



Method for Measuring the Thickness of Intumescent (Fireproofing) and Cryogenic Spill Protection Coatings Applied to Load-Bearing Structural Steel Members, Fire Divisions, Pipework, and Vessels/Tanks

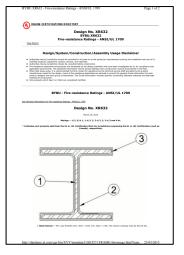
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Motivation for the development of Appendix 11

- 1. Lack of suitable industry standard addressing Dry Film Thickness (DFT) measurements of thick-film intumescent coating systems.
- 2. Ensure that applied systems would perform according to the applicable certified design, when exposed to a fire of similar intensity.















Applied
system
performs
according to
certification
in a fire, as
tested.



Challenges in developing Appendix 11

- 1. Various steel shapes must be verified as having a proper DFT, such as:
 - a) Open and closed profiles
 - b) Plate steel (e.g., divisions)
 - c) Equipment support (e.g., vessel skirts)
- 2. Insulative char formation, typically ranging from 8 to 50 times the DFT
- 3. Acceptable range of DFT measurements, both individual gage measurements and averages
- 4. Difficult areas, but critical, to obtain gage measurements (e.g., flange tips)
- 5. Texture, which can range from smooth to textured
- 6. Addressing uniformity of film build throughout a fireproofed member
- 7. DFT measurement frequency, locations, and distances between



Influencers include, not limited to, in the development of Appendix 11

- 1. UL 1709 and UL 263/ASTM E119 thermal couple placements on test specimens
- 2. SSPC-PA 2 DFT Standard
- 3. Institute of Corrosion PFP Inspection Program
- 4. AWCI Technical Manual 12-B
- 5. Load bearing characteristics of select members (e.g., W-sections)
- 6. Char Formation, both expansion and typical cracking during char formation
- 7. Typical steel members fireproofed
- 8. Typical spray pattern width and application techniques



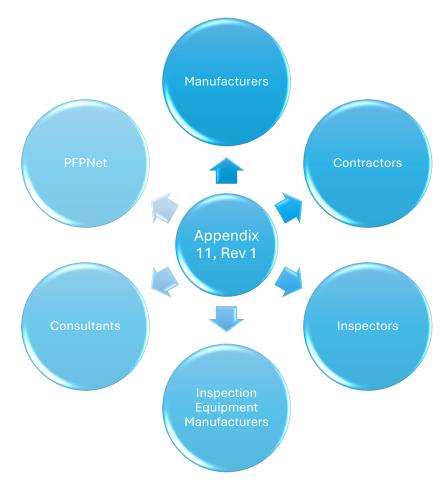






Goal for the development of Appendix 11, Revision 1

- ✓ Achieve balance of safety and efficiency of carrying out DFT inspections
- ✓ A more reproduceable DFT measurement procedure

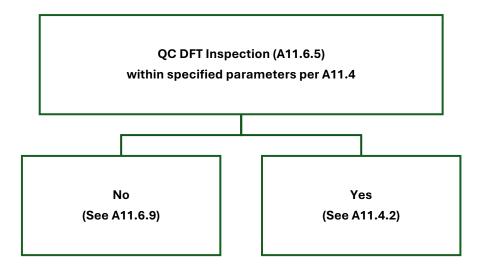




Headline News - Enhancement of Appendix 11, Revision 1

Quality Control (QC) Inspection

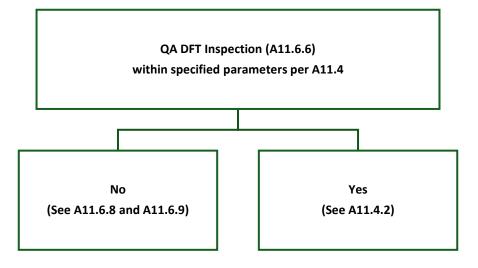
(e.g., Contractor during application)



✓ Quality control inspection procedures requires measuring the DFT on each structure coated.

Quality Assurance (QA)

(e.g., 3rd Party Inspector)



✓ Quality assurance inspection procedures requires measuring the DFT on select structure coated, determined by the total unit area coat within a given project.



Thank You!

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Dry Film Thickness measurement of thick film coatings

A study of the methods available based on a sample of steel sizes applied with an epoxy pfp in controlled conditions (shop application).

Project Aims



- To provide data for groups developing DFT check procedures for epoxy intumescents...
- ...by comparing and contrasting 4 methods:
 - AMPP
 - AWCI 12-b
 - PFPNET hybrid
 - Random scatter



Studies to Date

- Two rounds of studies have been done
- Shop-applied
- Experienced applicator
- 1st round:
 - 0.08"-0.18" target DFT,
 - Beams & cols 6"-24" deep, 23' long
- 2nd round
 - 0.4" target DFT
 - Beams & cols 8-32" deep



Overall summary of 2nd round



Based on the study of 11 beams (all d.f.t's in mm)

SECTION NUMBER	d.f.t. ACTUAL	AMPP d.f.t.	Random 10d.f.t.	Method 12-b d.f.t.	PFPNET hybrid d.f.t.	Maximum deviation from actual
1	10.94	10.96	10.78	10.87	11.43	<mark>+ 4%</mark>
2	11.17	<mark>11.73</mark>	10.51	11.12	11.33	<mark>+5%</mark>
3	11.05	11.55	10.40	11.61	11.34	<mark>-5%</mark>
4	11.14	11.27	10.69	<mark>12.04</mark>	11.52	<mark>+12%</mark>
5	10.71	10.72	10.76	10.47	10.68	All within 2%
6	10.26	10.08	10.38	10.69	10.33	All within 2%
7	10.18	10.04	10.36	<mark>9.78</mark>	10.23	<mark>-4%</mark>
8	10.33	10.33	10.32	10.28	10.32	All within 2%
9	10.63	10.88	10.42	10.7	10.47	All within 2%
10	9.65	9.80	9.63	<mark>8.75</mark>	9.51	- <mark>10%</mark>
11	10.74	10.82	10.75	10.62	10.56	All within 2%

Conclusions from the study?



- All the methods used produced a reasonable level of reproduction compared to the 'actual' d.f.t.
- Method 12-b had the highest number of deviations and the most pronounced.
 - Overall results more easily skewed by a single 'out' reading because of the low number of readings required.
- Even the random sampling came close to the actual dft on the majority of structures.

Conclusions from the study?



- Shop application and experienced contractor produced a very even DFT on all the structures – perhaps this contributed to the pattern of results.
- Little difference between PFPNET Hybrid and AMPP even though the former required approx. 50% of the number of readings...
- Possibly the size/depth of the samples contributed to this, deeper/larger steel may well show a different correlation.
- The pattern appears to be more important than the frequency of the pattern.

Future work...



- Different sizes of structure
- Greater range of thicknesses
- Field rather than shop application (greater variations in thickness).
- Look at the methodology of taking the readings (I used simple single point readings).
- Acceptance Criteria What sort of deviation is acceptable?
 - -10 or 15% allowable is based on the reduction in corrosion protection afforded by a coating, not how a structure would rise in temperature at an isolated low point.
 - Can the excellent work already conducted by PFPNET on quantifying anomalies and defects in pfp coatings be adapted in some way?





Thank You!

Ian Bradley

PFPNet Technical Director