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39TH CRCA TRADE SHOW& SEMINARS JANUARY 18-20, 2023 - CRCA-DRURY LANE OAKBROOK TERRACE, IL



Roof Top Failures -Learning From Mistakes to Prevent in the Future

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Topics

- Low Rise Adhesive Foam
- Concrete Roof Decks and Moisture
 - Still having problems and Solutions
- Cold Roof Decks and Moisture
- Cold Storage Roofs
 - Don't get it backwards
- Beware the cheapest roof you can install

- Two major categories of adhesive foams
 - 1 Part / Single Component Foam
 - 2 Part / Dual component Foam

• 1 - Part / Single Component Foam

- Originally sold as Dow "Instastik" and privately labeled by almost every manufacturer
- Still sold today
- Arrived as a 23 lb tank under pressure
 - Looks similar to a propane cylinder for a gas grill
- Kit included a disposable wand and hose
- This product dominated the adhesive foam market for a decade or so
 - Mostly taken a back seat to two component

- 1 Part / Single Component Foam
 - Chemistry requires free water molecules to be present in the atmosphere and or the substrate
 - The moisture molecules are incorporated into the polyurethane foam and facilitate cross linking
 - Crosslinking is where monomers (isocyante) are joined into long chains making polymers (urethane → polyurethane)

- 1 Part / Single Component Foam
 - Strengths and weaknesses
 - Simple chemistry (+)
 - Less expensive than 2 Part foam (+)
 - Reaction rate is temperature dependent/limited (-)
 - Reaction requires free moisture (+/-)
 - Too much or too little moisture can produce undesired results (-)

- As the name implies two components are mixed at the point of application
- Routinely referred to as "Part A" and "Part B"
- Chemistry can be modified for performance at different temperatures
 - "winter grade foam"
 - Older generations of the winter grade had warnings <u>NOT</u> to use them ABOVE 40° F
 - Current generation of these winter foams allow 25° F to 65 ° F
 - However, these foam products must be stored at room temperature before application
 - Properly done in winter typically requires a hot box or nearby interior storage

- Currently the most popular type of foam adhesive
- Can be dispensed by
 - Dual Cartridge
 - Cart with multi gallon "kits"
 - Dual Tanks
 - Dual 55 gallon Drums
- The Part A and Part B are mixed at the dispensing nozzle with a disposable "gated" tip

- Part A
 - Contains the isomers (Isocyanurate)
 - This is where the magic MDI (Methylene Diphenyl Diisocyanate) comes in
- Part B
 - Contains the polyol, catalysts, fire retardants, surfactants, water and other magic stuff
- Isocyanurate, MDI and Polyol create urethane bonds (isomer \rightarrow polymer)
- Isocyanurate and water create carbon dioxide (blowing agent)
- When the reactions run as intended good things happen
- When the reactions are off...bad roofs ensue (off ratio).











- Just like the single component foam, dual components can have problems
- Two major categories of problems (forensic) seen
 - Off ratio foam
 - Unreacted foam

- Off Ratio foam
- Typically caused by the disposable gated tip being used too long during start and stop application
 - Mixing gates get plugged with partially reacted A+B causing the foam to go off ratio
 - Foam chemistry is designed for 1:1 A+B chemistry. Mess this ratio up and the foam does not react as intended and or desired
- Off Ratio A Bias (too much A)
 - Hard, brittle and glassy foam
 - Can have extremely low strength
- In the field it will "crunch" under thumb pressure
- "Crispy"



- 2 Part / Dual Component Foam
 - Off Ratio B Bias
 - Soft and doughy consistency
 - Tends not to bond at all, it is present but doesn't adhere.
 - Consistency under pressure from thumb is similar to memory foam



- Unreacted A and or B components
- Typically Observed as operator error or supply (totes) shortage
 - Roofer sets the applicator down and commences another task
 - A and or B continues to drizzle out of the tip
 - 1:1 ratio should cause kits to run out simultaneous...if it doesn't...something is wrong
- Result is zero bond
- Forensically will have the consistency of maple syrup or honey
 - Tacky















Low Rise Foam Adhesive

- What do we do?
 - Temperature controlled storage
 - Correct foam for the season (cold weather grade)
 - Have extra nozzles or budget for drizzle
 - Training
 - In house
 - From manufacturer
 - Watch for updates to manufacturer's instructions





Low Rise Foam Adhesive

- What else can Roofing Contractors do to limit their liability?
 - Limit your warranty to "defects due to the fault of Roofing Contractor"
 - Include in your contract a waiver of consequential damages
 - Have your own contract form for re-roofing projects
 - Many owners will not have their own forms
 - Illinois law allows you to shorten the time for bringing a claim
 - <u>Example</u>: Any legal claim against Roofing Contractor alleging any breach of this Contract or negligence by Roofing Contractor must be initiated no later than two (2) years after substantial completion of the Work covered by this Contract.


- Problems have been on the Technical "radar" for a decade now
- Lots of research and product development have been done
- There still is no magic bullet
- Concrete roof decks are poured with moisture
 - Problem is dew, frost, snow, rain and other sources of exterior moisture
 - Leaky roofs have also been identified as issues in rewetting old concrete roof decks
- Light weight structural is still of more concern than regular weight structural

- When possible, always use coated glass facers over paper faced polyisocyanurate
- Never use water based anything when concrete is involved
- Vapor retarders are your friends over concrete
 - 2-ply BUR still very good choice [fast][cold weather adaptable]
 - Cold adhesives can be ridiculously strong!
- Venting is possible
 - Manufacturer specific
 - "suck down" systems are used

- Light weight insulating concrete has been used successfully
 - It is an option, but it needs to be vented
- No approved or accepted test for concrete moisture outdoors
 - Hand held meters are great for acceptance of the concrete surface being dry
- Surface profile should be specified and accepted based on ICRI profiles
 - <u>https://store.icri.org/tag/surface-profile-chips</u>
- Lots of legal pot holes and traps...good contracts and proposal provisions are key

- Contract and Proposal Provisions You agreed to what?
 - Carefully review Contracts and Requests for Proposal
 - Do <u>not</u> accept responsibility for the deck, substrate, other work, or existing conditions
 - Avoid provisions like the following:

By commencing its Work, Subcontractor (a) accepts full responsibility for all surfaces, areas and structures which interface with its Work; (b) warrants said surfaces, areas and structures are in compliance with the Contract Documents; and (c) warrants the condition of the surfaces, areas and structures will have no negative affect upon the proper and timely prosecution of the Work.

Failure to provide timely written notice to Contractor of any deficiencies or problems in the surfaces, areas, or structures before commencing the Work shall be deemed a complete waiver and/or release of claims that defects in the surfaces, area caused increased costs or delay to the Subcontractor.



- Contract and Proposal Provisions You agreed to what?
 - Carefully review Contracts and Requests for Proposal
 - Replace unacceptable language / clarify your obligations
 - Example provisions:

Roofing Contractor's prosecution of the roof work indicates only that the surface of the deck appears satisfactory to the Roofing Contractor to attach roofing materials. Roofing Contractor is not responsible for the construction, slope, moisture content, undulations, or structural sufficiency of the roof deck or other trades' work or design.

Roofing Contractor's commencement of roof installation indicates only that Roofing Contractor has visually inspected the surface of the roof deck for visible defects.



- Contract and Proposal Provisions You agreed to what?
 - Carefully review Contracts and Requests for Proposal
 - Avoid requirements to inspect the deck, substrate, other work, existing conditions
 - What does that mean? What type of inspection is required?
 - Limit to a <u>visual</u> inspection and review of only <u>visible</u> conditions
 - Do <u>not</u> accept responsibility for design
 - Look out for provisions referring to design or engineering
 - Avoid contractual representations related to the design (e.g., Roofing Contractor represents that the plans and specifications are sufficient.)
 - Raise any concerns about design Do <u>not</u> ignore your concerns
 - But also, make sure you are not accepting responsibility for design



- About a decade ago designers started a trend where they built apartments and mixed use (retail / apartments) with cold roof decks
- Cold roof decks have no insulation above them
- All insulation is below the deck, typically blown cellulose or fiberglass
- Platform construction with parallel cord trusses -> fire code required sprinklers above the top floor drywall ceiling
 - Exception is if it was blown solid with insulation
 - R-50 or so insulation and no sprinkler = win+win?





WARM ROOF

 Here was the catch, the designers / contractors put all the HVAC, electrical, venting (dryer/bath/stove), security and more in the ceiling assembly (aka roof deck)



- Well established that all of these ducts and vents leak air
- What happens when we leak warm moisture laden air above a vapor retarder in the ceiling and a cold single ply roof membrane?
 - Lots of condensation
 - Biological growth
 - Decay of OSB / plywood







- Even when everyone agreed what went wrong, roofer was drug along in legal proceedings
- There have been variations of this scenario
- Fix?
 - Repair moisture damage
 - Place insulation above roof deck
 - Keep the roof deck warm and not a condensing surface
 - As little at R-5 to R-10 has been anecdotally shown to prevent the decay
 - Guaranteed that code required insulation will protect the roof deck even without sealing and ducts or penetrations
- See Professional Roofing March 2022 for article
- Contract language or proposal language to protect the roofer?

- Limit your liability
 - Avoid Broad Indemnification Provisions
 - Illinois has an anti-indemnity statute that prohibits indemnity provisions requiring one party to indemnity the other from its own negligence.
 - Need to look closely at the language of the indemnity provision.
 - Be aware that some states do not have similar anti-indemnity statutes.
 - Best to Limit Your Indemnity Obligation
 - Limit to indemnity for claims, damages, expenses "to the extent caused by the negligent acts or omissions of Roofing Contractor or those for whose acts Roofing Contractor is liable."



- Limit your liability
 - Example provisions:

Roofing Contractor is not responsible for any loss, damage, or expense due to defects in plans or specifications or building code violations unless such damage results from a deviation by Roofing Contractor from what is specified.

Roofing Contractor shall perform the roofing work in a good and workmanlike manner in accordance with the plans and specifications.



- Clarify Your Responsibility
 - Example provision:

Roofing Contractor is not responsible for condensation, moisture migration from the building interior or other building components, location or size of roof drains, adequacy of drainage, ponding on the roof, structural conditions, or the properties of the roof deck or substrate on which Roofing Contractor's roofing work is installed.



- Raise any concerns about design Do <u>not</u> ignore your concerns
 - Provide customer a copy of the Professional Roofing March 2022 article
 - > But also, make sure you are not accepting responsibility for design
- Do <u>not</u> accept responsibility for design



- Cold storage roofs work in reverse of normal roofs
- Moisture flow is from exterior to interior
- NO VAPOR RETARDER ON THE DECK!!!!
- Air seals are of the utmost importance
 - Perimeter
 - Penetrations
 - Temperature changes
- Consider loading dock at 55°F and refrigerated warehouse at 36°F
 - Need to keep air from loading dock entering warehouse

- Worse than normal HVAC contractor is the Roofers mortal enemy
 - Is this possible?
- Ammonia pipes are placed on stands that are typically welded in place. Hundreds or more of these get welded after the roof is on.
 - Inspect before and after
 - Document
 - Even the most careful welder will put holes in membrane
- Remember it is reversed
 - Regular leaks are problems
 - Air leaks are problems
- Professional Roofing November 2019 article w/ details



















- Again . . .
 - Do <u>not</u> accept responsibility for design
 - Raise all concerns Do <u>not</u> ignore and hope things will be OK
 - Limit your warranty obligation (i.e., obligation to correct) to "defects due to the fault of Roofing Contractor"
 - Limit your indemnity obligation for damages "to the extent caused by the negligent acts or omissions of Roofing Contractor or someone for whose acts Roofing Contractor is liable."



- Avoid accepting risk of loss/damage caused by others
 - > Avoid provisions like the following:

Subcontractor shall be responsible for protecting and preventing damage to the Work and accepts all risk of loss until final completion of the Project and acceptance by the Owner.

Example of acceptable contract provision:

Subcontractor shall not be responsible for damage caused by circumstances beyond the control of Subcontractor. Contractor shall coordinate the Project so that the Project proceeds in an orderly and customary manner and so as to avoid newly installed roofing being damaged by or used as a surface for ongoing construction work. If the Subcontractor's Work is damaged by other trades, Contractor agrees to backcharge the trades causing the damage. Contractor will purchase or arrange with Owner to maintain Builder's Risk and property insurance.



Beware the cheapest roof you can install

- About once or twice a year SRI gets a call to inspect / defend a roof that was put down on the cheap.
- Code compliance is out the window
 - Wind
 - Edge metal
 - Energy code
 - What the???
- Be very, very careful if you are going to pull one of these.
- On the hook for tear off and replacement of your roof and possibly going back with a code compliant roof
 - Get the owner to accept it in writing?

Beware the cheapest roof you can install

- Roofing Contractors must comply with the Code
 - What if the cheaper roof is what the Customer wants and accepts?
 - May relieve you from a breach of contract claim by the Customer
 - Depends on what the entire contract says
 - If there are plans and specs, limit your obligation to perform the work in compliance with plans and specifications.
 - Will <u>not</u> relieve you from liability to third parties, from fines, etc.
 - What if the Customer will indemnify you from damages?
 - Likely against public policy (remember the anti-indemnity statute)



Closing Comments

- Low Rise Adhesive Foam
- Concrete Roof Decks and Moisture
 - Still having problems and Solutions
- Cold Roof Decks and Moisture
- Cold Storage Roofs
 - Don't get it backwards
- Beware the cheapest roof you can install

Questions?

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