPUT</th>
<th>DESIGN LIFE</th>
</tr>
</thead>
<tbody>
<tr>
<td>3/4&quot; x 48&quot; (19mm x 1,220mm)</td>
<td>45 Amps</td>
<td>20 years</td>
</tr>
<tr>
<td>1&quot; x 19.7&quot; (25mm x 500mm)</td>
<td>25 Amps</td>
<td>20 years</td>
</tr>
<tr>
<td>1&quot; x 39.4&quot; (25mm x 1,000mm)</td>
<td>50 Amps</td>
<td>20 years</td>
</tr>
<tr>
<td>1.25&quot; x 48&quot; (32mm x 1,220mm)</td>
<td>75 Amps</td>
<td>20 years</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ENVIRONMENT</th>
<th>MAX CURRENT DENSITY</th>
<th>LIFETIME</th>
</tr>
</thead>
<tbody>
<tr>
<td>CARBONACEOUS BACKFILL</td>
<td>4.6A/ft² (50A/m²)</td>
<td>20 years</td>
</tr>
<tr>
<td>CALCINED PETROLEUM BACKFILL</td>
<td>9.3A/ft² (100A/m²)</td>
<td>20 years</td>
</tr>
<tr>
<td>FRESHWATER</td>
<td>9.3A/ft² (100A/m²)</td>
<td>20 years</td>
</tr>
<tr>
<td>BRACKISH WATER</td>
<td>9.3-27.8A/ft² (100-300A/m²)</td>
<td>20 years</td>
</tr>
<tr>
<td>SEAWATER</td>
<td>55.8A/ft² (600A/m²)</td>
<td>20 years</td>
</tr>
</tbody>
</table>

Lifetimes stated are nominal, we can supply Amps / life different to stated standards on request.

TYPICAL APPLICATIONS FOR TUBULAR ANODES

**HORIZONTAL GROUNDBEDS**
- PROTECTION OF CROSS COUNTRY PIPELINES
- ANODES TYPICALLY INSTALLED IN A TRENCH WITH COKE BACKFILL
- IDEAL FOR AREAS OF LOW RESISTIVITY / NO ACCESS / R.O.W. ISSUES

**DEEPWELL GROUNDBEDS**
- PROTECTION OF PIPELINES / WELL CASINGS
- ANODES INSTALLED IN COKE BREEZE COLUMN OR BELOW WATER TABLE LEVEL
- USED IN AREAS OF HIGH SURFACE RESISTIVITY AND/ OR ACCESS / R.O.W. LIMITATIONS
- ACTIVE WELL AREA LINED WITH PERFORATED CASING
TELPRO DEEP WELL ANODES DATA SHEET

- HEADER CABLE
- PLAIN uPVC CASING
- PLAIN VENT PIPE
- PERFORATED uPVC CASING
- MMO/Ti TUBULAR ANODE
- ANODE CENTRALISERS
- PERFORATED VENT PIPE
- END WEIGHT
- CASING SUMP
Titanium Electrode Products Companies, “TELPRO,” are manufacturers of mixed metal oxide anodes for cathodic protection.

**TELPRO Wire Anodes** are manufactured using solid titanium, which meets ASTM B886 Grade 1 or Grade 2 standards, which has been coated with **TELPRO** Mixed Metal Oxide coating.

**TELPRO MMO** coating consists of IrO2/Ta2O5 and is suitable for use in all cathodic protection applications. Because mixed metal oxide anodes have an extremely low consumption rate, the titanium substrate remains constant throughout the design life of the anode.

**TELPRO MMO Wire Anodes** are available in two standard sizes, with two standard current output ratings. Other sizes and current output ratings are available upon request. Based upon accelerated life testing, conducted by an independent laboratory, **TELPRO MMO** coating has been proven to be equivalent or superior to other mixed metal oxide coatings which are currently being used; a copy of this test report is available upon request.

Strict quality control procedures are followed throughout the entire coating process, to guarantee proper coating adhesion and loading. Also, **TELPRO** products are tested using an X-Ray Fluorescence Spectrometer, to ensure production of the highest quality product, which is fundamental in every step of the manufacturing process.

**PERFORMANCE DATA AND RATINGS**

<table>
<thead>
<tr>
<th>ELECTROLYTE</th>
<th>MAXIMUM CURRENT DENSITY</th>
<th>LIFETIME</th>
</tr>
</thead>
<tbody>
<tr>
<td>SOIL</td>
<td>4.6 A/ft² (50A/m²)</td>
<td>20 YEARS</td>
</tr>
<tr>
<td>CARBONACEOUS BACKFILL</td>
<td>9.3 A/ft² (100A/m²)</td>
<td>20 YEARS</td>
</tr>
<tr>
<td>FRESHWATER</td>
<td>9.3 A/ft² (100A/m²)</td>
<td>20 YEARS</td>
</tr>
<tr>
<td>BRACKISH WATER **</td>
<td>9.3 - 27.8 A/ft² (100 - 300A/m²)</td>
<td>20 YEARS</td>
</tr>
<tr>
<td>SEAWATER</td>
<td>55.8 A/ft² (600A/m²)</td>
<td>20 YEARS</td>
</tr>
</tbody>
</table>

Coating loading can be increased or decreased depending on particular life / current density requirements

**USA OFFICE** : PHONE 281 498 4727 FAX 281 498 4728 TOLL FREE 877 483 5776
**UK OFFICE** : PHONE 44 1453 845 718 FAX 44 1453 845 719
**WEB** : WWW.TELPROCOMPANIES.COM
**EMAIL** : MASH@TELPROCOMPANIES.COM / CATHY@TELPROCOMPANIES.COM / ANDREW@TELPROCOMPANIES.COM
TELPRO WIRE ANODES DATA SHEET

TELPRO WIRE ANODES CURRENT RATING IN CALCINED PETROLEUM COKE:

- 0.062" (1.5mm) - 200mA/linear ft (656mA/linear m)
- 0.125" (3.175mm) - 400mA/linear ft (1,312mA/linear m)

BASED ON 20 YEAR DESIGN LIFE

Lifetimes stated are nominal, we can supply Amps/life different to stated standards on request.

TYPICAL APPLICATIONS FOR WIRE ANODES

SUSPENDED MMO WIRE ANODES FOR TANK INTERNAL PROTECTION

ANODES SUSPENDED / SECURED THROUGH EYEBOLTS IN TANK FLOOR / ROOF

ANODE WIRE RATING DETERMINED BY LIFE / ELECTROLYTE / TEMPERATURE FACTORS

EXTERNAL BOTTOM PLATE PROTECTION

UNDERTANK SYSTEM LAYOUT – CONCENTRIC WIRE / PIGGYBACK ANODE LOOPS

CAN OFFER GREATER CONTROL OF CP SYSTEM AND NO EXPOSED WELDING OF Ti BAR / ANODES

EASY TO INSTALL WITH PRE-CUT LENGTHS OF WIRE

ALTERNATIVE TO TUBULAR ANODES

WIRE ANODE

GALVANISED STEEL CANISTER

COKE BREEZE BACKFILL

IDEAL FOR DISTRIBUTED ANODE SYSTEMS IN CONGESTED PLANT AREAS.
TELPRO RIBBON ANODES DATA SHEET

Titanium Electrode Products Companies, “TELPRO,” are manufacturers of mixed metal oxide anodes for cathodic protection.

TELPRO Ribbon Anodes are manufactured using solid titanium, which meets ASTM B265 Grade 1 or Grade 2 standards, which has been coated with TELPRO Mixed Metal Oxide coating.

TELPRO MMO coating consists of IrO2/Ta2O5 and is suitable for use in all cathodic protection applications. Because mixed metal oxide anodes have an extremely low consumption rate, the titanium substrate remains constant throughout the design life of the anode.

Based upon accelerated life testing, conducted by an independent laboratory, TELPRO MMO coating has been proven to be equivalent or superior to other mixed metal oxide coatings which are currently being used; a copy of this test report is available upon request.

Strict quality control procedures are followed throughout the entire coating process, to guarantee proper coating adhesion and loading. Also, TELPRO products are tested using an X-Ray Fluorescence Spectrometer, to ensure production of the highest quality product, which is fundamental in every step of the manufacturing process.

<table>
<thead>
<tr>
<th>APPLICATIONS</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>ABOVE GROUND STORAGE TANK BASES</td>
<td></td>
</tr>
<tr>
<td>STEEL REBAR IN CONCRETE</td>
<td></td>
</tr>
<tr>
<td>LINEAR FLEX ANODE FOR INPLANT PIPEWORK</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>MMO RIBBON ANODE SPECIFICATIONS</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>COATING :</td>
<td>IRIDIUM BASED MIXED METAL OXIDE</td>
</tr>
<tr>
<td>SUBSTRATE :</td>
<td>TITANIUM ASTM B265 Gr1</td>
</tr>
<tr>
<td>NOMINAL DIMENSIONS:</td>
<td>0.25&quot; (6.35mm) Wide X 0.025&quot; (0.635mm) Thick</td>
</tr>
<tr>
<td>COIL LENGTH :</td>
<td>328ft (100m)</td>
</tr>
<tr>
<td>COIL WEIGHT :</td>
<td>3.5 lbs (1.6 Kgs)</td>
</tr>
<tr>
<td>SURFACE AREA :</td>
<td>0.014m2/m</td>
</tr>
<tr>
<td>RESISTANCE :</td>
<td>0.042 ohms/ft</td>
</tr>
</tbody>
</table>

USA OFFICE : PHONE 281 498 4727 FAX 281 498 4728 TOLL FREE 877 483 5776
UK OFFICE : PHONE 44 1453 845 718 FAX 44 1453 845 719
WEB : WWW.TELPROCOMPANIES.COM
EMAIL : MASH@TELPROCOMPANIES.COM / CATHY@TELPROCOMPANIES.COM / ANDREW@TELPROCOMPANIES.COM
CURRENT OUTPUT OF RIBBON IN FINE SAND
12.8mA/ft (42mA/m) When operating at an anode current density of 0.278A/ft² (3A/m²)

DESIGN LIFE
50 years plus when operating at an anode current density of 0.278A/ft² (3A/m²)

Lifetimes stated are nominal, we can supply Amps / life different to stated standards on request.

CURRENT OUTPUT OF RIBBON IN CONCRETE
0.45mA/ft (1.5mA/m) when operating at an anode current density of 10.19mA/ft² (100A/m²)

DESIGN LIFE
100 years plus when operating at an anode current density of 10.19mA/ft² (100A/m²)

Lifetimes stated are nominal, we can supply Amps / life different to stated standards on request.

NOMINAL DIMENSIONS OF TITANIUM CONDUCTOR BAR

<table>
<thead>
<tr>
<th>MATERIAL</th>
<th>TITANIUM ASTM B265 Gr1</th>
</tr>
</thead>
<tbody>
<tr>
<td>DIMENSIONS</td>
<td>0.50&quot; (12.7mm) Wide x 0.035&quot; (0.9mm) Thick</td>
</tr>
<tr>
<td>COIL LENGTH</td>
<td>328ft (100m)</td>
</tr>
<tr>
<td>COIL WEIGHT</td>
<td>11 lbs (5kgs)</td>
</tr>
</tbody>
</table>

TYPICAL APPLICATIONS FOR RIBBON ANODES

- RELIABLE
- ECONOMICAL
- EASY TO INSTALL
- EXTENSIVE WORLDWIDE TRACK RECORD
Titanium Electrode Products Companies, “TELPRO,” are manufacturers of mixed metal oxide anodes for cathodic protection.

**TELPRO RIBBON MESH Anodes** are manufactured using a titanium expanded mesh substrate, which meets ASTM B265 Grade 1 or Grade 2 standards, which has been coated with **TELPRO Mixed Metal Oxide coating**.

**TELPRO MMO coating** consists of IrO2/Ta2O5 and is suitable for use in all cathodic protection applications. Because mixed metal oxide anodes have an extremely low consumption rate, the titanium substrate remains constant throughout the design life of the anode.

Based upon accelerated life testing, conducted by an independent laboratory, **TELPRO MMO coating** has been proven to be equivalent or superior to other mixed metal oxide coatings which are currently being used; a copy of this test report is available upon request.

### MMO RIBBON MESH ANODE SPECIFICATIONS

<table>
<thead>
<tr>
<th>RIBBON MESH WIDTH</th>
<th>10mm</th>
<th>13mm</th>
<th>15mm</th>
<th>20mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>CURRENT RATING @ 110mA/m²</td>
<td>2.8 mA/m</td>
<td>3.5 mA/m</td>
<td>3.9 mA/m</td>
<td>5.30 mA/m</td>
</tr>
<tr>
<td>EXPECTED LIFE</td>
<td>75 years in concrete</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CATALYST</td>
<td>Iridium / Tantalum Mixed Metal Oxide</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**MAXIMUM ANODE / CONCRETE INTERFACE CURRENT DENSITY:**

<table>
<thead>
<tr>
<th>FHWA LIMIT</th>
<th>110 mA/m²</th>
<th>SHORT TERM LIMIT</th>
<th>220 mA/m²</th>
</tr>
</thead>
</table>

**NOMINAL DIMENSIONS**

<table>
<thead>
<tr>
<th>WIDTH</th>
<th>10 mm</th>
<th>13 mm</th>
<th>15 mm</th>
<th>20 mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>COIL LENGTH</td>
<td>100 m</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ANODE SURFACE PER UNIT LENGTH ANODE</td>
<td>0.025 m²/m</td>
<td>0.032 m²/m</td>
<td>0.036 m²/m</td>
<td>0.0482 m²/m</td>
</tr>
<tr>
<td>APPROX. EXPANDED THICKNESS</td>
<td>1.30 mm</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DIAMOND DIMENSIONS</td>
<td>2.5 x 4.6 x 0.6 mm</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SHIPPING WEIGHT</td>
<td>1.4 Kgs per</td>
<td>1.9 Kgs per 100m</td>
<td>2.85 Kgs per</td>
<td>3.8 Kgs per</td>
</tr>
</tbody>
</table>

**USA OFFICE:** PHONE 281 498 4727 FAX 281 498 4728 TOLL FREE 877 483 5776
**UK OFFICE:** PHONE 44 1453 845 718 FAX 44 1453 845 719
**WEB:** WWW.TELPROCOMPANIES.COM
**EMAIL:** MASH@TELPROCOMPANIES.COM / CATHY@TELPROCOMPANIES.COM / ANDREW@TELPROCOMPANIES.COM
RIBBON MESH ANODES DATA SHEET

<table>
<thead>
<tr>
<th>SUBSTRATE</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>COMPOSITION</td>
<td>Titanium to ASTM B265 Grade 1</td>
</tr>
<tr>
<td>CURRENT DISTRIBUTOR</td>
<td></td>
</tr>
<tr>
<td>WIDTH</td>
<td>12.7 mm</td>
</tr>
<tr>
<td>THICKNESS</td>
<td>0.90 mm</td>
</tr>
<tr>
<td>COIL LENGTH</td>
<td>100 m</td>
</tr>
<tr>
<td>SHIPPING WEIGHT PER COIL</td>
<td>5.2 Kgs</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ELECTRICAL PROPERTIES</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>ANODE RIBBON MESH</td>
<td>0.5 Ohm/m 0.39 Ohm/m 0.375 Ohm/m 0.25 Ohm/m</td>
</tr>
<tr>
<td>CURRENT DISTRIBUTOR</td>
<td>0.049 Ohm/m</td>
</tr>
</tbody>
</table>

Lifetimes stated are nominal, we can supply Amps / life different to stated standards on request

Strict quality control procedures are followed throughout the entire coating process, to guarantee proper coating adhesion and loading. Also, TELPRO products are tested using an X-Ray Fluorescence Spectrometer, to ensure production of the highest quality product, which is fundamental in every step of the manufacturing process.

TYPICAL APPLICATIONS FOR RIBBON MESH ANODES

- RIBBON MESH IS ISOLATED FROM REBAR WITH CLIPS
- RIBBON MESH ANODES FOR NEW BUILD AND EXISTING CONCRETE STRUCTURES. PROVEN METHOD OF STOPPING CORROSION AND PROLONGING LIFE OF THE STRUCTURE.
- 75 YEARS + ANODE LIFE CAN BE CONSIDERED
- DESIGN IS “ZONED” IN DISCRETE SECTIONS TO PROVIDE CONTROL AND TO ENABLE ACCURATE MEASUREMENT OF SYSTEM PERFORMANCE
Titanium Electrode Products Companies, “TELPRO,” are manufacturers of mixed metal oxide anodes for Cathodic protection.

**TELPRO MMO Flex-Anodes** can be assembled using TELPRO Wire Anodes (ASTM B348), or TELPRO Ribbon Anodes (ASTM B265) which have been coated with TELPRO Mixed Metal Oxide Coating.

TELPRO MMO coating consists of IrO2/Ta2O5 and is suitable for use in all cathodic protection applications. Because mixed metal oxide anodes have an extremely low consumption rate, the titanium substrate remains constant throughout the design life of the anode.

Based upon accelerated life testing, conducted by an independent laboratory, TELPRO MMO coating has been proven to be equivalent or superior to other mixed metal oxide coatings which are currently being used; a copy of this test report is available upon request.

Strict quality control procedures are followed throughout the entire coating process, to guarantee proper coating adhesion and loading. Also, TELPRO products are tested using an X-Ray Fluorescence Spectrometer, to ensure production of the highest quality product, which is fundamental in every step of the manufacturing process.

**TELPRO MMO Flex-Anodes** are a flexible, packaged linear anode assembly. The linear anode is packaged in a highly absorbent fabric sleeve. This sleeve is sewn using a poly four-thread double interlocking stitch, which prevents the seam from separating during installation, or when stored in high temperature conditions. The sleeve is filled using a high quality, calcined petroleum coke.

- **ANODE TO CABLE CONNECTION IS RESIN FILLED AND HELIUM TESTED FOR AN EFFECTIVE SEAL OF CONNECTION**
- **FABRIC SLEEVE IS AVAILABLE IN 1.5” to 3” DIAMETERS WITH A VARIETY OF LENGTHS AVAILABLE**
- **AVAILABLE WITH OUTPUTS RANGING FROM 16mA/LIN. FT. TO 400mA/ LIN. FT.**
- **FLEXIBLE AND LIGHTWEIGHT MAKES FOR EFFICIENT INSTALLATIONS**
- **PACKAGED USING HIGH QUALITY CALCINED PETROLEUM COKE IN A HIGHLY ABSORBENT FABRIC SLEEVE.**
- **REDUCES REQUIREMENT FOR IN PLANT ISOLATION**
**FLEX ANODES DATA SHEET**

**LAYOUT OF FLEX ANODE PRODUCT**

- MMO / Ti Wire – 1.5mm or 3mm Diameter
- Calcined Coke Breeze Backfill
- Header Cable – HMPVE as standard but options available
- Encapsulated MMO/Ti Wire to cable crimp at defined spacing.
- Double cross stitched fabric sock

**Standard Current Ratings Available (output per linear meter / linear feet)**
- FLEX-ANODE 52 – 52mA/m (~16mA/ft)
- FLEX-ANODE 100 – 100mA/m (~30.5mA/ft)
- FLEX-ANODE 250 – 250mA/m (~76mA/ft)
- FLEX-ANODE 400 – 400mA/m (~122mA/ft)
- FLEX-ANODE 650 – 650mA/m (~200mA/ft)

**Lifetime (at full rated output)**
- Lifetimes stated are nominal.

**Please note that FLEX-ANODES Anodes can be made according to client’s custom specification. Please contact us for details stating current output required and design lifetime.**

**Length (per sock):**
- Maximum 150m c/w 1m of cable either end.

**Backfill:**
- Carbonaceous Backfill
  - Type: Calcined petroleum coke
  - Fixed Carbon: 99.8%
  - Moisture: 0.07%
  - Volatile: 0.02%
  - Ash: 0.1%
  - Particle Size: 1.0 mm (max.)

**Anode materials:**
- Titanium Wire MMO/Ti Wire 1.5mm or 3mm
- ASTM B863 Grade 1 or Titanium MMO/Ti Ribbon
- Nominal dimensions: 6.35mm x 0.6mm ASTM B265 Grade 1
<table>
<thead>
<tr>
<th><strong>Sleeve Diameter</strong></th>
<th>38mm</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Anode Cable</strong></td>
<td>To client specification but as standard #8 AWG(10mm²) HMWPE with 1m free cable tail at either end for splicing/termination.</td>
</tr>
<tr>
<td><strong>Custom Cable</strong></td>
<td>Available as per client request in HALAR/HMWPE or PVDF/HMWPE</td>
</tr>
</tbody>
</table>
| **Cable To Wire / Ribbon Connection** | Every 10m as a minimum. Note that spacing will vary dependent upon several factors such as  
  - Anode used.  
  - Cable size  
  - Environment the Flex-Anode is placed in. Telpro can assist with design optimisation of your product. |
| **Cable Wire / Ribbon Splice** | Proprietary technique using  
  - Copper Compression Connector  
  - Two Part Epoxy Resin  
  - Heat – Shrink Sleeve. |
| **Product Weight** | Approx 1.5Kgs per linear m |
| **Backfill Weight** | Approx 1.15Kgs per linear m |
| **Jacket Material & Construction** | The linear anode and cable is assembled in a highly absorbent fabric sleeve. The fabric sleeve is sewn using a poly four thread double interlocking stitch, which prevents the seam from separating during installation or when stored in high temperature conditions. |
| **Testing** |  
  - Anode to cable seal is resin filled and helium tested for an effective seal of the connection.  
  - Anode to cable connection is checked for resistance.  
  - Cable and anode are checked for electrical continuity and resistance.  
  - MMO Coating is tested using an X-Ray Fluorescence Spectrometer to verify coating loading and adhesion. |
| **Packing** | In plywood packing cases or wooden reels ready for export/domestic shipment as required. |
| **Marking** | Each length of anode is labelled to show:  
  - Section Lengths (if varying from standard)  
  - Current output  
  - Cable type  
  - Diameter. |
APPLICATIONS FOR TELPRO FLEX-ANODE

- PROTECT MULTIPLE PIPELINES IN A CORRIDOR
- EASY TO INSTALL ALONG WITH PIPE IN THE SAME TRENCH
- MULTIPLE LINEAR ANODES CAN BE DEPLOYED TO ENSURE EVEN CURRENT DISTRIBUTION
- POWER FEED CONNECTION ADVISED EVERY 100-150m MAXIMUM

- TELPRO “FLEX ANODE” INSTALLED IN RINGS AROUND THE VESSEL / BULLET TANK
- BURIED VESSELS / BULLET TANKS CAN BE PROTECTED WITH DISTRIBUTED TUBULAR / CANISTER ANODES
- TELPRO FLEX ANODE CAN ALSO BE USED FOR EASE OF INSTALLATION AND EVEN CURRENT DISTRIBUTION
- “CLOSE ANODE” SYSTEMS ENSURE PROTECTION AND REMOVE ISOLATION COSTS.
Telpro Flex-Anodes are ideal for under-tank base plate protection. Anode loops are arranged in a concentric pattern as shown below with power feed cables routed back to a junction box. The Flex-Anode rating and spacing between loops can be adjusted according to the tank diameter, base plate coating, lifetime required and medium underneath the tank base. The Flex Anode can be provided pre-packaged in coke breeze backfill contained in a fabric sleeve or placed directly in low resistivity, soft, clean and washed sand.

**Telpro Flex-Anode** placed in concentric loops beneath the tank base. Spacing and current rating defined by:

- Tank diameter,
- Base plate coating,
- Lifetime required
- Medium underneath the tank base and resistance
- Anode installation depth

Flex-Anode can be supplied in pre-cut lengths to enable fast and easy installation.
MANUFACTURERS OF MMO AND PLATINIZED TITANIUM ELECTRODES

MESH STRIP ANODES DATA SHEET

Titanium Electrode Products Companies, “TELPRO,” are manufacturers of mixed metal oxide anodes for cathodic protection.

TELPRO Mesh Anodes are manufactured using a titanium expanded mesh substrate, which meets ASTM B265 Grade 1 or Grade 2, which has been coated with TELPRO Mixed Metal Oxide coating.

TELPRO MMO coating consists of IrO2/Ta2O5 and is suitable for use in all cathodic protection applications. Because mixed metal oxide anodes have an extremely low consumption rate, the titanium substrate remains constant throughout the design life of the anode.

Based upon accelerated life testing, conducted by an independent laboratory, TELPRO MMO coating has been proven to be equivalent or superior to other mixed metal oxide coatings which are currently being used; a copy of this test report is available upon request.

Strict quality control procedures are followed throughout the entire coating process, to guarantee proper coating adhesion and loading. Also, TELPRO products are tested using an X-Ray Fluorescence Spectrometer, to ensure production of the highest quality product, which is fundamental in every step of the manufacturing process.

TELPRO’s Canistered Mesh Anodes have been designed specifically to replace the massive 3” x 60” silicon iron anodes, typically used in horizontal and shallow ground beds. The TELPRO Mesh Strip Anode is 1.25” wide by 48” long and is rated at 5amps, for a 20 year design life, in fine petroleum coke. TELPRO Mesh Strip Anodes can be packaged in galvanized steel canisters or flexible fabric sleeves, both of which are available in a wide variety of diameters and lengths.

ADVANTAGES

- LIGHTWEIGHT AND UNBREAKABLE
- ELECTRICAL CONNECTION FULLY ENCAPSULATED IN RESIN
- CONNECTION RESISTANCE LESS THAN 0.001 OHMS
- FINE PETROLEUM COKE USED TO ENSURE EFFICIENT CURRENT DISTRIBUTION FROM ANODE
- LOWER COST THAN 3” X 60” SILICON IRON ANODES
- LIGHTER WEIGHT MEANS LESS FREIGHT COST
MESH STRIP ANODES DATA SHEET

CABLE OF YOUR CHOICE

CANISTER CAP

CABLE TO MESH ANODE CONNECTION AND RESIN ENCAPSULATION

SPIRAL WOUND GALVANISED STEEL CANISTER

MESH STRIP ANODE 1.25” WIDTH X 48” LENGTH, RATED 5A / 20 YEARS DESIGN LIFE IN COKE BREEZE BACKFILL

CANISTER FILLED WITH CALCINED PETROLEUM COKE BREEZE, 99% FIXED CARBON CONTENT

DIFFERENT SIZES, CURRENT RATINGS, DESIGN LIFES AVAILABLE UPON REQUEST.
Titanium Electrode Products Companies, “TELPRO,” are manufacturers of mixed metal oxide anodes for Cathodic protection.

TELPRO Rod Anodes are manufactured using titanium, which meets ASTM B348 Grade 1 or 2 standards, which has been coated with TELPRO Mixed Metal Oxide coating.

TELPRO MMO coating consists of IrO2/Ta2O5 and is suitable for use in all cathodic protection applications. Because mixed metal oxide anodes have an extremely low consumption rate, the titanium substrate remains constant throughout the design life of the anode.

Based upon accelerated life testing, conducted by an independent laboratory, TELPRO MMO coating has been proven to be equivalent or superior to other mixed metal oxide coatings which are currently being used; a copy of this test report is available upon request. Strict quality control procedures are followed throughout the entire coating process, to guarantee proper coating adhesion and loading. Also, TELPRO products are tested using an X-Ray Fluorescence Spectrometer, to ensure production of the highest quality product, which is fundamental in every step of the manufacturing process.

TELPRO Rod Anodes are available in diameters of 1/8” (3.175mm), 1/4” (6.35mm), 1/2” (12.7mm), and 3/4” (19mm), as well as many other sizes which are all available upon request.

<table>
<thead>
<tr>
<th>Environment</th>
<th>Maximum Current Density</th>
<th>Lifetime</th>
</tr>
</thead>
<tbody>
<tr>
<td>CARBONACEOUS BACKFILL</td>
<td>4.6 A/ft² (50 A/m²)</td>
<td>20 years</td>
</tr>
<tr>
<td>CALCINED PETROLEUM COKE BACKFILL</td>
<td>9.3 A/ft² (100 A/m²)</td>
<td>20 years</td>
</tr>
<tr>
<td>FRESHWATER</td>
<td>9.3 A/ft² (100 A/m²)</td>
<td>20 years</td>
</tr>
<tr>
<td>BRACKISH WATER</td>
<td>9.3-27.8 A/ft² (100-300 A/m²)</td>
<td>20 years</td>
</tr>
<tr>
<td>SEAWATER</td>
<td>55.8 A/ft² (600 A/m²)</td>
<td>20 years</td>
</tr>
</tbody>
</table>

Lifetimes stated are nominal, we can supply Amps / life different to stated standards on request.
TELPRO ROD ANODES DATA SHEET

LAYOUT OF A TYPICAL ROD ANODE ASSEMBLY.

STEEL NIPPLE  STEEL COUPLING  POLYPROPYLENE SHIELD

¾” OR ½” SOLID TITANIUM ROD WITH TELPRO MIXED METAL OXIDE COATING.

WATER BOX / TANK APPLICATIONS

“THRU WALL” ROD ANODE ASSEMBLY CAN BE EASILY INSTALLED, RETRIEVED AND REPLACED AT END OF SERVICE LIFE

PIPELINE INTERNAL PROTECTION APPLICATIONS

TELPRO ROD ANODES CAN BE FITTED TO PROTECT PIPELINE INTERNALS.

TYPICALLY APPLIED TO LARGE DIAMETER WATER COOLING INTAKE PIPES

RETRIEVABLE ACCESS FITTINGS CAN BE USED TO ENABLE INSPECTION, REPAIR AND REPLACEMENT AT END OF SERVICE LIFE
TELPRO DISC ANODES DATA SHEET

Titanium Electrode Products Companies, “TELPRO,” are manufacturers of mixed metal oxide anodes for Cathodic protection.

**TELPRO Disc Anodes** are manufactured using titanium, which meets ASTM B265 Grade 1 or 2 standards, which has been coated with **TELPRO Mixed Metal Oxide coating**.

**TELPRO MMO coating** consists of IrO2/Ta2O5 and is suitable for use in all cathodic protection applications. Because mixed metal oxide anodes have an extremely low consumption rate, the titanium substrate remains constant throughout the design life of the anode.

Based upon accelerated life testing, conducted by an independent laboratory, **TELPRO MMO coating** has been proven to be equivalent or superior to other mixed metal oxide coatings which are currently being used; a copy of this test report is available upon request.

Strict quality control procedures are followed throughout the entire coating process, to guarantee proper coating adhesion and loading. Also, **TELPRO** products are tested using an X-Ray Fluorescence Spectrometer, to ensure production of the highest quality product, which is fundamental in every step of the manufacturing process.

**TELPRO Disc Anodes** are available as standard in diameters of 6” (150mm) & 12” (300mm) as well as other sizes which are all available upon request.

<table>
<thead>
<tr>
<th>Environment</th>
<th>Maximum Current Density</th>
<th>Lifetime</th>
</tr>
</thead>
<tbody>
<tr>
<td>CARBONACEOUS BACKFILL</td>
<td>4.6A/ft² (50A/m²)</td>
<td>20 years</td>
</tr>
<tr>
<td>CALCINED PETROLEUM COKE BACKFILL</td>
<td>9.3A/ft² (100A/m²)</td>
<td>20 years</td>
</tr>
<tr>
<td>FRESHWATER</td>
<td>9.3A/ft² (100A/m²)</td>
<td>20 years</td>
</tr>
<tr>
<td>BRACKISH WATER</td>
<td>9.3-27.8A/ft² (100-300A/m²)</td>
<td>20 years</td>
</tr>
<tr>
<td>SEAWATER</td>
<td>55.8A/ft² (600A/m²)</td>
<td>20 years</td>
</tr>
</tbody>
</table>

Lifetimes stated are nominal, we can supply Amps / life different to stated standards on request.
TELPRO DISC ANODES DATA SHEET

LAYOUT OF A TYPICAL DISC ANODE ASSEMBLY.

- DIELECTRIC SHIELD
- MMO DISC ANODE
- CABLE TERMINATION AND ENCAPSULATION
- CABLE TAIL

TYPICAL APPLICATIONS FOR DISC ANODES

**JETTY / OFFSHORE STRUCTURE**

Disc anodes can be installed with a low profile, preventing damage from passing ships / craft.

Extra coating may be applied to the structure to prevent local overprotection.

**THRU WALL ANODE FOR CONDENSERS / WATER BOXES.**

Anodes ideal for installation in areas of fast flowing water with risk of vibration or shearing damage.
TELPRO “TEL-TANK” ANODE DATA SHEET

TELPRO TEL-TANK Anode Assemblies are designed for ease of installation and cost savings. TEL-TANK Anode Assemblies use TELPRO MMO Ribbon Anodes assembled on HMWPE Cable. TELPRO Ribbon is manufactured using titanium to ASTM B265 Grade 1 specifications, which has been coated with TELPRO Mixed Metal Oxide coating.

TELPRO MMO coating consists of IrO2/Ta2O5 and is suitable for use in all cathodic protection applications. Because mixed metal oxide anodes have an extremely low consumption rate, the titanium substrate remains constant throughout the design life of the anode.

TELPRO TEL-TANK Anodes are assembled to meet customer requirements. Each TEL-TANK Anode System is factory assembled and ready for installation. No field welds are required. All anode-to-cable connections are sealed using a moisture resistant epoxy, which has been helium tested to ensure the quality of the seal and provide long lasting protection.

Based upon accelerated life testing, conducted by an independent laboratory, TELPRO MMO coating has been proven to be equivalent or superior to other mixed metal oxide coatings which are currently being used; a copy of this test report is available upon request.

Strict quality control procedures are followed throughout the entire coating process, to guarantee proper coating adhesion and loading. Also, TELPRO products are tested using an X-Ray Fluorescence Spectrometer, to ensure production of the highest quality product, which is fundamental in every step of the manufacturing process.

TO RECEIVE A QUOTATION FOR TEL-TANK SYSTEMS PLEASE SPECIFY AS FOLLOWS,

- Quantity of Tanks
- Diameter of Tanks
- Required Design Life
- Operating Temperature of Tank
- Current Density to be Applied to Tank Base
- Details of External Base Plate Coating
- Installation Depth Of Anode Layer
- Cable Distance to Junction Box Location.

CURRENT OUTPUT OF RIBBON IN FINE SAND
12.8mA/ft (42mA/m) When operating at an anode current density of 0.278 A/ft² (3A/m²)

DESIGN LIFE
50 years plus when operating at an anode current density of 0.278 A/ft² (3A/m²)

Lifetimes stated are nominal, we can supply Amps / life different to stated standards on request.
Telpro Sawtooth Ribbon Anodes are a new product development for Telpro. We corrugate a flat ribbon to increase its overall surface area to obtain a higher current output. Telpro Sawtooth Ribbon Anode is manufactured using titanium which meets ASTM B265 Grade 1 which has been coated with Telpro Mixed Metal Oxide Coating.

Telpro MMO coating consists of IrO$_2$/Ta$_2$O$_5$ and is suitable for use in all cathodic protection applications. Because mixed metal oxide anodes have a very low consumption rate the titanium substrate remains constant throughout the design life of the anode.

Telpro Sawtooth Ribbon Anode provides greater flexibility because the ribbons are laid on the concrete surface in parallel lines with the separation between ribbons adjusted to give the required per square meter output. The maximum spacing between the anodes will vary according to the concrete cover over the rebar, but is usually up to 14” (350mm). The approach is price competitive compared to using a mesh product, especially where you have areas of increased steel density where you simply put more ribbon together.

**SAWTOOTH RIBBON SPECIFICATIONS**

<table>
<thead>
<tr>
<th>MATERIAL</th>
<th>NOMINAL DIMENSIONS</th>
<th>CURRENT OUTPUT IN CONCRETE</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.50&quot; (12.7mm)</td>
<td>0.50&quot; (12.7mm) Wide x 0.16&quot; (4mm) Thick</td>
<td>6.3mA/m (at industry recommended maximum current density of 110mA/m$^2$)</td>
</tr>
<tr>
<td>0.25&quot; (6.35mm)</td>
<td>0.25&quot; (6.35mm) Wide x 0.24&quot; (0.6mm) Thick</td>
<td>3.15mA/m (at industry recommended maximum current density of 110mA/m$^2$)</td>
</tr>
</tbody>
</table>

Lifetimes stated are nominal, we can supply Amps / life different to stated standards on request.
SAWTOOTH RIBBON ANODES DATA SHEET

Strict quality control procedures are followed throughout the entire coating process, to guarantee proper coating adhesion and loading. Also, TELPRO products are tested using an X-Ray Fluorescence Spectrometer, to ensure production of the highest quality product, which is fundamental in every step of the manufacturing process.

TYPICAL APPLICATIONS FOR SAWTOOTH RIBBON ANODES

SAWTOOTH RIBBON IS ISOLATED FROM REBAR WITH CLIPS

SAWTOOTH RIBBON ANODES FOR NEW BUILD CONCRETE STRUCTURES – PROVEN METHOD OF STOPPING CORROSION AND PROLONGING LIFE OF THE STRUCTURE.

PROLONGING LIFE OF THE STRUCTURE.
75 YEARS + ANODE LIFE CAN BE CONSIDERED

DESIGN IS “ZONED” IN DISCRETE SECTIONS TO PROVIDE CONTROL AND TO ENABLE ACCURATE MEASUREMENT OF SYSTEM PERFORMANCE

ADVANTAGES OF SAWTOOTH RIBBON ANODE

- LOWER INTERNAL RESISTANCE THAN RIBBON MESH ANODES
- BETTER CONTACT WITH CONCRETE / MORTOR
- LESS LIKELY TO DEVELOP VOIDS AROUND THE ANODE WHEN CASTING WHICH CAN FILL WITH MOISTURE AND LEAD TO CORROSION OF REBAR

0.5” (12.7mm) Width
0.25” (6mm) Height
Titanium Electrode Products Companies, “TELPRO,” are manufacturers of mixed metal oxide anodes for cathodic protection.

TELPRO Mixed Metal Oxide Activated Tubular Point Source Anodes are manufactured using titanium, which meets ASTM B338 Grade 1 or Grade 2 standards, which has been coated with TELPRO Mixed Metal Oxide coating.

TELPRO MMO coating applied to the titanium substrate has been designed for use in all cathodic protection applications. TELPRO coating consists of IrO$_2$/Ta$_2$O$_5$ and is suitable for use in soils, freshwater, brackish water and seawater. Because mixed metal oxide anodes have an extremely low consumption rate, the titanium substrate used remains constant throughout the design life of the anode.

Based upon accelerated life testing, conducted by an independent laboratory, TELPRO MMO coating has been proven to be equivalent or superior to other mixed metal oxide coatings which are currently being used; a copy of this test report is available upon request.

Strict quality control procedures are followed throughout the entire coating process, to guarantee proper coating adhesion and loading. Also, TELPRO products are tested using an X-Ray Fluorescence Spectrometer, to ensure production of the highest quality product, which is fundamental in every step of the manufacturing process.

TELPRO MMO Oxide Activated Tubular Point Source Anodes can be self-gas venting or supplied with venting holes, plastic end-caps and a PVC venting tube. These anodes can also be supplied with a spot welded titanium conductor bar, typically manufactured of titanium ribbon, 0.25” (6.35mm) by 0.025” (.635mm), which can be either coated or uncoated, and of a length appropriate to suit project requirements.

The current output of the anode is calculated by multiplying the anode surface area x design current density, which typically can vary 110mA/m$^2$ to 900mA/m$^2$, subject to design factors such as gas venting, acidic attack on concrete, life of system, etc. Normal Design Life for the point source anode is typically 50 plus years when operating at an anode current density of 900mA/m$^2$. Coating loading can be adjusted for any combination of current output and design life. Lifetimes are nominal we can supply amps / life different to stated standards on request. Working Environment: Evolution of O$_2$, Cl$_2$ or combination of both.

USA OFFICE : PHONE 281 498 4727 FAX 281 498 4728 TOLL FREE 877 483 5776
UK OFFICE : PHONE 44 1453 845 718 FAX 44 1453 845 719
WEB : WWW.TELPROCOMPANIES.COM
EMAIL : MASH@TELPROCOMPANIES.COM / CATHY@TELPROCOMPANIES.COM / ANDREW@TELPROCOMPANIES.COM
POINT SOURCE DISCRETE ANODES DATA SHEET

LAYOUT OF POINT SOURCE ANODE PRODUCT

- PVC TUBE FOR GAS VENTING
- UN-COATED TITANIUM RIBBON FOR ELECTRICAL CONNECTION SPOT WELDED IN 3 PLACES
- MIXED METAL OXIDE / TITANIUM TUBE
- 4 ROW OF VENT HOLES (OPTIONAL)
- PLASTIC END CAPS

TYPICAL INSTALLATION OF POINT SOURCE ANODES.

POINT SOURCE DISCRETE ANODES FOR NEW BUILD AND RETROFIT OF CATHODIC PROTECTION TO CONCRETE STRUCTURES – PROVEN METHOD OF STOPPING CORROSION AND PROLONGING LIFE OF THE STRUCTURE.

75 YEARS + ANODE LIFE CAN BE CONSIDERED

DESIGN IS “ZONED” IN DISCRETE SECTIONS TO PROVIDE CONTROL AND TO ENABLE ACCURATE MEASUREMENT OF SYSTEM PERFORMANCE.