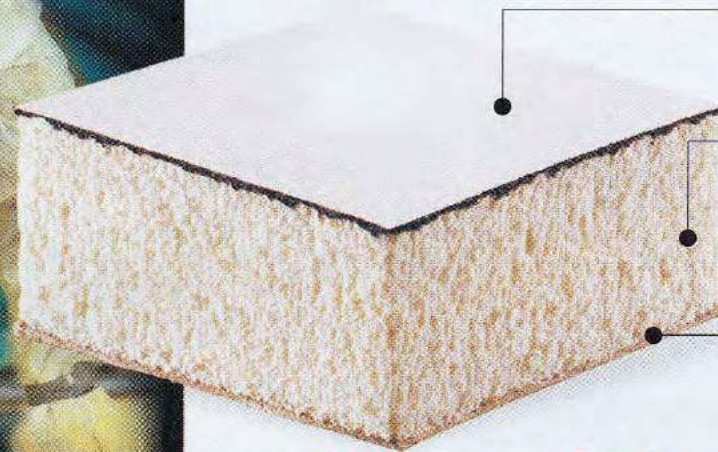
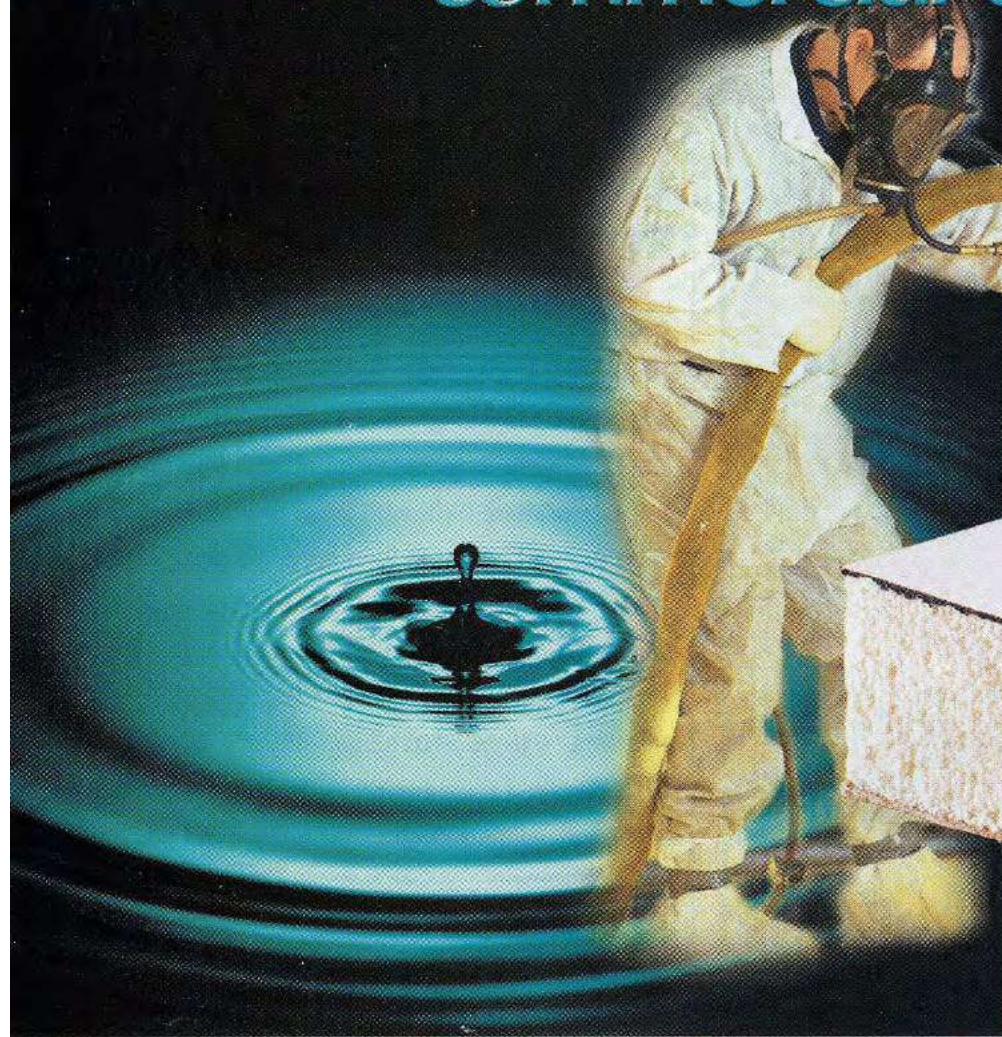


Spray Polyurethane Foam (SPF)

Rooftop Quality Assurance

advanced technology for
commercial & industrial facilities

The Roofing System
that pays for itself
in under 5 years!



Dual layered fluid applied seamless protective elastomeric coating membrane

Seamless monolithic blanket of sprayed poly-urethane foam. This instantaneous waterproofing foam dries in one minute and can be walked on in two minutes.

Polyurethane foam can be applied to virtually all existing and new construction substrates

Your Final Roof!

Spray polyurethane foam roofing systems. (SPF)
Finally, a "Life-of-the-Building" roofing system!



**GE Roofing System
Qualified Applicator**

Course Objectives

- Explain SPF industry terms and application procedures
- Establish and explain SPF Roofing Systems Quality Standards
- Explain Tools and Resources for SPF
- Explain Before, During and After Observations/Inspections Requirements

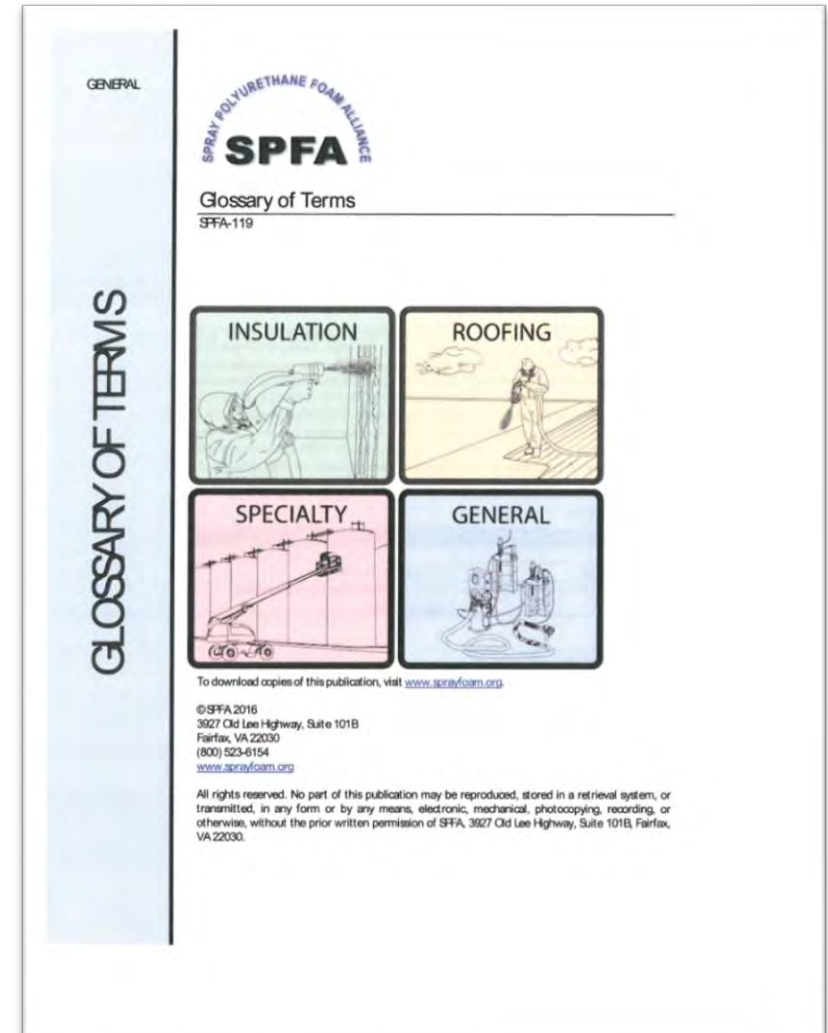
What is SPF?

- The industry has identified SPF to mean a roofing system that may contain one or more of the following: spray foam, elastomeric coatings or other surfacings
- The system can be coatings over a metal roof, a re-cover using foam and coatings or a new roof using foam and aggregate
- SPF as an industry would describe all of these applications

Glossary of Industry Terms

The glossary of Industry Terms is available from SPFA at www.sprayfoam.org

This is free for download at their website under technical documents.



SPF Roof System Application What the Observer Should Look For

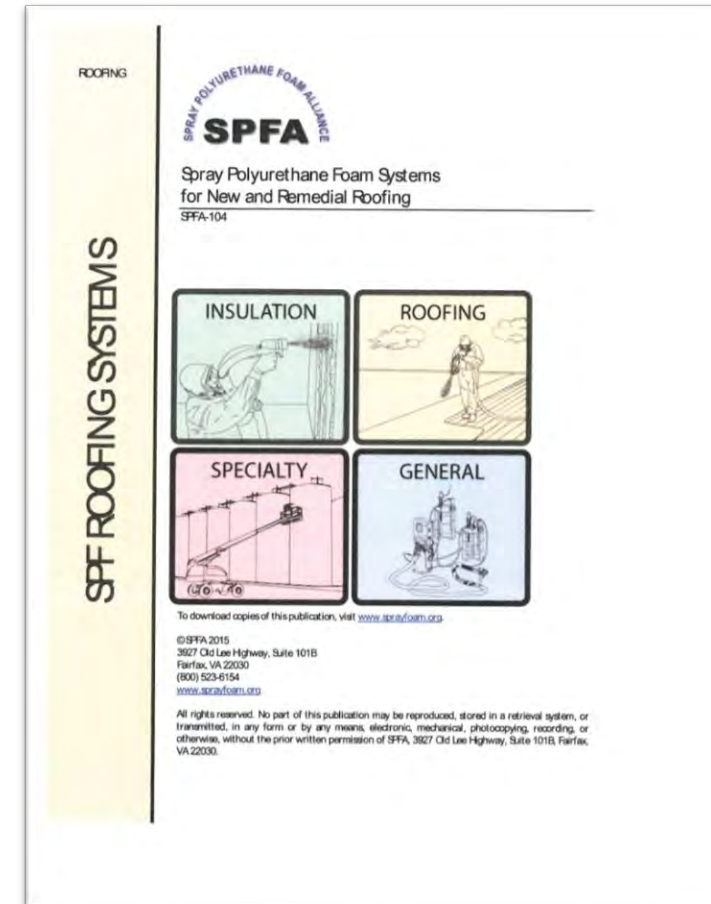
- Review/Inspect substrate for readiness for foam installation
- Inspect equipment for compliance with industry standards
- Review Contract Documents and Submittals
- Review Site Conditions
- QC Before, During, and After

SPF Roof Application, cont..

- Apply the base coating/Inspect
- Apply the intermediate (optional) or topcoat/Inspect
- Apply (optional) granules or sand/Inspect
- Apply (optional) lock coat application of coating over granules
- Final Inspection

New and Remedial SPF Roofing

- Before inspecting a spray polyurethane foam and coatings roof go to www.sprayfoam.org
- Download Spray Polyurethane Foam Systems for New and Remedial Roofing
- Visit www.spraypolyurethane.org for safety requirements



- Spray Based Polyurethane Foam Roofing
- Available for purchase at www.nrca.net
- Excellent resource with roofing details

The NRCA Roofing Manual: Metal Panel and SPF Roof Systems—2016 (Hard copy)

This manual provides you with comprehensive information including design, materials and installation techniques applicable to metal panel and spray polyurethane foam (SPF) roof systems used in low- and steep-slope applications. With two complete sections, Metal Panel Roof Systems and SPF Roof Systems, this manual is a welcome addition to your technical library.

The Metal Panel Roof Systems section includes guidelines applicable to metal and metal panel roof systems, substrates, architectural metal panel systems and structural metal panel roof systems in addition to 83 construction details. The SPF Roof Systems section includes information about materials, design considerations, application and design guidelines, as well as 71 construction details, including SPF details for reroofing and roof systems with fleece-backed membranes.



[Click to view additional images.](#)

Item #: 0436

Member price: \$195.00

Nonmember price: \$395.00

Quantity [Add to cart](#)

Roof Observations

- Before Foam Application
- During Foam Application
- After Foam Application
- Before Base Coat Application
- During Base Coat Application
- After Base Coat Application
- Repeat for Intermediate or Topcoat



SPF Application Equipment

- Ratio A and B to + or - 2%
- Heat A and B to thin viscosity so they spray in a defined pattern and are mixed
- Normal spraying pressure range: 800 psi to 2,000 psi
- Normal Primary Heating Settings: 95 F to 140 F



Equipment Components



Spray Application Gun

- The two parts of spray foam are ratioed, pressurized, heated and come together at the spray gun
- The spray applicators arm movement and foot travel control the foam thickness



Adhesive Applications

- Two-part foam adhesives for securing roofing components

www.sprayfoam.org

- You will also find a SPF equipment guide on this site also.



Graco Predator (Heated)

- Two-part adhesives are used to secure above deck components such as insulation and membranes.
- The foam reacts much slower than spray foams to allow working time to set the components into the wet foam



Graco Gap Gun

- Cost \$1,800 Estimate
- This is a simple spray gun used for two-part foam adhesives used for roofing components
- It can be modified to spray or lay a bead of foam, normally 12" on center or full 100% coverage



Probler Pole Gun

Pole guns have been designed to be used with SPF adhesives to minimize overspray and keep the gun closer to the target



Observation Tools

Optical Comparator



**No. 140 – Caliper,
Decimal inch sizes.**

Somewhat similar to Reticle No. 125, Consider No. 125 as a feeler-gage and this one as a snapgage for miniature parts and dimensions.



**No. 121 – 1/2 in.
By .005 in. Div.**

This is the most popular scale for mechanics, toolmakers, and engineers working with decimal measurements.

Observation Tools

Depth Gauge



Observation Tools

Digital Anemometer



Observation Tools

Moisture Meter



Observation Tools

Infrared



Observations

- Is the foam part A and part B (system) the correct one?
- Does the mfg.'s. technical data sheet show acceptable density and compressive strength?
- Are the equipment settings specified and being followed?
- Is the reactivity of the foam suited for the application conditions?

Foam Components

A side- Isocyanate

- Polymeric MDI -Methylene diphenyl diisocyanate (*MDI*). •- most common for SPF
- The A side is common to most foams

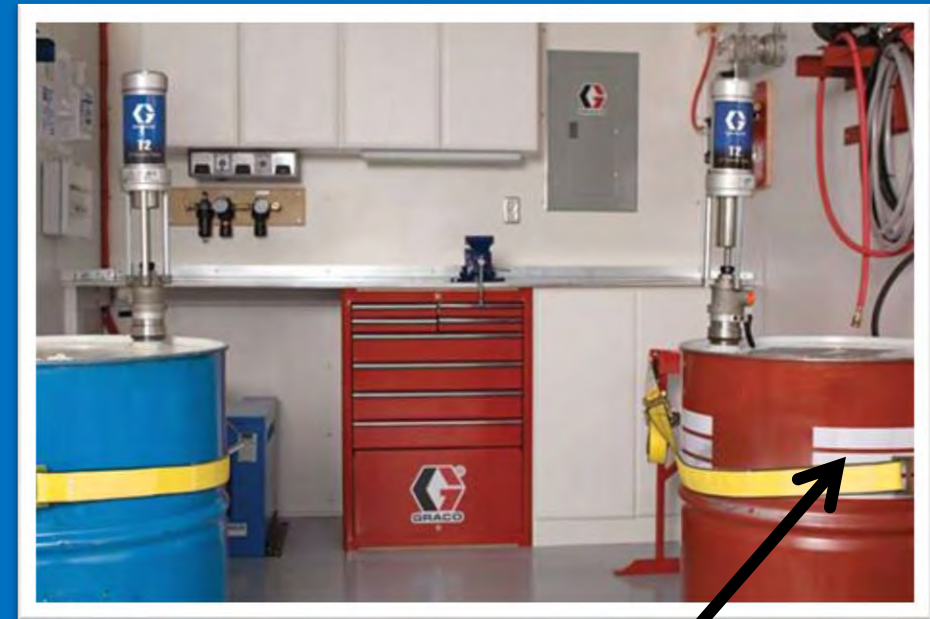
B side- Resin

- Polyols
- Surfactants
- Catalysts
- Blowing agents
- Fire retardants
- The B side is where density and reactivity changes are made

Typical Material Drum/Product Data Sheet

Check Drum Labels to Find:

- Product Mfgr Name
- Product Name or Number
- Lot or Batch Number
- Date of Manufacture
- Website for more information or Technical Contact Information



Chemical Reaction

- Exothermic - limits lift or pass thickness, most mfgr. product sheets call for a min. of ½” pass to a max. of 1-1/2” thick at one time
- Cream time - 3-6 seconds
- Dry to touch - 1-3 minutes
- Cure time
 - 12- 15 minutes to walk on
 - 1 hour for 90% cure, 90% properties
 - 1-3 days, final cure

“A” Side Chemical Reaction because of its Moisture Sensitivity

- “A” component will react with water, generating CO₂ this can result in weak knit line adhesion and blister formation. The rule is not to spray foam if the air temperature is not more than 5 degrees from the current dew point.
- Apply foam to dry surfaces. Application to damp or wet surfaces can be seen and will effect the foam physical properties. Inspection of the bottom portion of core samples and slit samples should not show blown or sporadic cells

Inspections

The blown cells can be seen at the bottom of the foam lift.

They look blown, vs the rest of the foam above.



Substrate Considerations

Logical and by code

- Remove all wet material
- Cut out blisters
- Remove loose surfacing
- Confirm that substrate is well attached
- Confirm that flashings are well secured and of sufficient height
- Determine wind uplift requirements
- Determine what fire classification is required

Inspections

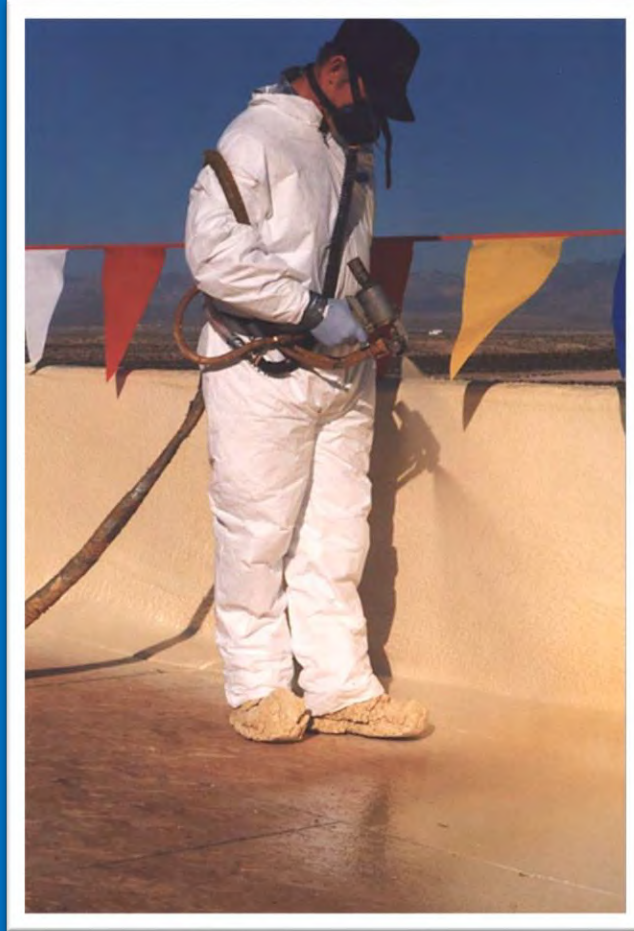
Need to inspect the foam surface

- Skin Texture per Guide
- Pinholes
- Blisters
- Discoloration
- Lacking A
- Lacking B
- Thumb test used to press thumb onto foam surface observing indentation or lack there of

ASTM's

- ASTM C 1029 Guide to selection of spray foam
- ASTM D 5469 Guide for New SPF Applications
- ASTM D 6083 Acrylic Elastomeric Coatings
- ASTM D 6694 Silicone Elastomeric Coatings
- ASTM D 6947 Moisture Cure Urethane Coatings
- ASTM D 7119 SPF Roof Sampling
- ASTM D 7186 Roof Observation

Spray Foam



Foam Surface Textures

This book will explain the foam surface textures and define what steps to take to apply coatings.

www.sprayfoam.org

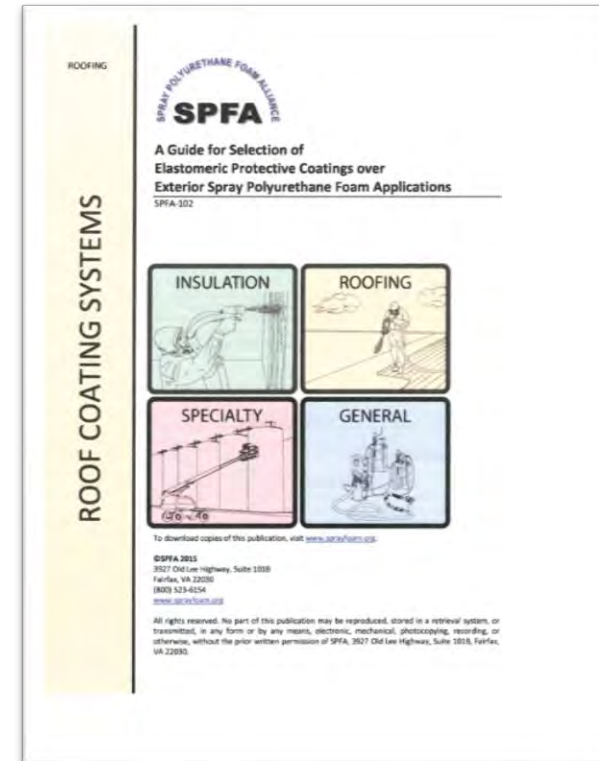
The rougher the foam, the more coating volume needed to coat the surface!



Coatings Calculations

This guide for selection of Elastomeric Protective Coatings over spray foam is where you will find foam surfaces and coating requirements

www.sprayfoam.org



Smooth Surface - “ Ideal”



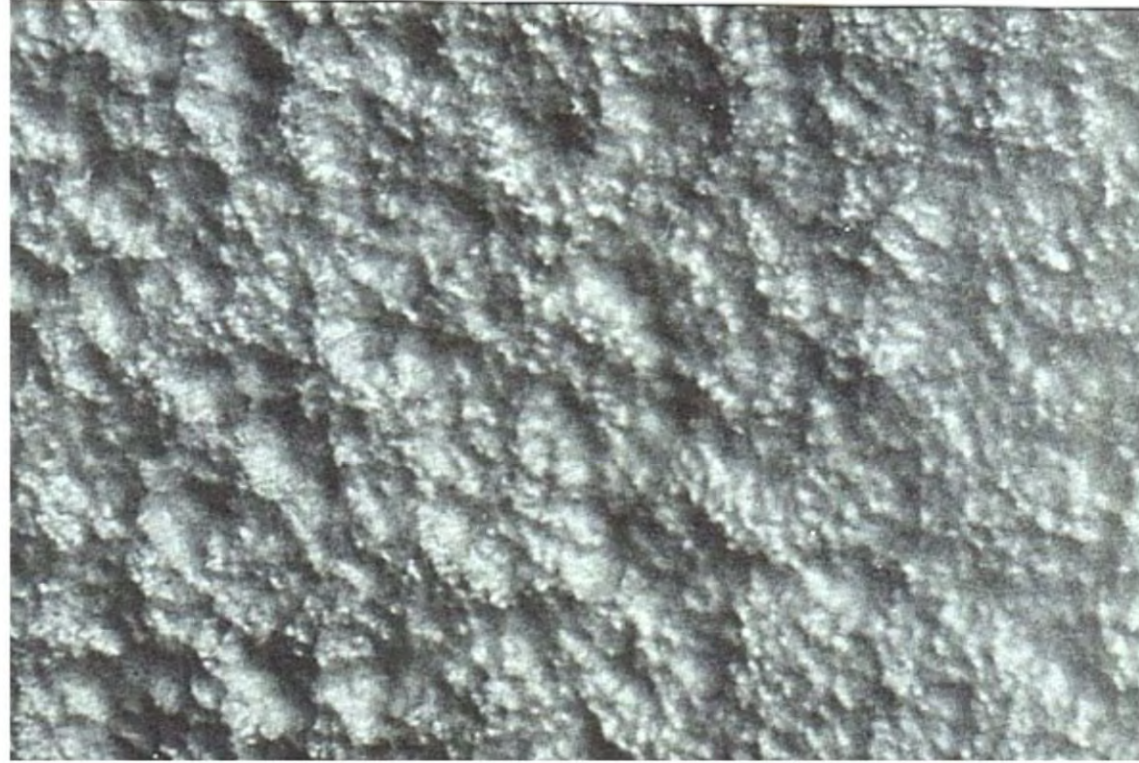
+5%

Orange Peel - “fine texture”



+10%

Course Orange Peel



+25%

Verge of Popcorn



+50%

Note: **Undesirable** due to the additional coating required to achieve specified mil thickness.

Popcorn



Tree bark



Off Ratio Foam

- Caused by pressure imbalance- A and B pump pressures on proportioner should be within 200 psi reading of each other
- Must Fix the problem
- A and B pressure gauges are the indicators
- Remove “off ratio” foam, correct the problem and re-spray

Spray Foam Application

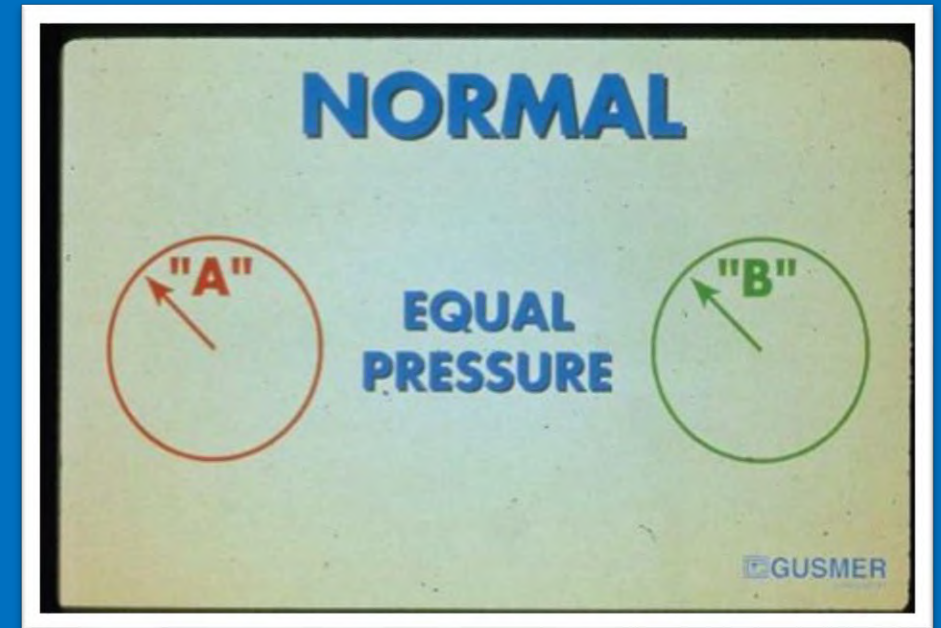
This is a core sample that shows a layer (dark shiny) of A material that is lacking the B foaming agent

Long-term may form a foam blister

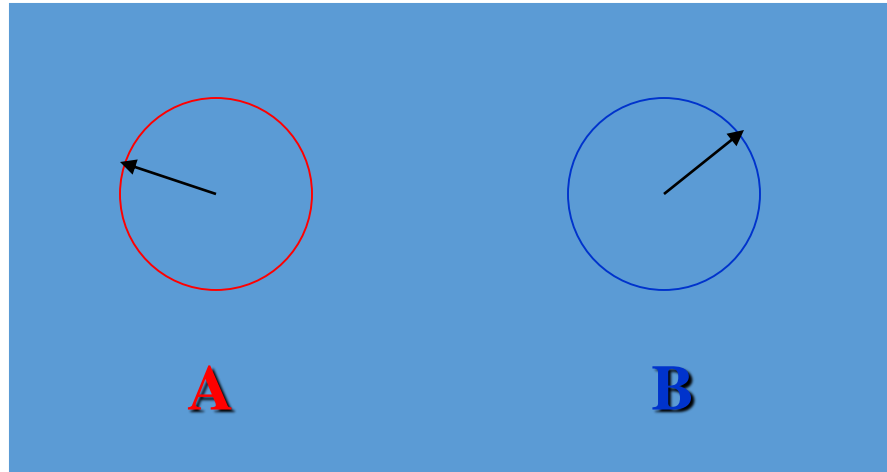


Pumping Trouble Shooting

- This is what the normal gauges should look like
- They should be within 200 psi of each other
- Pressure is the measurement of resistance-REMEMBER the viscosity of A and B differ, so there is some imbalance expected as well as pulsation as the unit operates



Pressure Imbalance



Low Pressure
Means a Material
Supply or Feed
Problem from
console back to
compound

High Pressure
Indicates a
Material Blockage
from console
forward

When we notice “out the gun” changes

Step 1 - What do I see out the gun

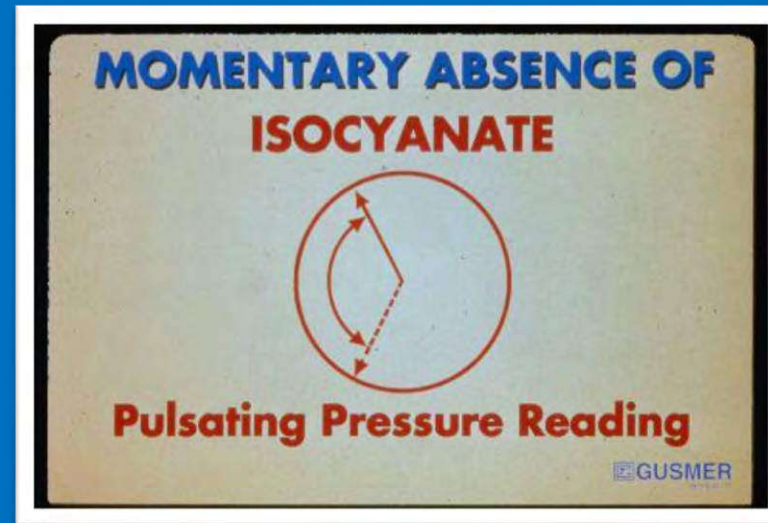
- Dark coffee colored material (Part A)
- White fluffy material (Part B)
- Neither (Can't call it?)

Step 2 - If you can spot the lacking material.....

- Applicator should identify if it is high or low compared to the other gauge

Step 3 - Applicator must correct the supply or restriction problem, remove defective foam, and re-spray

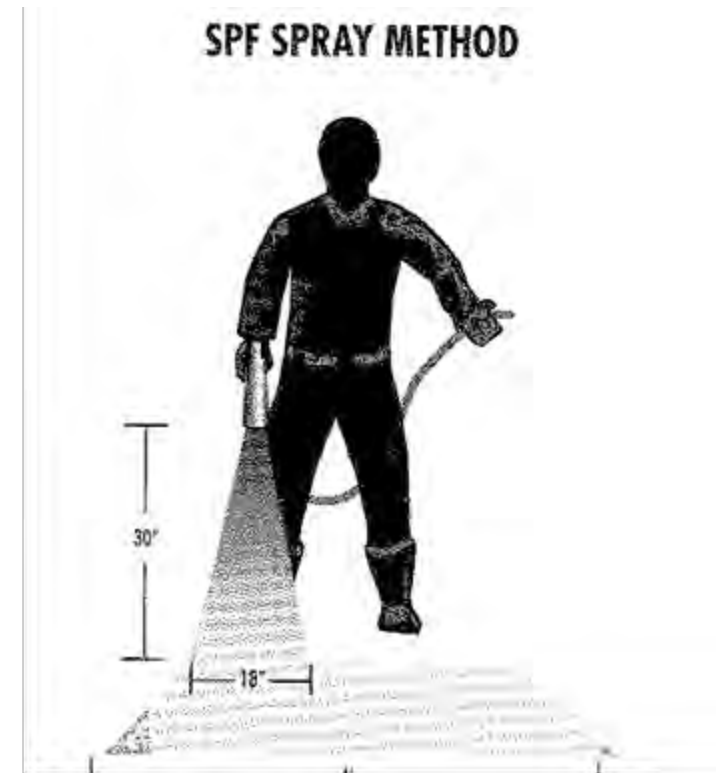
Momentary Absence of (A)



White Fluffy Material Only- -Lacking the A or hardener

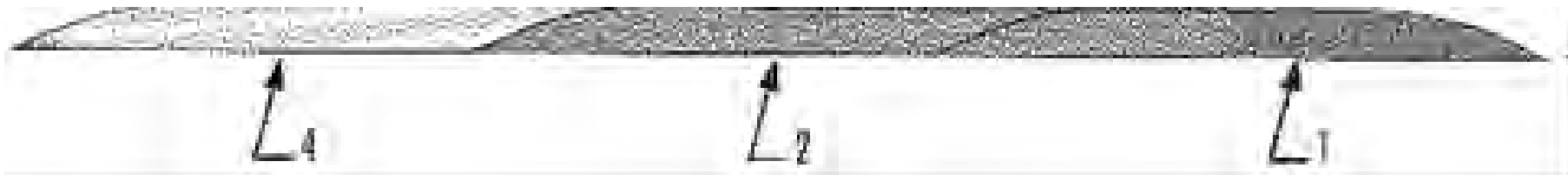
Spray Method

- The applicator will hold the gun waist high and move the gun left to right.
- They spray about 4 ft wide and will move backward, keeping it uniform
- This would be called a run and laying down a lift or pass of foam



Spray Gun Problems

- A good spray pattern is needed to be able to mix and distribute the foam uniformly
- Spray Technique is also required
- Normally use a “overlap” of 30 to 50% and nice straight lines with “tie-ins” on the left and right extremes of the “pass”



Gun Spray Pattern

- Assume that the gun is clean and functioning properly
- Pressure
 - Normally 1000 psi to 1500 psi
 - A and B gauges within 200 psi of each
- Heat
 - Primary Heat to reduce viscosity, normal settings range of 110-130F approx.
 - Hose Heat to maintain the primary heat temperature to the gun, 110-130 F range

Spray Pattern

- The objective is to use heat to reduce the viscosity to a point where A and B are matched so that they easily mix together
- Heat and Pressure work together
 - More heat, less pressure
 - More pressure, less heat
- If not properly adjusted, it must be determined what is wrong and fix it!

Gun Spray Patterns

- A perfect circle that is round and full
- This means a uniform thickness and an evenly shaped spray pattern
- This is what the contractor's test spray pattern should look like



SPF Inspections Summary

On going during foaming application:

- Inspect Equipment:
 - Proper Settings
 - Right Foam System
 - Good A and B Pressure Balance
- Inspect Foam
 - Pinhole Free
 - Good Color
 - Proper Texture

Blisters Must Be Removed



Pinholes Must Be Identified

Pinholes such as these are best stopped by closely looking at the foam surface-BEFORE the coatings application.

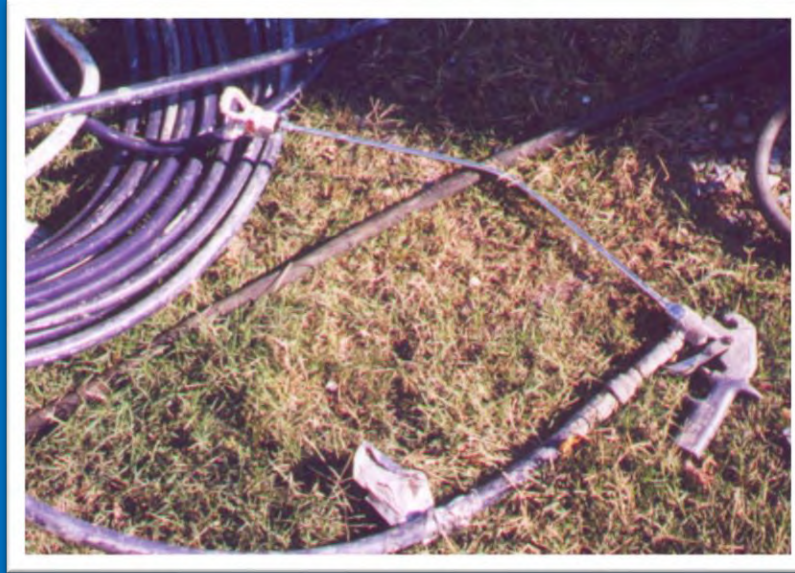
It should be part of the foam surface inspection.



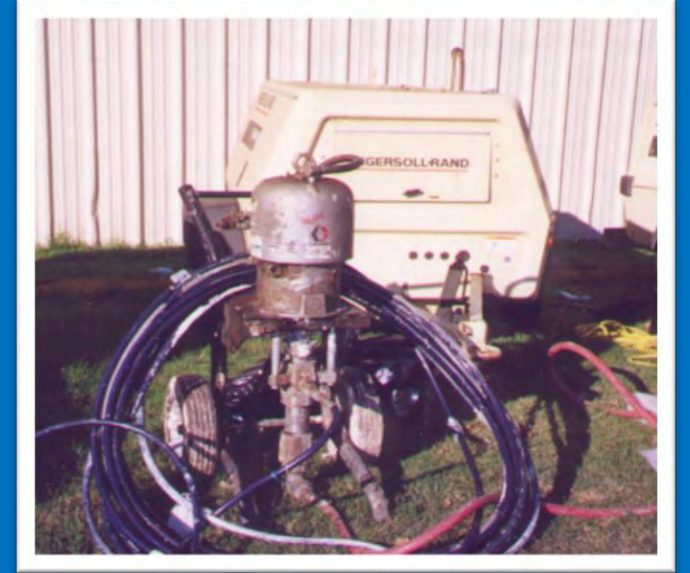
Coatings Application



Feed Pump



Spray Gun



Main Pump

Coatings Application

- Assume Foam surface is OK and clean
- Read Technical Data Sheet and Application Instructions
- Determine Mil Thickness Requirements
- Inventory On Hand Materials (Both Foam and Coatings) at job start
- Keep records of materials used

Coatings Application

Coating Application must have fall protection, same as other roofing systems.

The wet coating is especially slippery when wet.



Coating Types

- Acrylic-water based
- Silicone-mineral spirits based
- Polyurethane-hydrocarbon based
- Polyurea-two part A and B

Application

- Based on X gallons per square (10' x 10')
- Foam Surface
 - smooth- -near theoretical coverage
 - rough- -must add 30-50% more coatings
- Objective-uniform mil thickness over the foam surface, which meets the requirements

During Application

Spray Pattern from gun should show a uniform spray pattern for even distribution.

Fingering-will provide heavy near fan pattern edges and light in the middle of the fan (Usually lack of pressure or worn tip or improper tip)

Applicator uses overlap for uniform coating

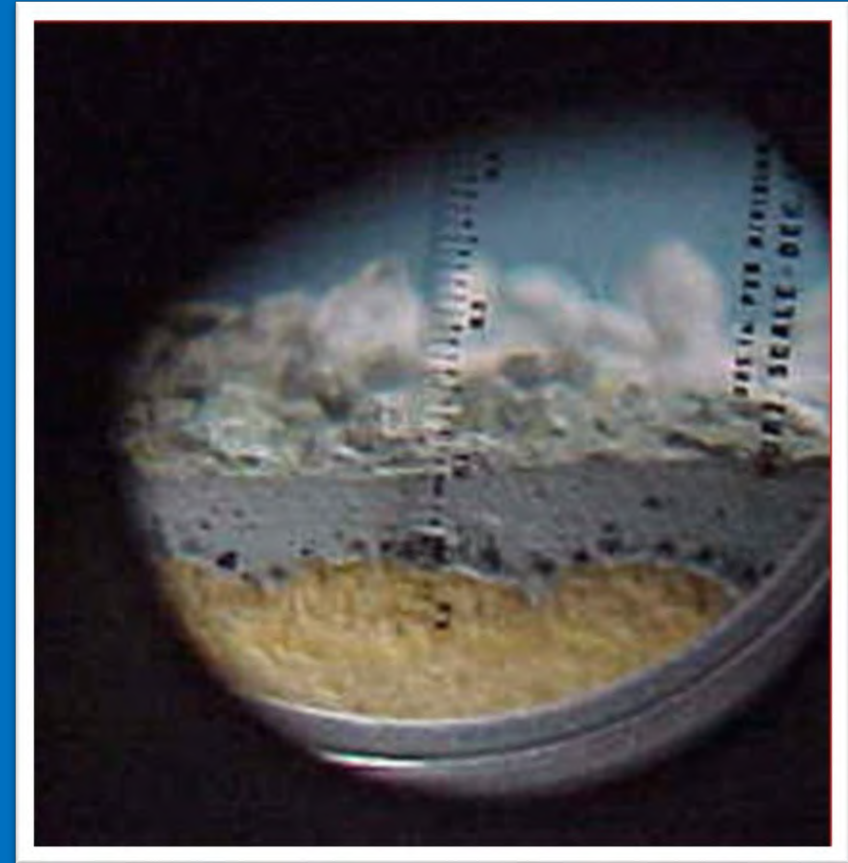
Coating Thickness Measurement

SPF Industry Practices for measurement and evaluation of coating thickness

Sample Thickness

The use of an optical comparator to check the finished coating film for thickness, uniformity, ect.

- Make sure you identify the scale and read the comparator correctly!
- 1 mil = 1/1000th of an inch



Mil Thickness

The average thickness of a credit card normally falls in the range of 25 to 30 mils in thickness.

- NRCA/SPFA Recommended Minimum Dry Mils
- Silicone 22 dry mils
- Urethane 30 dry mils
- Acrylic 30 dry mils



Boat Slit Sample

The slit sample should be cut with a sharp knife (razor type) so that a clean edge is made.

This will make reading the mil thickness easier.



Contrasting Color Scale

Install either the white reticle or the black reticle depending on what the coating color is

- Black Coating-White Scale
- White Coating-Black Scale
- Grey Coating-White Scale



Focus Adjustment

After the reticle has been mounted, set the focus by looking through the lens and adjusting the comparator lens in and out until you have a clear focus of the scale



Measuring

The slit sample should be held against the reticle tightly and you then view the thickness reading across the sample.

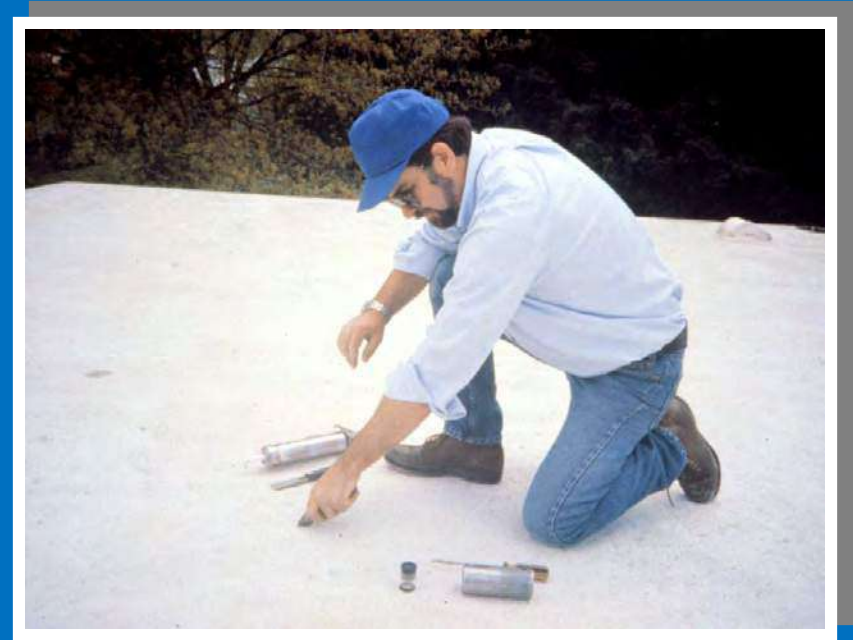
- Minimum=reading for the least mil thickness
- Average= avoid reading thick and thin areas



Slit Samples - how many?

Random

Minimum 5 per 10,000 sq. ft. (additional areas 3 per 10,000 sq. ft.)



Slit Samples

Size

- 1/2" wide
- 2-3" length
- 3/4" depth

Use a razor-sharp knife



Slit Samples

Measure total foam depth

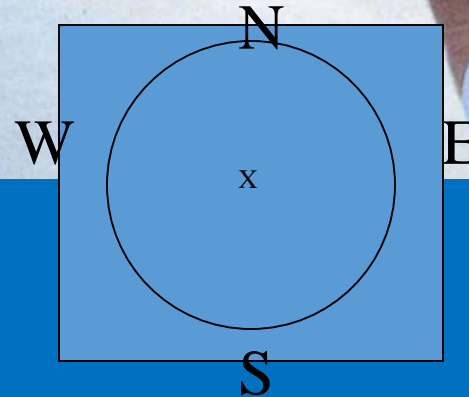
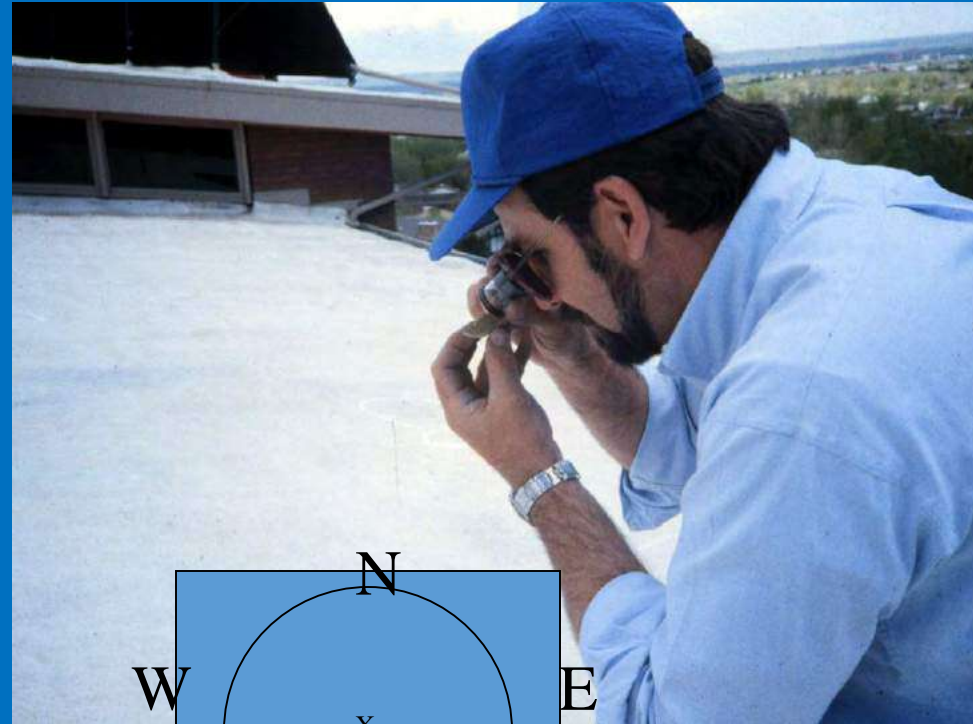


Slit Samples

Examine slits immediately

If coating is thin:

- take additional slits in a 5' radius in all 4 directions
- If still thin, additional slits in a 10' radius or until adequate coating thickness is found



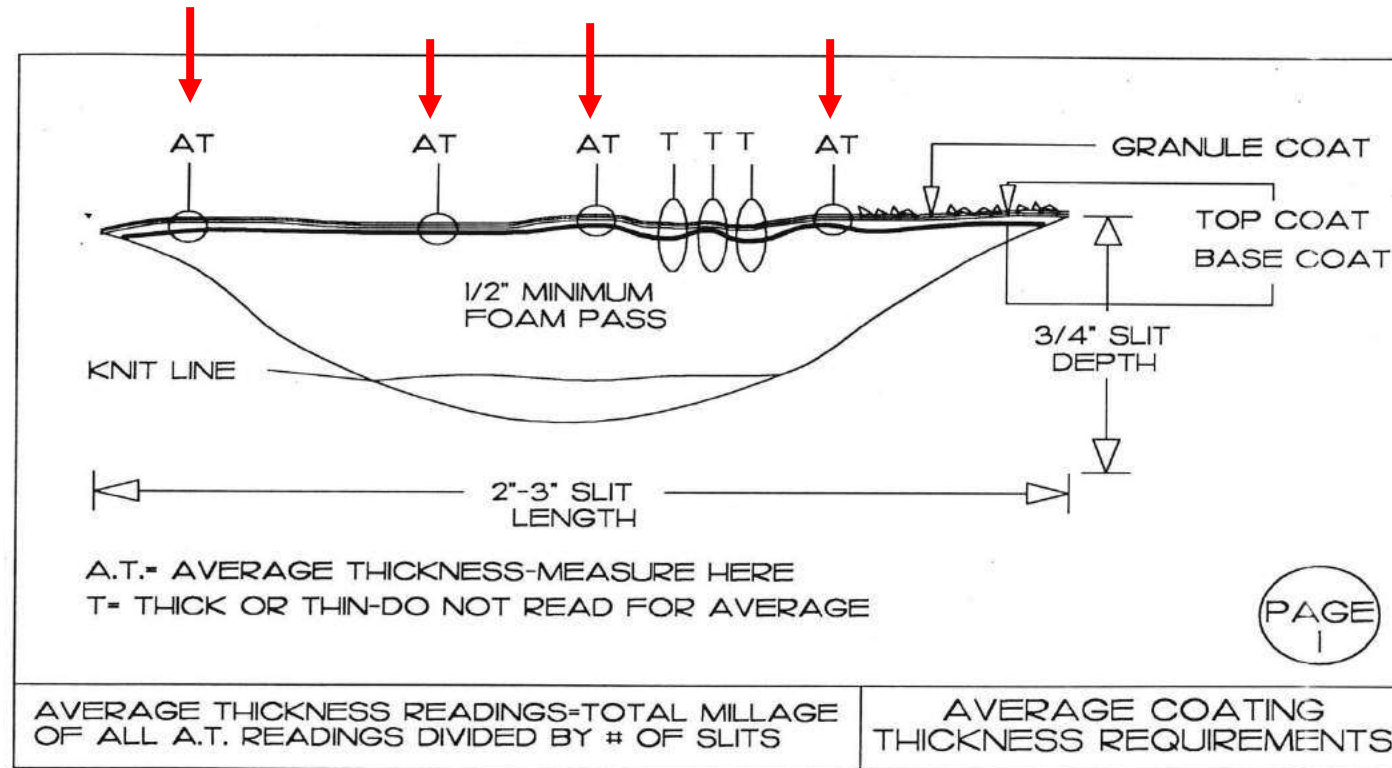
Slit Samples

Examine for:

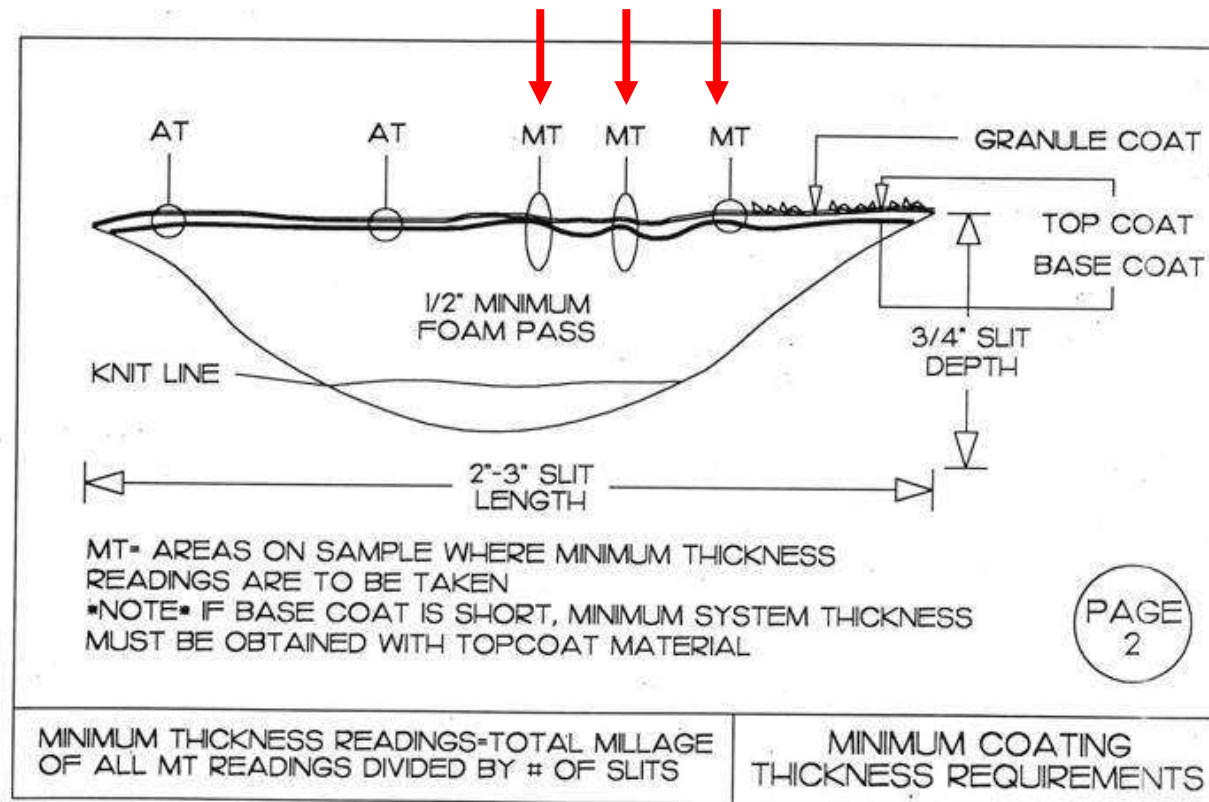
- Coating to foam adhesion
- UV degradation
 - Foam surface at coating interface



Observe Average DFT



Observe Minimum Thickness



Evaluation

Determine if the contractor adequately completed:

The coating thickness requirements for

- Base Coat
- Intermediate Coat (optional)
- Topcoat
- Surfacing (optional)

Evaluation

Determine if the contractor adequately completed:

- All of the supplier's installation instructions
- All specifications requirements for the roof assembly

Inspection Findings

Document findings on report form and forward to appropriate parties.

Report should include:

- Roof Map
- Slit sample and Core Sample Locations
- Results of samples
- Noted deficiencies
- Observation of roof drainage and details



Questions and Discussion