



M.D.S.
- TOUGHGalv -

(CTI-TM-MDS-001_A10)



1.0 Introduction

- 1.1 TOUGHGalv is an advanced zinc aluminium coating (90% Zn/10% Al) with an outstanding active corrosion resistance. TOUGHGalv provides superior corrosion, abrasion, cathodic protection, thermal and dynamic performance when compared to traditional hot dip galvanized coatings.
- 1.2 TOUGHGalv provides a tough smooth surface finish that can be relied upon in many applications that hot dip galvanized is unsuitable, such as humid, alkaline, and harsh environments including marine offshore. TOUGHGalv can be welded, works at elevated temperatures and when deformed.

2.0 Benefits

- 2.1 Superior corrosion resistance
- 2.2 Excellent cathodic protection at cut-edges
- 2.3 Improved protection against storage stain white rust
- 2.4 Economic alternative to many stainless-steel applications
- 2.5 Economic alternative to traditional pre-galvanized and post-galvanized zinc finishes
- 2.6 Superior ductility retains properties and performance after heavy dynamic deformation
- 2.7 Eliminates complex, costly, and environmentally unfriendly post-galvanizing processes
- 2.8 Retains properties and performance after exposure to stress-relieving elevated temperatures

3.0 Standards

- 3.1 ASTM B997
- 3.2 ASTM B117
- 3.3 ASTM B606
- 3.4 ISO 9227

4.0 Proven Performance

- 4.1 Service temperature:
 - 4.1.1 Maximum: +660°F / +350°C
 - 4.1.2 Minimum: -58°F / -50°C
- 4.2 Hardness Vickers:
 - 4.2.1 TOUGHGalv: 50 - 55 µHV
- 4.3 Toughness Taber:
 - 4.3.1 TOUGHGalv: +25% tougher than zinc
- 4.4 Ductility ASTM B606:
 - 4.4.1 TOUGHGalv: Passed ASTM B606 / 16 weeks heat soak at +660°F / +350°C
- 4.5 Corrosion ASTM B117:
 - 4.5.1 TOUGHGalv: 3000 hours (50 years outdoor industrial / 40 years marine offshore service life)



5.0 Proven Corrosion Resistance

5.1 Corrosion performance is derived from the results of normalized salt spray testing in compliance with ASTM B117 and ISO 9227 (35°C – 5% NaCl).

5.2 The below table shows ASTM B117 test results of TOUGHGalv plus Hot Dip Galvanized (HDG) and Pre-Galvanized coated wire of 0.118-inch (3.0mm) diameter.

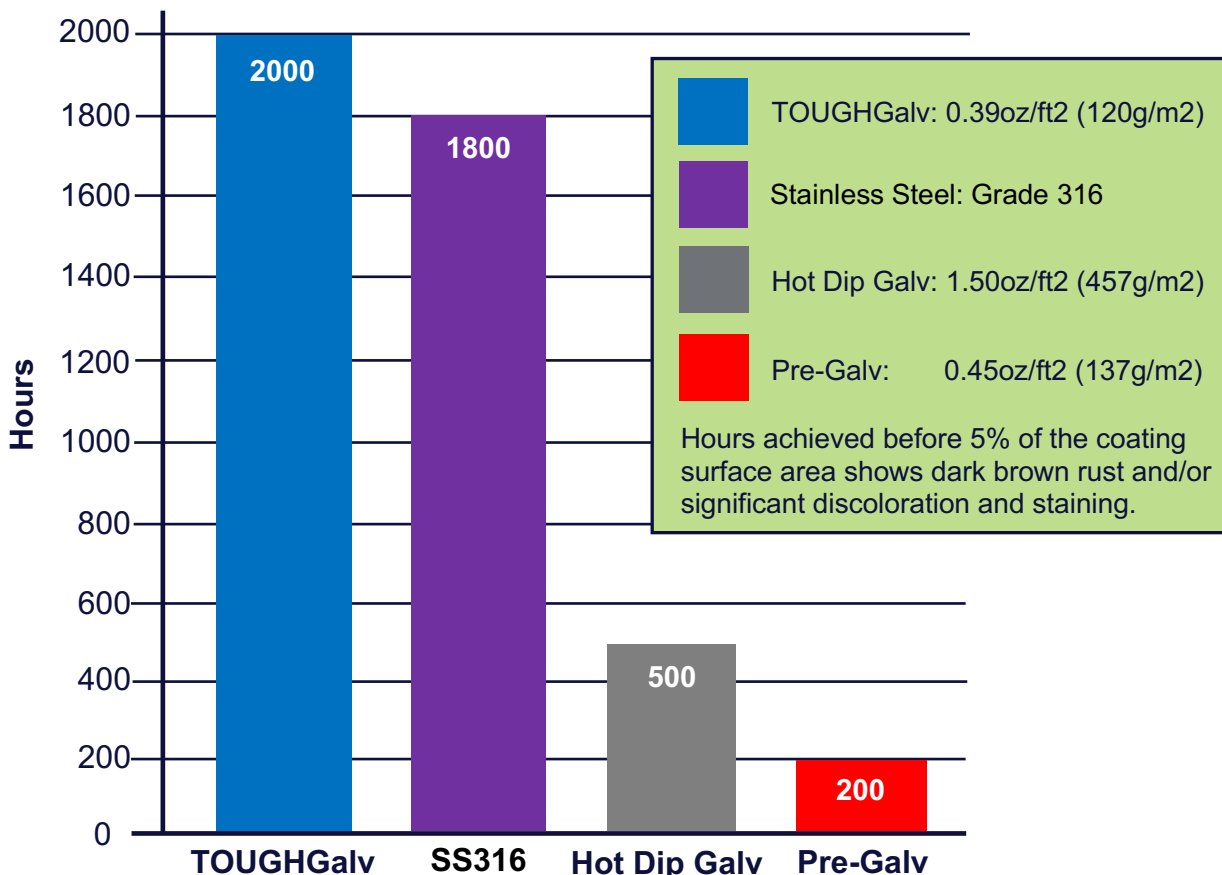
5.4 Tested wire samples were coated to:

5.4.1 TOUGHGalv : ASTM B997

5.4.2 Hot Dip Galv : ASTM A123

5.4.3 Pre-Galv : ASTM A653

5.5 The below table shows the maximum test hours achieved before the wire samples surface area exhibited 5% dark brown rust.



5.6 TOUGHGalv Corrosion Resistance:

5.6.1 TOUGHGalv = **5X** a traditional Hot Dip Galvanized ASTM A123 zinc coating.

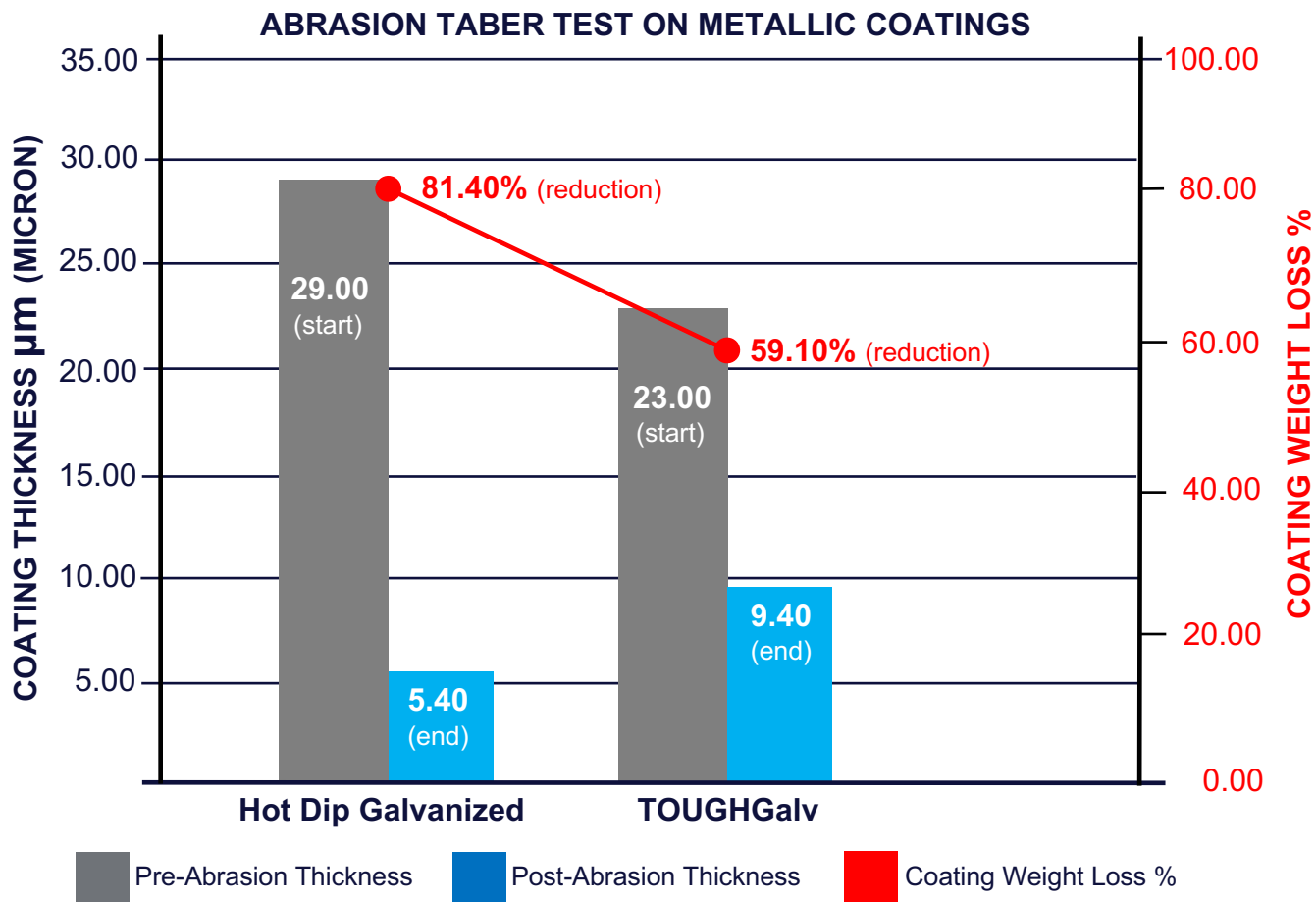
5.6.2 TOUGHGalv = **11X** a traditional Pre-Galvanized ASTM A653 zinc coating.

Note: Refer to Section 11.0 for comparative data on stainless-steel



6.0 Proven Toughness and Durability

- 6.1 TOUGHGalv coated wire and HDG (Hot Dip Galvanized) coated wire were tested for enhanced wear performance using the Abrasion Taber Test. The wire samples were subjected to controlled rubbing with a hard material (artificial diamond). Taber test results are detailed in the below table.
- 6.2 The coating weight loss was measured after completion of the abrasion taber test. As can be seen from the test results, TOUGHGalv retained more coating weight compared to a HDG zinc coating. Proving TOUGHGalv provides superior wear resistance in abrasive frictional applications.



7.0 Proven Toughness

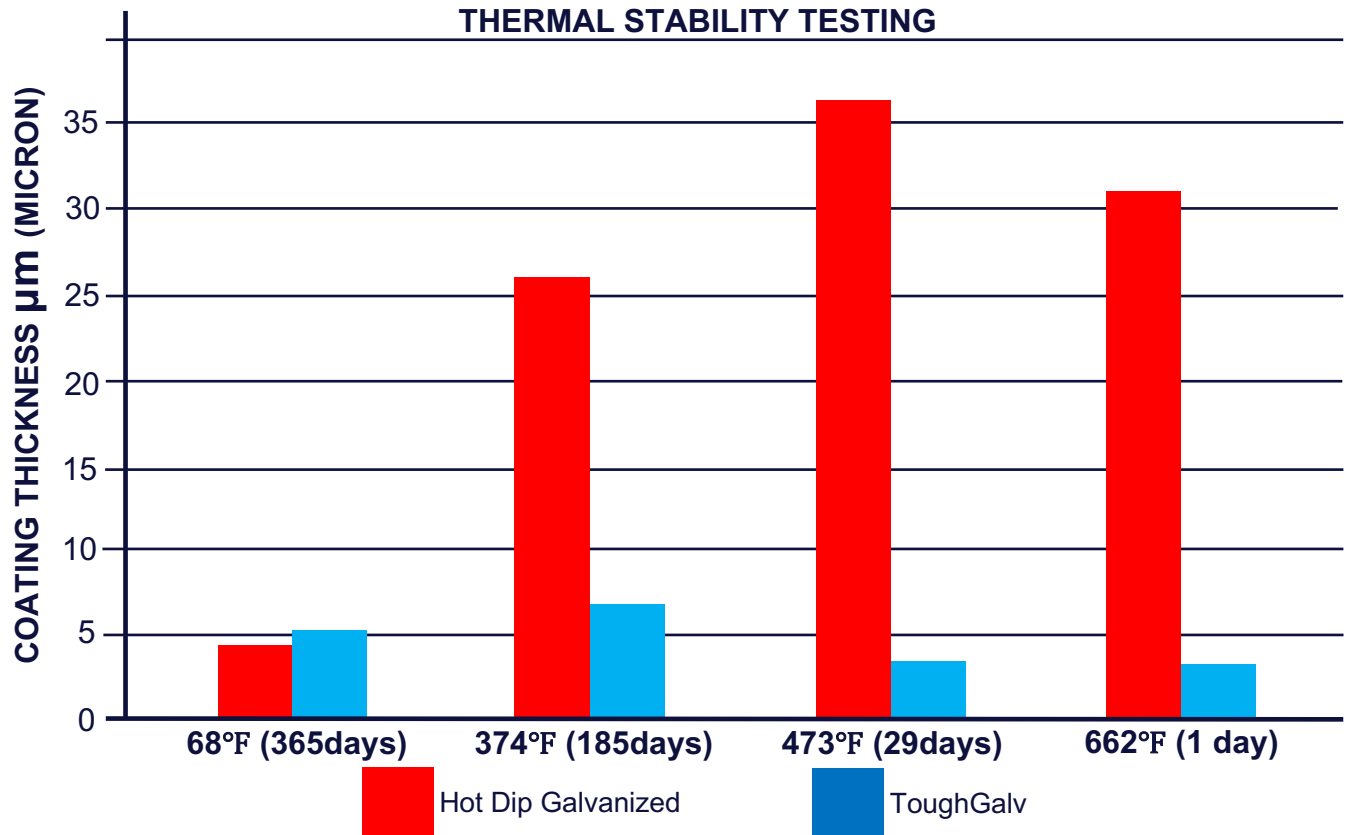
- 7.1 TOUGHGalv and HDG (Hot Dip Galvanized) coated wires with a 1600 N/mm² tensile strength were tested for Vickers hardness. Test results show TOUGHGalv is the superior harder coating.

Wire Specimen	Vickers Hardness
Hot Dip Galvanized coated wires	50-60 µHV
TOUGHGalv coated wires	70-80 µHV



8.0 Proven Thermal Stability

8.1 In many applications TOUGHGALV will be exposed to elevated temperatures. When traditional HDG (Hot Dip Galvanized) coatings are exposed to elevated temperatures above +302°F (+150°C), the brittle intermetallic FeZn will grow, and the zinc will start to flake. Taber test results are detailed in the below table. These show superior temperature performance +662°F (+350°C) of TOUGHGalv.

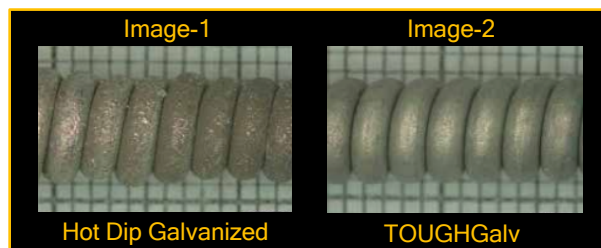


8.2 Stability Test Results:

8.2.1 PASS = TOUGHGalv is stable and resistant to +662°F / +350°C

8.2.2 FAIL = Hot Dip Galvanized starts to flake at +302°F / +150

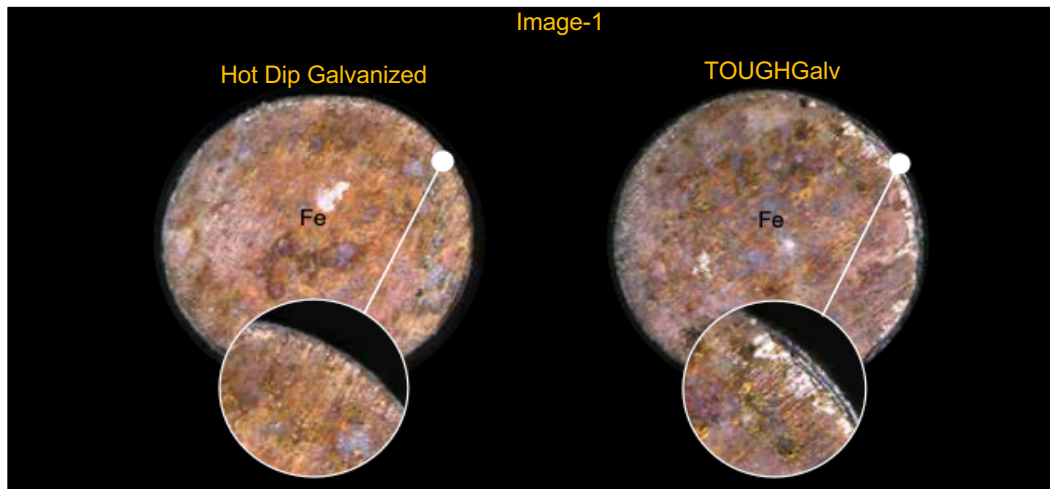
8.3 As shown in the below macrography, Hot Dip Galvanized coating (Image-1) fails due to cracking. TOUGHGalv (Image-2) shows no cracking, proving its superior stability and fatigue performance.





9.0 Proven Cathodic Protection

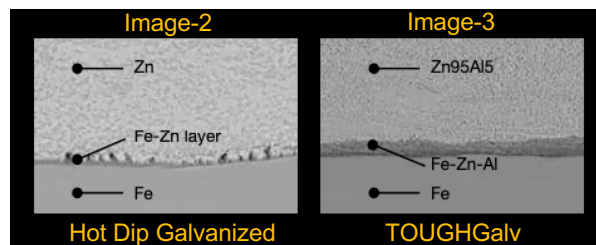
- 9.1 TOUGHGalv provides excellent cathodic protection to the base material. TOUGHGalv coating has superior self healing properties when compared to traditional hot dip galvanized zinc coatings.
- 9.2 The below macrography (Image-1) shows 0.157" (4.0mm) diameter wire cut ends after three (3) years continuous outdoor exposure. TOUGHGalv cut end shows superior cathodic protection.



- 9.3 For applications that necessitate cutting the wire; the superior cathodic protection properties of TOUGHGalv provide better corrosion protection to the wire cut end.

10.0 Proven Coating Ductility

- 10.1 To test ductility of TOUGHGalv and Hot Dip Galvanized coated wires, samples as shown in the below photograph (Image-1) were wrapped to form a coil. The wire samples of TOUGHGalv and Hot Dip Galvanized were then inspected by macrographic examination to determine each coatings performance.
- 10.2 As shown in the below macrography:
 - A. Hot Dip Galvanized coating (Image-2) fails due to cracking.
 - B. TOUGHGalv coating (Image-3) passes, showing no cracking, proving superior ductility.





11.0 Proven Alternative to Stainless Steel

11.1 TOUGHGalv coated steel wires demonstrates superior corrosion performance to stainless-steel during ASTM B117 tests. When compared to stainless-steel, TOUGHGalv also demonstrates the following improved material properties:

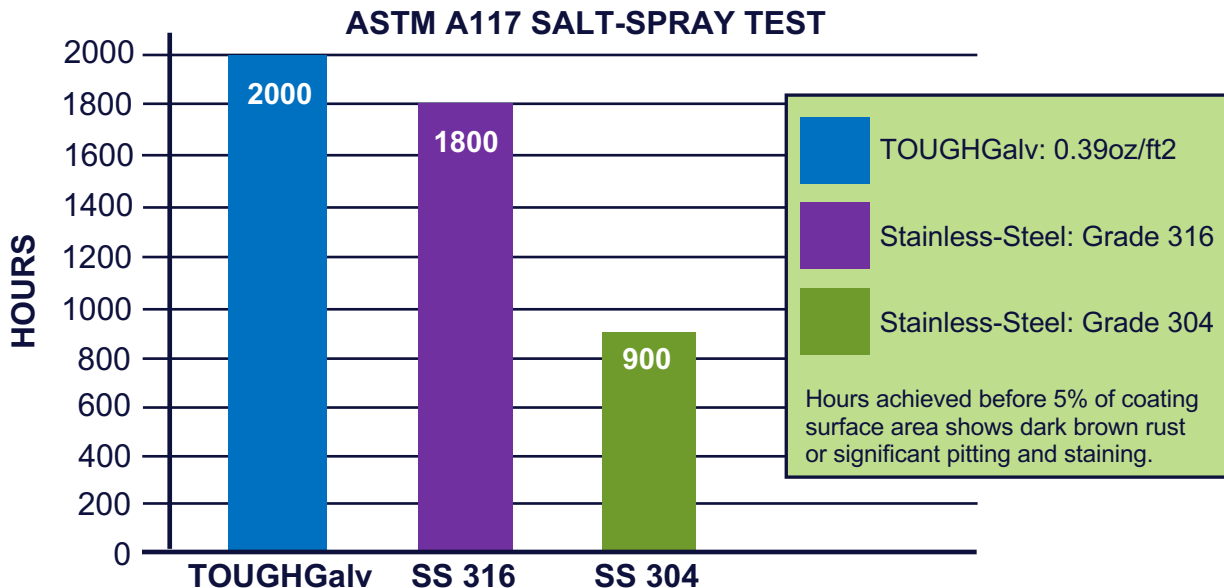
- A. 17% higher e-modulus
- C. Superior material ductility
- D. Superior fatigue performance

11.2 The superior ductility and fatigue resistance of TOUGHGalv when compared to stainless steel, is a better choice for tight tolerance forming. These are ideal properties, providing a better material solution for the tight tolerance forming and manufacture of TOUGHMesh cable trays.

11.3 Stainless-steel over time, can and will corrode. The alloying elements Molybdenum, Chromium and Nickle are added to stainless steels to improve corrosion resistance and although this helps to improve resistance, it does not prevent rusting in many environments. Exposure to chlorine rich environments (e.g., swimming pools) are corrosive to stainless-steel, with exposure to saline (salt-water), chemicals, grease, or heat for prolonged periods also a cause of corrosion. Grade 304 has no Molybdenum and is therefore particularly susceptible to saline (salt-water) corrosion.

11.4 ASTM B117 neutral salt-spray testing of Stainless-Steel and TOUGHGalv is shown in the below table.

- A. TOUGHGalv : ASTM B997
- B. Stainless-Steel 304 : ASTM A580
- C. Stainless-Steel 316 : ASTM A580



11.5 ASTM B117 testing shows both stainless-steel grades 304 and 316 exhibited pitting corrosion and significant staining. TOUGHGalv coating demonstrated superior performance than 304 and equivalent corrosion performance to 316.



12.0 Summary of Superiority

12.1 TOUGHGalv demonstrates superior performance compared to hot dip galvanized coatings and many stainless-steel applications. Given below is a summary of superiority and benefits.

TOUGHGalv SUPERIORITY	TOUGHGalv BENEFITS
<ul style="list-style-type: none"> • Do Better with <i>Corrosion Resistance</i> • Do Better with <i>Environmental Friendliness</i> • Do Better with <i>Cathodic Performance</i> • Do Better with <i>Temperature Resistance</i> • Do Better with <i>Hardness</i> • Do Better with <i>Ductility</i> • Do Better with <i>Storage</i> 	<ul style="list-style-type: none"> • Be Better with <i>Longer Service Life</i> • Be Better with <i>Less Harmful Processes</i> • Be Better with <i>Enhanced Protection</i> • Be Better with <i>Higher Thermal Stability</i> • Be Better with <i>Reduced Material Wear</i> • Be Better with <i>Lower Material Fatigue</i> • Be Better with <i>White Stain Resistance</i>

12.2

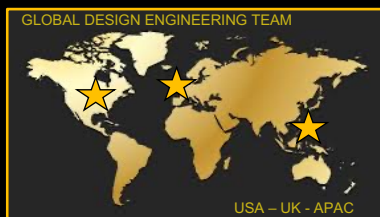


CT INNOVATIONS

CT Innovations provide customers superior solutions and services to help you do better. TOUGHGalv provides a superior coating solution to a wide range of applications. If you have a tough challenge, need superior performance, want longer life, ask for better. TOUGHGalv.



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Do Better. Be Better.