



Zinc...essential for life



Why ASTM Specifications?

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INTRODUCTION

- ASTM Standards for Coated Products:
 - Material and testing standards used worldwide
 - Relied on to achieve consistent quality
 - Coated sheet standards managed by Committee A05
 - Zinc and zinc-alloy standards under jurisdiction of Committee B02

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INTRODUCTION

- ASTM's primary mission is to develop and maintain voluntary full compliance standards for materials, products, testing and services
- A forum for producers, users, ultimate customers and those having a general interest to meet on common ground

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3

How Do ASTM Standards Differ From Other Standards?

- Primary difference – **FULL CONSENSUS**
 - Subcommittee responsible must deal with and resolve **every** negative vote
 - Negative can be:
 - Found persuasive – document redrafted or dropped
 - Found non-persuasive (technical reason), or non-related and approved as balloted
 - A Society Committee on Standards (COS) reviews every non-persuasive vote that passes at Main Committee to ensure proper procedures followed

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4

How Do ASTM Standards Differ From Other Standards?

- Other organizations can develop standards using less than full consensus procedures. Examples are:
 - **Company Standards** – consensus among employees of given organization
 - **Industry Standards** – consensus among companies within a given industry (typically by a professional society)
 - **Professional Standards** – consensus among individuals of a given profession
 - **Government Standards** – consensus among employees of a government agency or department

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5

How Do ASTM Standards Differ From Other Standards?

- ASTM believes full consensus (broad input from the beginning) results in technically valid and very credible standards when critically examined as the basis for commercial and regulatory actions
- **“When a standard has a large pool of “owners”, i.e., developers, it is more likely to be revised, improved and updated regularly”**

James A. Thomas, ASTM President

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6

Why Do Members Support ASTM?

- Because it meets their needs:
 - ASTM's management assures members a voice in the development of standards affecting their organization/industry
 - **It exempts them from any personal liability in the development of standards**
 - **It ensures their right to due process when they dissent**

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7

Who Uses ASTM Sheet Steel Standards?

- Used by thousands of individuals, companies and agencies:
 - Purchasers and sellers write them into contracts
 - Scientists and engineers use them in their laboratories
 - Architects and designers use them in their plans
 - Government agencies reference them in their codes, regulations and laws
 - All manner of technical people refer to them for guidance

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Types of Hot-Dip Coatings

Coating Name	Coating Composition	ASTM Specification
Galvanize	Zinc	A653/A653M A1063/A1063M
Galvanneal	Zinc-10% Iron	A653/A653M
Aluminum-Zinc	55% Aluminum-Zinc	A792/A792M
Zinc-Aluminum	Zinc-5% Aluminum	A875/A875M
Zinc-Aluminum-Magnesium	Zn-5/13% Al-2/4% Mg	A1046/A1046M
Aluminized	Al-5/11% Si, or pure Al	A463/A463M
Terne	Lead-8% Tin	A308/A308M
General Requirements for all hot-dip coatings – ASTM A924/A924M		

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9

ASTM Coating Designations What Do They Specify?

- ASTM designations for hot-dip coated sheet specify:
 - Minimum triple-spot-test (TST) value – average of three edge-center-edge readings – a **total-both-sides requirement**
 - Minimum single-spot-test (SST) value – is a single-spot **total-both-sides requirement**, and
 - Minimum single-side requirement – **is based on a TST only!**
- The TST test **only applies to the original, full-width sheet**
- Narrow sheet cut from full-width sheet is subject only to min SST requirements – therefore total-both-sides only
- With the exception of supplementary Table S2.1 in A653/A653M, ASTM specifications **are silent on the minimum weight on one side of a single-spot-test**

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10

G90 Coating Weight Results - Illustrating Passing and Failing the Requirements of A653/A653M (Table 1) – oz/ft²

Requirements:

Minimum Triple-Spot-Test average (TST), Total-Both-Sides (TBS) – 0.90 oz/ft²

Minimum Single-Spot-Test (SST), Total-Both-Sides (TBS) – 0.80 oz/ft²

Example	Test	E1	E2	E3	TST	Comments
1	TBS	0.92	0.93	0.96	0.94	Passes min TST
2	TBS	0.85	0.93	0.96	0.91	Passes min TST
3	TBS	0.85	0.87	0.96	0.89	Fails on min TST
4	TBS	0.78	0.95	0.96	0.90	Fails on min SST

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11

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Requirements:

Minimum Triple-Spot-Test average (TST), Total-Both-Sides (TBS) – 0.90 oz/ft²

Minimum Single-Spot-Test (SST), Total-Both-Sides (TBS) – 0.80 oz/ft²

Minimum One-Side (OS), Triple-Spot-Test average (TST) – 0.32 oz/ft²

Example	Test	E1	E2	E3	TST	Comments
5	OS-Top	0.30 ¹	0.31 ¹	0.40	0.34	Passes min TST-OS & TBS
	OS-Bot	0.55	0.62	0.47	0.54	
	TBS	0.85	0.93	0.96	0.91	
6	OS-Top	0.30	0.31	0.31	0.31	Fails on min TST-OS
	OS-Bot	0.55	0.62	0.65	0.60	
	TBS	0.85	0.93	0.96	0.91	

¹ These values meet the specification since the OS-TST average is above 0.32 oz/ft²

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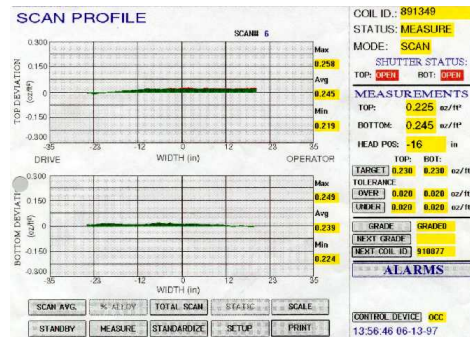
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12

Coating Weight Control

On-line testing to A754/A754M – X-Ray Fluorescence Test Method

- Measure top & bottom, E-C-E in a zigzag pattern
- Thousands of single-spot readings per coil, on each surface
- Displays results graphically and as averages
- Software randomly selects at least 5, E-C-E scans, averages them to arrive at a triple spot average for each coil



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13

Coating Weight Control

- There are multiple constraints to meet when running ASTM coating weight requirements:
 - Triple-spot averages, including total-both-sides and single-side
 - Single-spot total-both sides, **yet there is no**
- No single-side, single-spot minimum specified!
- When coating to automotive specifications only one constraint exists – the single-side, single-spot value, as ASTM designations have never been acceptable to this industry
- The single-side, single-spot minimum is the most pertinent limit of all, **and most coating lines can easily comply**
- **“Controlling to triple-spot and liberal single-side triple spot minimum is wasteful of zinc.”** Robert Wilhelm, GA Meeting, 2006

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14

Other ASTM Coated Sheet Developments

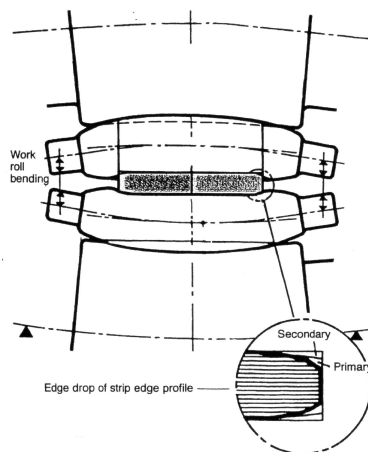
- **Thickness Tolerances (A924/A924M)**
 - Prior to 2009 ASTM standard thickness tolerance tables were “liberal” when compared to ISO and EN tolerances
 - ISO and EN tables excluded the outer 25 mm (1”) at the sheet edges. ASTM standard tables excluded only the outer 3/8”.
 - The 3/8” point is well into the “feather” or primary thickness drop off near the edge
 - **Solution** – make ASTM thickness tolerances seen to be equal or better of any in the world by making the existing ‘restricted tolerance, 1” edge distance’ tolerances (used by automotive for decades) the standard default tolerances.
 - **North American rolling mills are as good or better than any in the world. Without any significant technical or operational changes, ASTM thickness tolerance specifications were revised so as to make this capability plainly evident.**

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15

Thickness – Edge Drop



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16

Other ASTM Coated Sheet Developments

- New Standard (2012) for Advanced High Strength Steels
 - **A1079 Steel Sheet, Complex Phase (CP), Dual Phase (DP) and Transformation Induced Plasticity (TRIP), Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process**
- First standard in ASTM for these steels
- Use by automotive will take time
- Will serve as an industry “educational” standard that may help forestall the proliferation of an unmanageable number of steel chemistries

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17

ASTM Standards for Zinc

- **“Using the correctly specified grade of zinc, continuous galvanizing grade (CGG) alloy, or master alloy is key to producing a galvanized product that meets the requirements of the marketplace.”**

Richard Lynch – GA Meeting, 2000

- Close control of Al in the zinc is critical to achieving good adhesion of zinc to steel
- The galvanizer must be able to depend on a supply of zinc ingots that meet specific composition limits

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18

Zinc Grades Used for Continuous Hot-Dip Galvanizing

Chemical Composition Limits for Zinc & Zinc Alloys Used in Continuous Galvanizing (Wt%, Range or Max)

ASTM	Grade (UNS*)	Al	Pb	Cd	Fe	Cu	Others
B6 - SHG	Z13001	0.002	0.003	0.003	0.003	0.002	0.010 (all)
B6 - HG	Z15001	0.01	0.03	0.01	0.02	-	0.010 (all)
B852 CGG	Z80310	0.22-0.28	0.007	0.01	0.0075	0.01	0.01
	Z80411	0.31-0.39	0.007	0.01	0.0075	0.01	0.01
	Z80511	0.40-0.50	0.007	0.01	0.0075	0.01	0.01
	Z80531	0.40-0.50	0.01-0.03	0.01	0.0075	0.01	0.01
	Z80610	0.49-0.61	0.007	0.01	0.0075	0.01	0.01
	Z80710	0.58-0.72	0.007	0.01	0.0075	0.01	0.01
	Z80810	0.67-0.83	0.007	0.01	0.0075	0.01	0.01
	Z80910	0.90-1.10	0.007	0.01	0.0075	0.01	0.01

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19

B6 Standard Specification for Zinc

Specifies the chemical requirements and other deliver conditions for 5 zinc grades, including Special High Grade (SHG), High Grade (HG) and Prime Western (PW)

SHG (99.990% Zn) is used to reduce the aluminum content in coating line zinc baths

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B852 Standard Specification for Continuous Galvanizing Grade (CGG) Zinc for Hot-Dip Galvanizing of Sheet Steel

Specifies 8 CGG grades of zinc having aluminum levels from 0.25% to 1.0%. Restricts lead to a maximum of 0.007% in all but one of the grades. Has achieved a significant reduction in the number of custom grades of zinc that were once used by CGLs.

The reason for the different levels of aluminum is to enable more effective management of zinc bath chemistry and minimize the use of “ 10% Al brightener bar” that can shock the bath into precipitating dross

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B897 Standard Specification for the Configuration of Zinc and Zinc Alloy Jumbo and Block Ingot

Specifies the dimensions of 2400 lb (1089 kg) jumbo and block ingots designed for use with automatic handling systems that add zinc to the baths on continuous galvanizing lines

Standardizes the dimensions of these products, allowing a reduction in the multiple ingot designs that were once specific to individual coating lines

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B914 Standard Practice for Color Codes on Zinc and Zinc Alloy Ingot for Use in Hot-Dip Galvanizing of Steel

Specifies the color code system used to identify zinc and zinc alloy ingots

There is a unique color code for each zinc and zinc alloy grade to avoid confusion in galvanizing plants

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23

Summary

- ASTM standards are developed to do the most good for the most people
- **“A standard developed in a spirit of cooperative antagonism by a full, balanced contingent of interests has credibility and integrity. It is less likely to be biased or unduly influenced by a single driving force, or beneficial to only a small segment of society.”**

James A. Thomas, ASTM President

- ASTM standards for coated sheet have and continue to be developed in this manner and the active participation of members of the coated sheet industry is invited
- **The control “philosophy” of hot-dip sheet coating weight measurement needs to be reviewed and revised to bring it in line with current production capabilities**

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24



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Thank You