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Auditing a Coatings Shop

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MxV Rail is a subsidiary of the Association of American Railroads (formerly TTCI)

Commonly Used Terms

- Dry Film Thickness (DFT)
- Continuity / Holiday Test
- Blast
- Blast Profile
- DTM (Direct to Metal)
- VOC (Volatile Organic Compounds)
- Plural Component/PC
- Solvent Free/100% solids
- AMPP/NACE
- SSPC

Why Coat?

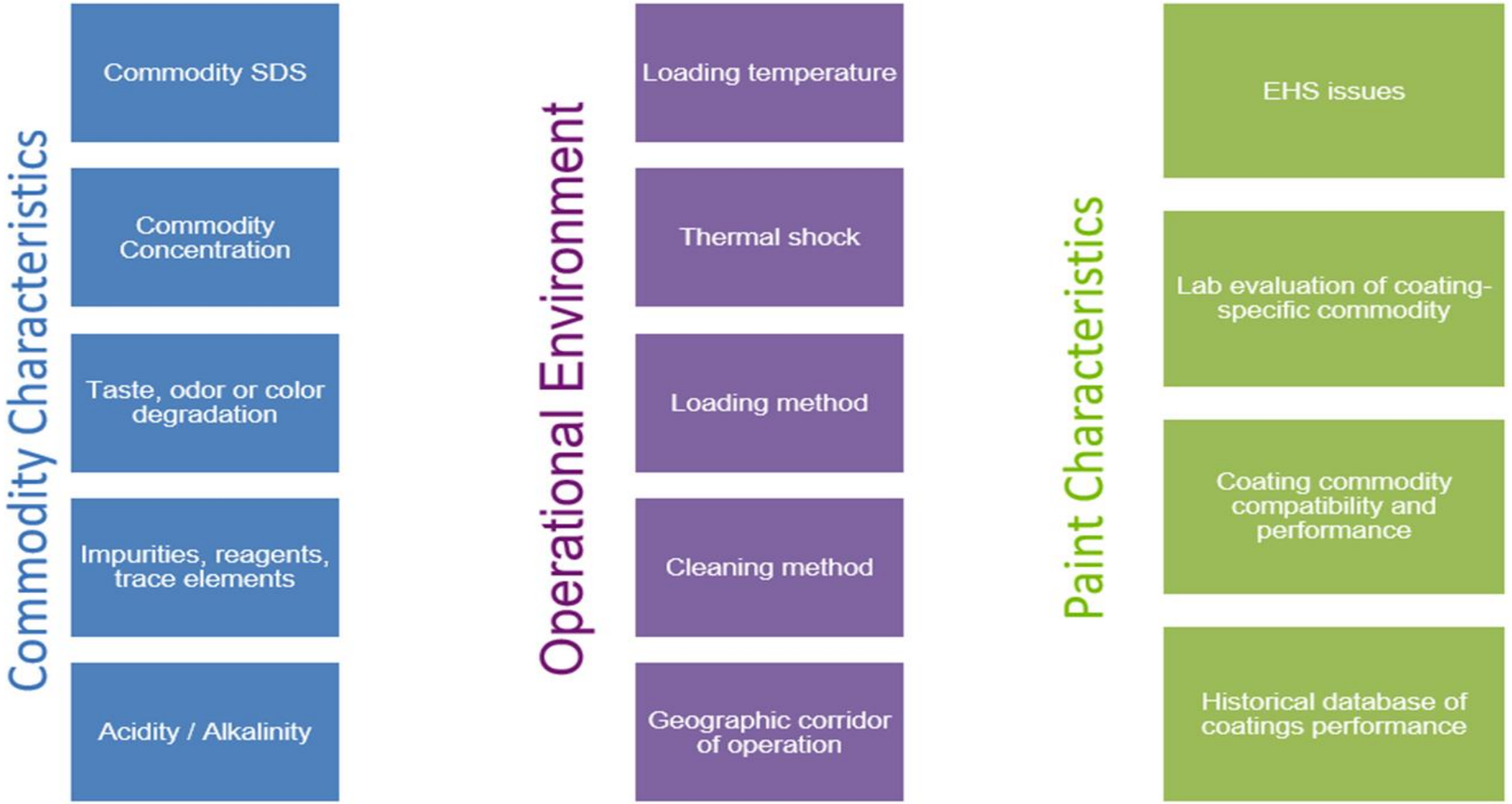
Two basic reasons:

- *to protect*
- *to decorate*

Industrial Customers: Protection of assets (most railcars are made from various grades of carbon steel, and therefore one of the main reasons for coating them is for corrosion protection).

Protect from what?.....primarily, *RUST*

Coating Selection: Things to Consider



Coating Selection: Things to Consider

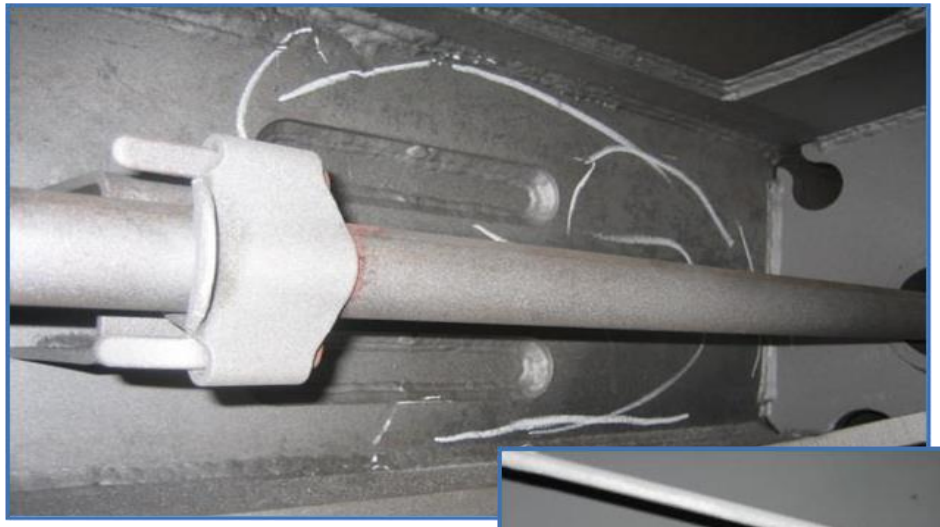
- Does the Railcar have any design challenges for the application?
- Internal heating coils?
- Brackets?
- Difficult to prepare and line orifices
- Dissimilar metals?
- Surface condition of car body itself?

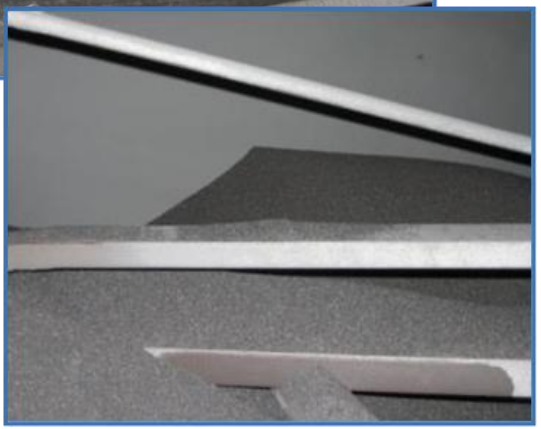
Factors Affecting Coatings Life

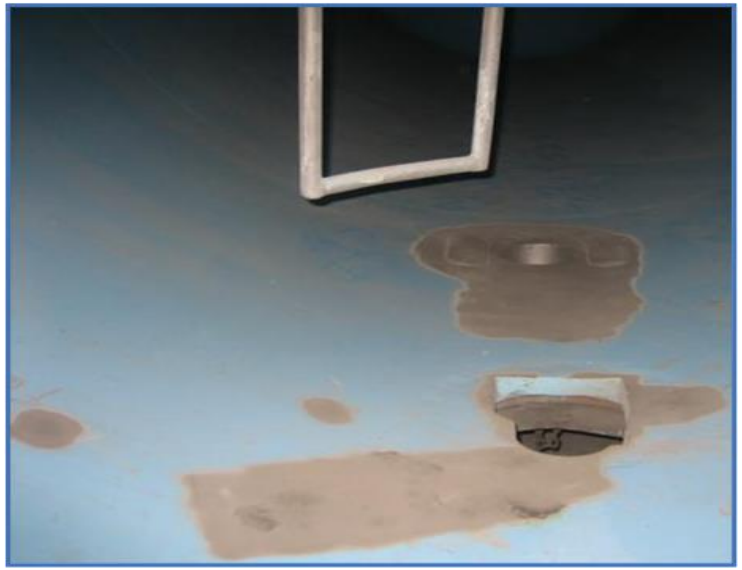
- UV light
- Chemical exposure
- Environmental exposure
- Temperature exposure
- Loading characteristics
- Inappropriate commodity
- Car handling
- Cleaning process
- Proper application
- Damage
- Electrolyte (a conductive liquid)
- Humidity / Nitrogen Padding
- Commodity concentration
- Metal surface – carbon steel vs. stainless steel
- Product immersion time
- Agitation during transportation
- Lining-commodity incompatibility

Car Preparation Considerations

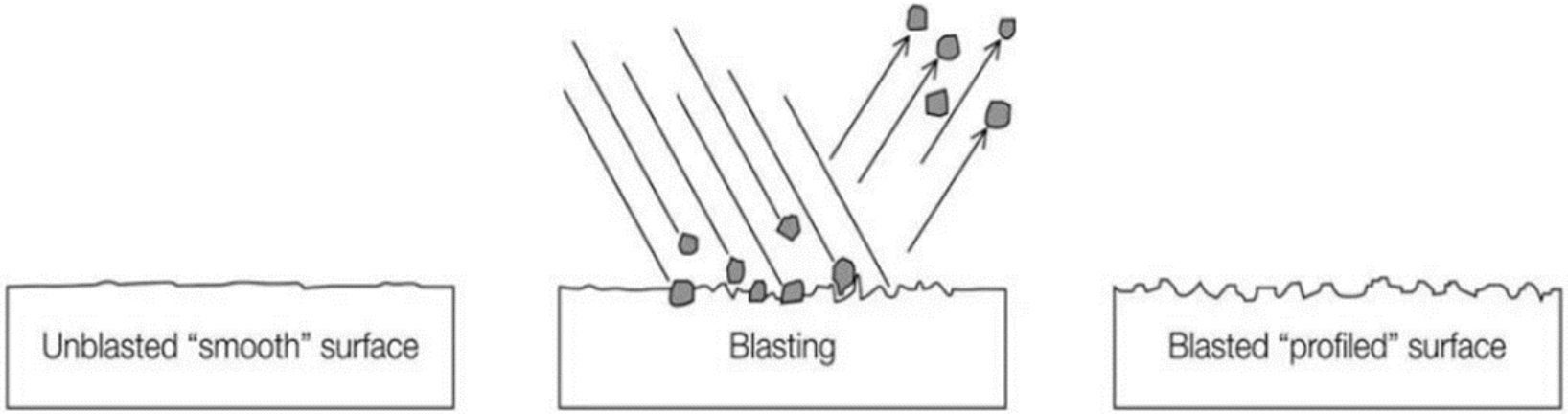
- Pre-blast cleaning (solvent)
- Blast Profile
- Blast Cleanliness
  - SP5: White Metal
  - SP6: Commercial
  - SP7 – Brush-off
  - SP10: Near White
- Pre-application preparation
  - Caulking
  - Masking
    Striping
- Ventilation





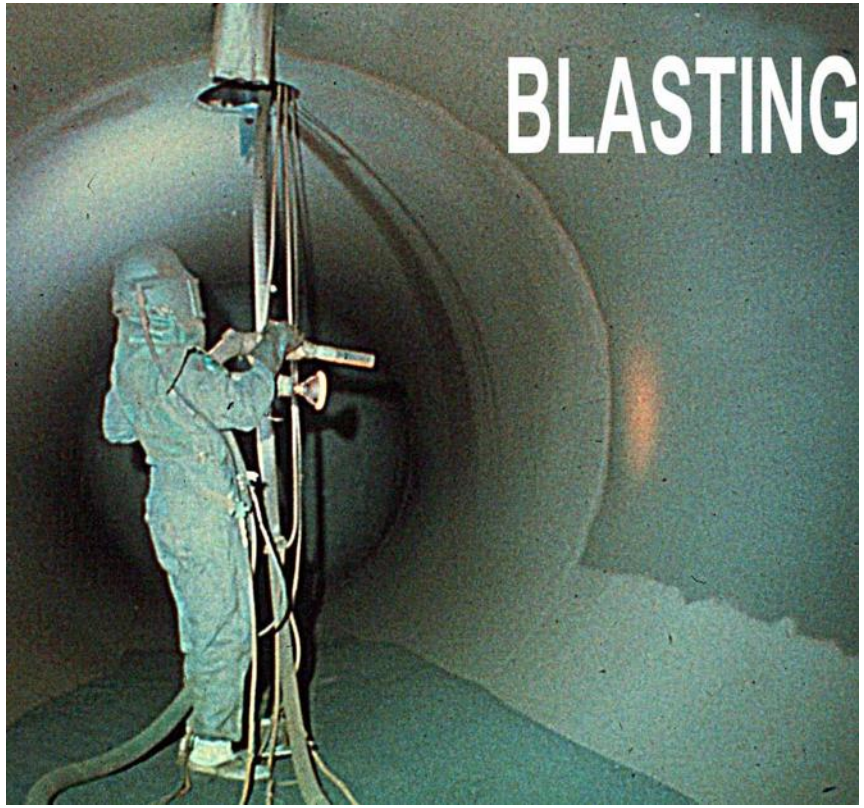


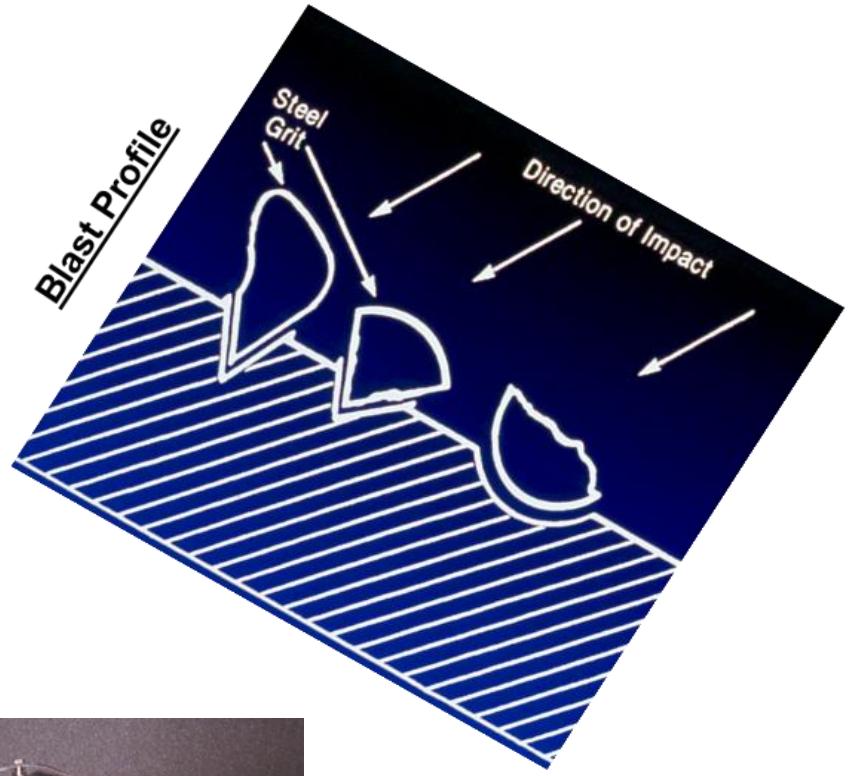
Surface Preparation/Blasting



Surface profile is defined as **a measurement of the maximum peak-to-valley depth generated by abrasive blast cleaning and impact-type power tools**. These operations effectively increase the surface area and provide an "anchor" for the applied coating system.

Surface Preparation/Blasting





Press-O-Film

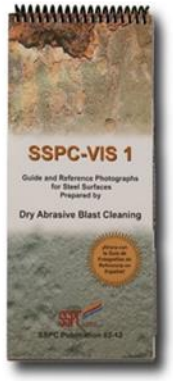
Blast Standards

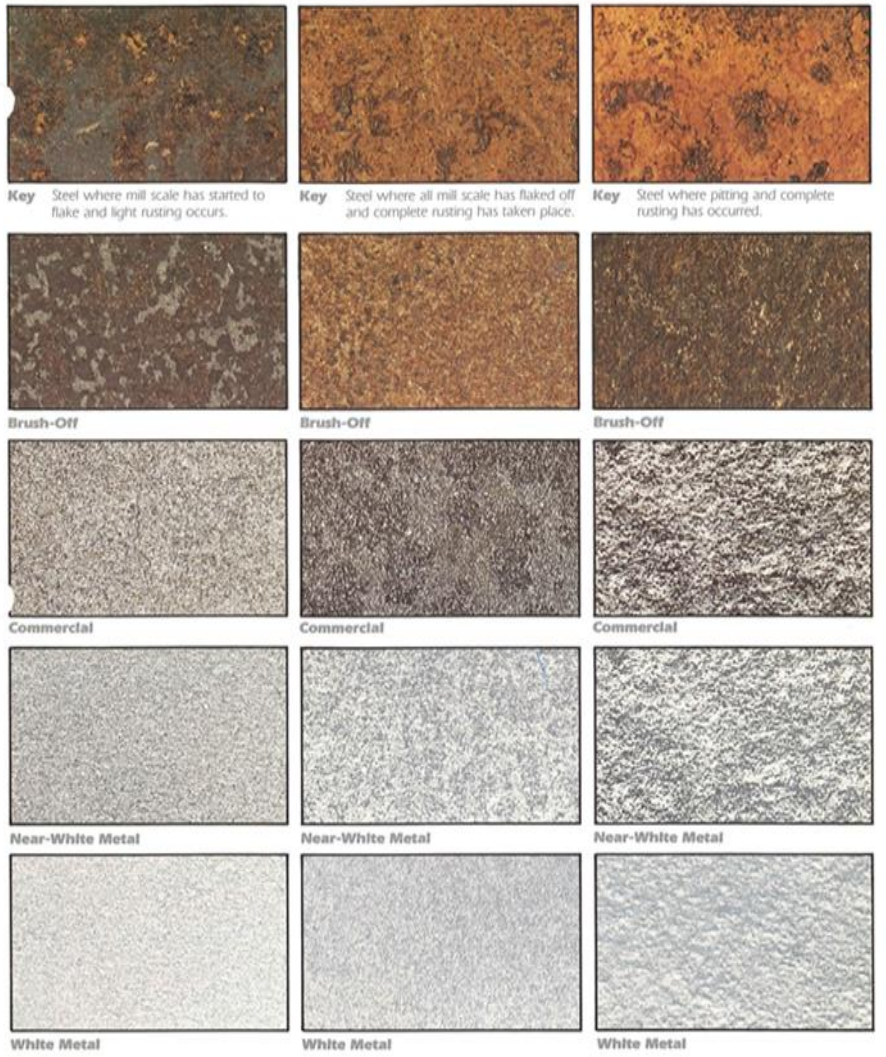
Exterior is typically specified as

SSPC SP-6 Commercial Blast clean

Interior tanks and hoppers can be specified

SSPC SP-10 or SSPC SP-5





Blast Standards

Coatings Application Considerations

- Mixing procedure
- Spray application parameters
- Applicator technique
- Car accessibility
- Wet film thickness readings
- Curing technique
- Dry film thickness readings
- Post-rinse

Paint Storage

Paint Storage

The single most important parameter affecting
the storage stability of paint is the temperature –
in general, the higher the storage temperature the faster the ageing.

Paint Storage

LOW TEMPERATURES:

Solvent borne paints will in general resist even heavy frost conditions. They will all become more viscous and unsuitable for application, but ***slowly re-heating will in most cases result in the original consistence of the paint.*** Some of the binder ingredients of certain two-component paints (epoxy and polyurethane) with high solids content (or solvent less) may at subzero temperatures form crystals and may therefore require special heating and re-mixing if exposed to too low temperatures.

Waterborne coatings should never be exposed to frost. If the temperature drops below the freezing point of water, the paint will become irreversibly destroyed.

General recommendations in relation to storage of paint:

- Storage only in closed/sealed cans.
- If possible, turn the can upside down every 3 months - to reduce the amount of settlement.
- Never expose waterborne coatings to frost.
- Store the paint in a sheltered but well-ventilated area.

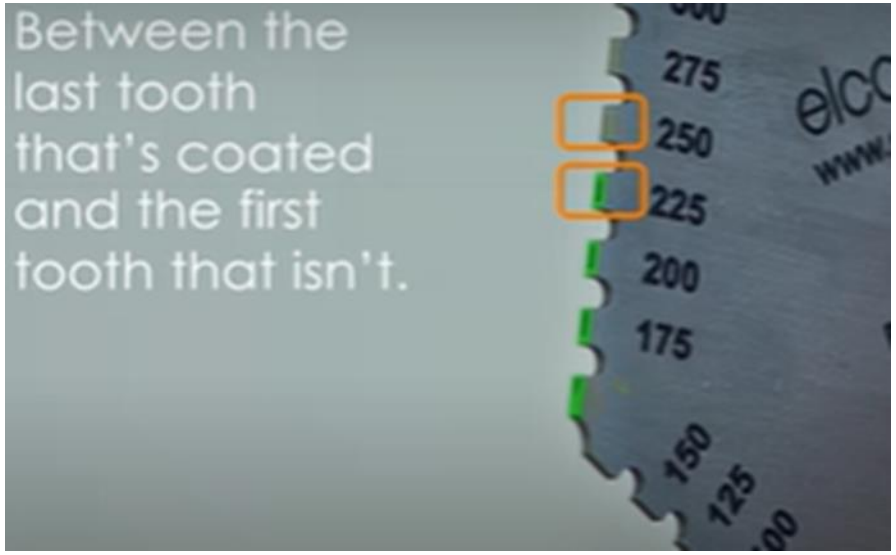
Wet Film Thickness Vs Dry Film Thickness

Wet Film Thickness Gauge (WFT)

Complies with ASTM D-4414

A wet film gauge is a tool used as a **guide** to measure the thickness of liquid material before it dries to determine how thick the liquid is.

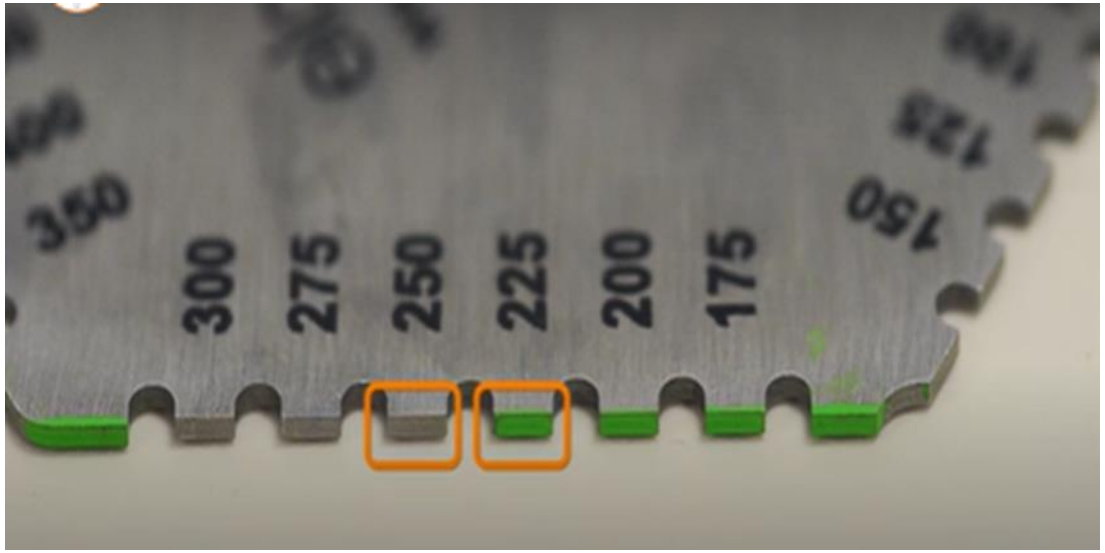
Wet Film Thickness Gauge (WFT)



Wet film thickness is determined as being the last wetted step and the next adjacent higher dry one.
Wet film thicknesses are “guideline” thicknesses only.
Use the gauge along the length, not the width of a curved surface.

Q: How many WFT readings should the applicator take.

A: As few as possible if distance, speed and pass count stay consistent.



Dry Film Thickness Gauge (DFT)

Type 1 - Pull off Gauge

SSPC: The Society for Protective Coatings
Paint Application Standard No. 2
Procedure for Determining Conformance to Dry Coating Thickness Requirements

Type 2
Electronic Gauge

Complies with ASTM D-7091 and SSPC PA-2 ***(Procedures to Measure Dry Film Thickness of a Nonmagnetic Coating over Magnetic Substrates)***

The purpose of the dry film thickness gauge is to measure the thickness of the coating to verify if you comply with the specification requirements outlined by the coatings manufacturer instructions.

Dry Film Thickness Gauge (DFT)

Calibration - Annual

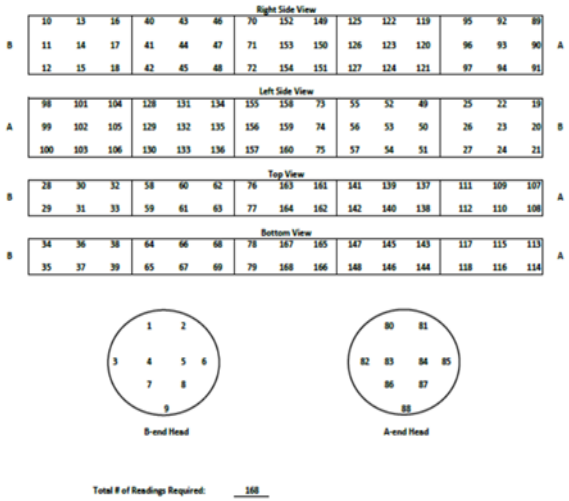
Calibration is the high-level, controlled, and documented process of measuring traceable calibration standards over the full operating range of the gauge and verifying that the results are within the stated accuracy of the gauge. If necessary, gauge adjustments are made to correct any out-of-tolerance conditions. Calibrations are typically performed by the gauge manufacturer or by a qualified laboratory in a controlled environment using a documented process.

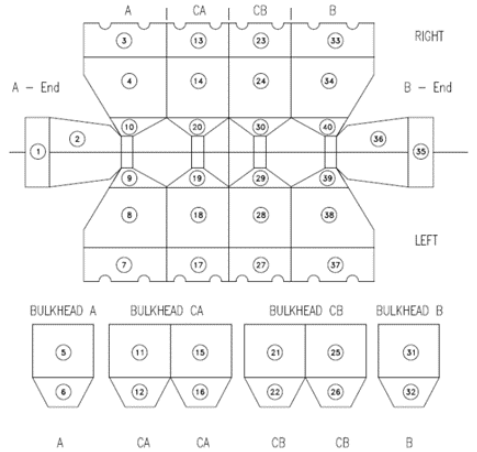
Verification of Accuracy – Typically at the Beginning of Each Shift

Verification is an accuracy check performed by the instrument user on known reference standards prior to gauge use for the purpose of determining the ability of the coating thickness gauge to produce reliable values compared to the combined gauge manufacturer's stated accuracy and the stated accuracy of the reference standards. The process is intended to verify that the gauge is still functioning as expected. Verification is typically performed to guard against measuring with an inaccurate gauge at the start or end of a shift, before taking critical measurements, when an instrument has been dropped or damaged— or whenever erroneous readings are suspected.

Current Procedures for DFT Measurement Recording Used in Rail (AMPP/NACE TR21499)

Most users take and record single gauge readings, while some record the average of three readings. Since recording Type 2 gauges are predominantly used, a printed report of the DFT readings is commonly generated and retained in the railcar file. When non-recording Type 1 and Type 2 gauges are used, the DFT readings are commonly handwritten on a railcar diagram, which is also retained in the railcar file. Current technology of gauges allows for the importing of DFT readings directly onto railcar diagrams. Some gauge manufacturers will use railcar facility diagrams in a spreadsheet or text file format, and with some minor formulation, those diagrams can be auto-populated with the DFT readings. Other gauge manufacturers, using their software, will convert railcar facility diagrams into a format compatible with the DFT gauge, and those diagrams will be auto-populated with the DFT readings. In some cases, those diagrams will be visible on the DFT gauge screen while taking the DFT readings. In both cases, the diagrams containing DFT readings can be printed and retained as part of the railcar file records.





AMPP/NACE TR21499

While many industrial coating applicators and inspectors use ***SSPC-PA 2*** in its entirety, the railcar industry uses it in more of a discretionary manner such as:

- For daily verification and necessary adjustment of DFT gauges
- For acceptance criteria of allowable DFT range ***(SSPC-PA 2 Levels 1-5)***
- For conflict resolution

Third-party or railcar owner or lessee inspectors often take and record DFT readings as well. In most cases, these inspections consist of taking numerous random DFT readings in confined areas within easy reach, focusing specifically on known problem areas (i.e., just off the weld seams, tie-in areas, hard-to-spray areas, etc.).

COATING THICKNESS RESTRICTION LEVELS

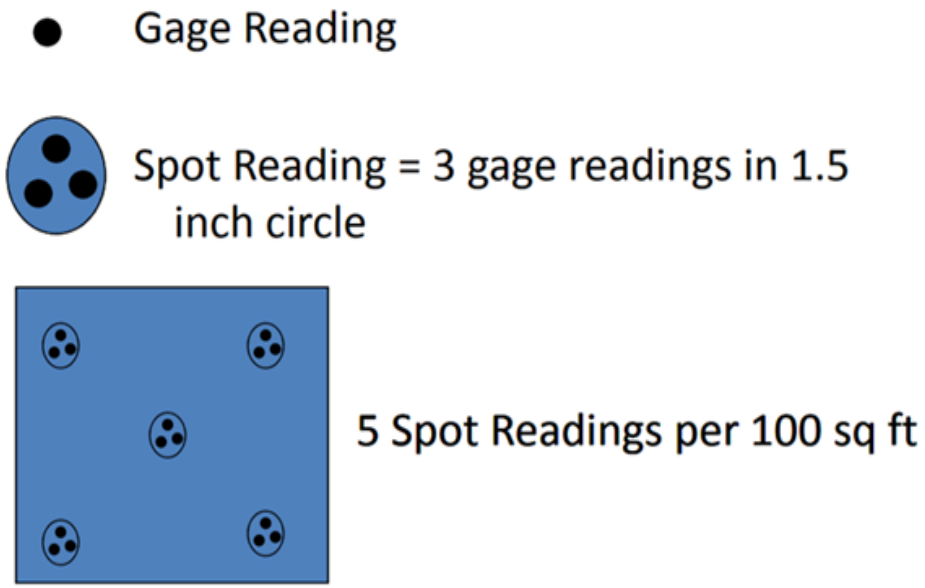
Thickness	Gage Reading	Spot Measurement	Area Measurement
Level 1			
Minimum	Unrestricted	As specified	As specified
Maximum	Unrestricted	As specified	As specified
Level 2			
Minimum	Unrestricted	As specified	As specified
Maximum	Unrestricted	120% of maximum	As specified
Level 3 (default)			
Minimum	Unrestricted	80% of minimum	As specified
Maximum	Unrestricted	120% of maximum	As specified
Level 4			
Minimum	Unrestricted	80% of minimum	As specified
Maximum	Unrestricted	150% of maximum	As specified
Level 5			
Minimum	Unrestricted	80% of minimum	As specified
Maximum	Unrestricted	Unrestricted	Unrestricted

Measurement Frequency Per SSPC-PA2 (Paint Application Standard No. 2)

1. If the structure is less than 300 square feet, (~28 square meters) each 100 square feet (~10 square meters) is measured

2. If the structure is between 300 and 1000 square feet (~28 and 100 square meters), arbitrarily select 3 random 100 square foot (~10 square meter) test areas and measure

3. For structures exceeding 1000 square feet (~100 square meters), arbitrarily select 3 random 100 square feet (~10 square meter) testing areas for the first 1000 square feet (~100 square meters), and 1 random 100 square foot(~10 square meter) testing area for each additional 1000 square feet (100 square meters)



Area Measurement: The average of five spot measurements obtained over each 10 m2(~100 ft2) area of coated surface, or portion thereof.

Measurement Frequency Per SSPC-PA2 (Paint Application Standard No. 2)

- Individual ***gage readings*** obtained and averaged to generate a spot measurement are unrestricted (unusually low or high readings that can't be repeated are discarded).
- ***Spot measurements*** (the average of the gage readings) must be within 80% of the minimum thickness and 120% of the maximum thickness.
- ***Area measurements*** must be within specified range.
- Specifications should indicate the ***range*** of coating thickness (e.g., 5-7 mils), ***not as a single value*** (e.g., 5 mils).
- It is impossible for an applicator to achieve a single thickness value.

Inspection Equipment

Blasting & Coatings Related Inspection Equipment

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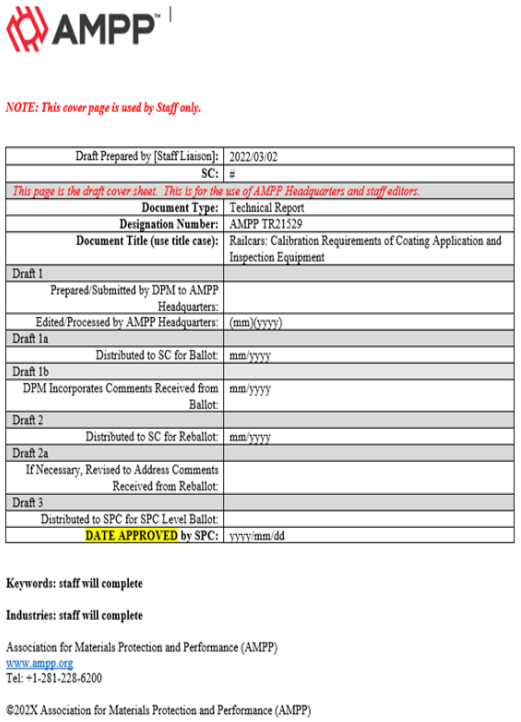
- Blast needle pressure gage
- Nozzle throat gage
- Spring micrometer and shims
- Psychrometer / Hygrometer
- DFT gages and shims
- Holiday Detectors
- Probe and contact thermometers
- Lining temperature bake recorders
- Calibration and/or verification required

AMPP TR21529 - Railcars: Calibration Requirements of Coating Application and Inspection Equipment



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Gauges	Proposed
Blast Pressure Gauge	Non-Calibration
Throat Nozzle Gauge	Non-Calibration
Spring Micrometer	1 yr.
DFT Gauge	Verify prior to use on each rail car and after each coat is applied
Positector Probes - RTR, DFT, DPM, SPG and SST	
Blast reference plate	Must be representative of current anchor profile observed from unit
DFT Shims	Certified at receipt / Visual
Temperature Gauges	1 yr.
Thermocouple	
Psychrometer	1 yr.
Sieves	Non-Calibration
Scales	Non-Calibration
Holiday detector - Low	1 yr.
Holiday detector - High	1 yr.
Holiday detector - Spark	1 yr.
Peak Voltage Calibrator	1 yr.
Pressure Gauges used in blast and coating operations	Non-Calibration
Shore A and Shore D Durometer	1 yr.

Effects of Corrosion

AMPP/NACE International today released the *"International Measures of Prevention, Application and Economics of Corrosion Technology (IMPACT)"* study, in which it estimates the global cost of corrosion to be US **$2.5 trillion**, equivalent to roughly 3.4 percent of the global Gross Domestic Product (2016 GDP).

MxV RAIL

Thank you

Association of American Railroads
Quality Assurance Committee