

**Construction Specification for  
Hot-Spot Cathodic Protection  
of Existing Iron Watermains**

**Table of Contents**

<b>TS 7.21.01</b>	<b>SCOPE .....</b>	<b>2</b>
TS 7.21.01.01	Workmanship.....	2
TS 7.21.01.02	Handling and Storage of Materials .....	2
TS 7.21.01.03	Units.....	2
<b>TS 7.21.02</b>	<b>REFERENCES .....</b>	<b>2</b>
<b>TS 7.21.03</b>	<b>DEFINITIONS .....</b>	<b>2</b>
<b>TS 7.21.04</b>	<b>DESIGN AND SUBMISSION REQUIREMENTS – Not Used .....</b>	<b>3</b>
<b>TS 7.21.05</b>	<b>MATERIALS.....</b>	<b>3</b>
TS 7.21.05.01	Manufacture of Sacrificial Anodes .....	3
TS 7.21.05.02	Magnesium Anodes .....	3
TS 7.21.05.03	Thermite Welds .....	3
TS 7.21.05.04	Miscellaneous .....	4
<b>TS 7.21.06</b>	<b>EQUIPMENT – Not Used .....</b>	<b>4</b>
<b>TS 7.21.07</b>	<b>CONSTRUCTION .....</b>	<b>4</b>
TS 7.21.07.01	Anode Installation.....	4
TS 7.21.07.02	Installation of Bond Cables .....	5
<b>TS 7.21.08</b>	<b>QUALITY ASSURANCE.....</b>	<b>5</b>
TS 7.21.08.01	Quality Assurance.....	5
<b>TS 7.21.09</b>	<b>MEASUREMENT FOR PAYMENT – Not Used.....</b>	<b>5</b>
<b>TS 7.21.10</b>	<b>BASIS OF PAYMENT – Not Used .....</b>	<b>5</b>

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**TS 7.21.01            SCOPE**

This specification covers the materials required and the work to be undertaken to provide hot-spot cathodic protection to existing ductile and grey cast iron watermains in the city of Toronto.

Hot-spot cathodic protection is the application of cathodic protection to a localized area on a watermain, by installing a sacrificial anode at a break repair site or any other watermain excavation.

**TS 7.21.01.01            Workmanship**

Skilled labour shall only be used for all work.

All work shall be performed according to instructions and specifications given by the City, using the most suitable equipment

**TS 7.21.01.02            Handling and Storage of Materials**

Material shall be stored so as to prevent injury to persons and to prevent the delay of work by others.

Sacrificial anodes and other materials which can be damaged by exposure to the environment must be stored in a clean, dry enclosure.

Sacrificial anodes shall not be handled by their lead wires.

**TS 7.21.01.03            Units**

Units of measurement given in this specification are based on the International System of Units (SI) and the National Standards of Canada Metric Practice Guide.

**TS 7.21.02            REFERENCES**

This specification refers to the following standards, specifications or publications:

**City of Toronto Standard Drawings**

T-1106.02            Thermite Welding of Metallic Watermains  
T-1106.03            Electrical Bonding of Iron Watermains

**American Society of Testing and Materials**

B843-93            Standard Specification for Magnesium Alloy Anodes for Cathodic Protection  
G97-89            Standard Test Method for Laboratory Evaluation of Magnesium Sacrificial Anode Test Specimens for Underground Applications

Where a discrepancy exists between the drawings and the specification, the specification shall have priority.

**TS 7.21.03            DEFINITIONS**

For the purpose of this specification, the following definitions apply:

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TS means Toronto Specification

AWG means American Wire Gauge

**TS 7.21.04                    DESIGN AND SUBMISSION REQUIREMENTS – Not Used**

**TS 7.21.05                    MATERIALS**

**TS 7.21.05.01                Manufacture of Sacrificial Anodes**

Lead wire silver-soldered to steel core.

Soldered connection encapsulated in heat shrinkable tubing.

Magnesium casting centered in anode package and surrounded by a minimum of 25 mm of special backfill.

**TS 7.21.05.02                Magnesium Anodes**

Packaged magnesium anodes shall have a 14.5 kg magnesium casting having a length of 560 mm  $\pm 20$  mm and a high potential alloy composition according to ASTM B843-93, Type M1C specification or equal.

The magnesium casting shall be contained in a rugged moisture-absorbent cardboard container of the following dimensions: 200 mm diameter x 700 mm long. The core shall be a 3 mm diameter steel core extending a minimum of 75 per cent of the length of the casting.

The magnesium anode shall be no less than 45 per cent efficient for each sample tested according to ASTM G97-89.

The magnesium casting within the container shall be supplied surrounded with a special backfill material having an electrical resistivity of less than 45 ohm-cm when saturated with distilled water and the following composition by volume:

- Gypsum 77%  $\pm 2\%$
- Bentonite 15%  $\pm 1\%$
- Anhydrous Sodium Sulphate 8%  $\pm 1\%$

Packaged magnesium anode shall be supplied with 3000 mm of AWG No 10/7 strand copper with RWU90 blue insulation.

**TS 7.21.05.03                Thermite Welds**

Thermite weld materials to be CADWELD, as manufactured by Erico Products Inc.

Thermite weld metal:

- Anode lead wires: Cat. N° CA25XF-19
- Bond cables: Cat. N° CA45XF-19

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Thermite weld moulds:

- Anode lead wires: Cat. N° CAHBA-1G-PD, where PD is pipe Ø in inches
- Bond cables: Cat. N° CAHBA-1G-PD, where PD is pipe Ø in inches

#### **TS 7.21.05.04            Miscellaneous**

Bond cables:

- AWG N° 4/7 strand copper conductor having RWU90 black insulation.

Mastic:

- Roskote A-51 Mastic.

Ground clamps – Blackburn as manufactured by Thomas & Betts:

- Water services up to 25 mm Ø, Cat N° JD
- Water services of greater than 25 mm Ø, Cat N° J2D

#### **TS 7.21.06                EQUIPMENT – Not Used**

#### **TS 7.21.07                CONSTRUCTION**

##### **TS 7.21.07.01            Anode Installation**

The anodes shall be kept dry prior to installation.

The anode shall not be handled or lowered by their lead wires.

Anodes shall be installed complete with their cardboard container and enclosed special backfill.

Anodes shall be installed horizontally at pipe depth a minimum of 500 mm to the side of the pipe, and shall be backfilled with native soil.

The anode lead wire shall be wrapped around the watermain and secured, that is to say knotted. Sufficient slack shall be left in the wire to prevent any stress on the anode during backfilling and subsequent soil settlement.

The anode lead wire shall be attached to the water piping by connecting to either:

- A copper service pipe, using a ground clamp, according to the clamp manufacturer's instructions;  
or
- The watermain, using the thermite weld process.

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**TS 7.21.07.02            Installation of Bond Cables**

Bond cables shall be installed to maintain electrical continuity between all metallic components of the water distribution system that are exposed within the excavation.

Bond cables shall be connected to the watermain, fittings, and couplings, using the thermite weld process.

Install one bond cable across each exposed Tyton joint which is not already bonded.

Where a repair clamp is installed across a circumferential break, install one bond cable across the break, following the installation of the repair clamp.

Where a cut-out is required, install one bond cable:

- From each coupling to the watermain.
- From the new section of pipe to each side of the existing watermain, only if the new section of pipe is metallic.
- Across the cut-out, from one side of the existing watermain to the other, only if the new section of pipe is non-metallic.

**TS 7.21.08                    QUALITY ASSURANCE**

**TS 7.21.08.01            Quality Assurance**

Contractor shall ensure that the anodes supplied conform to this specification.

The Contractor or anode supplier shall forward a copy of the *Certificate of Compliance* acquired from the anode manufacturer to the City for each anode shipment, prior to either their installation or delivery acceptance.

The City may randomly select samples of anodes supplied by the Contractor for testing, by an independent laboratory, with testing costs to be borne by the City.

Any batch of anodes found not to conform to the specification shall be replaced immediately by the Contractor at no extra cost to the City. No additional work shall take place until such time that the anodes are approved and accepted by the Contract Administrator.

Any installed anodes found not to conform to the required specifications shall be replaced by the Contractor at his own expense.

**TS 7.21.09                    MEASUREMENT FOR PAYMENT – Not Used**

**TS 7.21.10                    BASIS OF PAYMENT – Not Used**