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# The Replacement of Warranties with Logic and Common Sense

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Many problems are caused by owners specifying project technical requirements to expert vendors, then picking the low-price vendor, assuming that all the vendors are providing the same quality of product. Research over the last 20 years has identified that when working with highly technical areas, this practice brings high risk to the owner because the vendors do not have the expertise to understand the requirements. The Alpha sprayed polyurethane foam (SPF) roof system has brought the Dallas Independent School District (DISD) high value but also occasional risk caused by the low-price vendor. The authors are proposing that DISD's effort to buy the Alpha SPF roof system through the low-price competition will cause DISD risk. A new approach is proposed to DISD: the Alpha SPF roof system only be used as an alternate value added option. This approach assumes that the only way the Alpha SPF system can be procured is if it is in the best interest of the owner due to dominant value. This approach minimizes the risk that DISD has encountered from low-price contractors who have not been able to minimize risk through the use of expertise and experience because their low-price was directly related to practices which are related to a lack of experience and expertise.

**Keywords:** roofing, Alpha Program, Sprayed polyurethane, Best Value, performance

## Introduction

Sprayed polyurethane foam (SPF) roof systems have been installed since the early 1970s. SPF roof systems have the following characteristics:

1. Have the highest insulating factor out of all roof insulation systems.
2. Have the lowest weight compared to any roofing system (0.50 PSF (3 PCF)).
3. Monolithic.
4. Has a very technical application utilizing an exothermic reaction that transforms two liquid components into a rigid three-pound density SPF.
5. The industry has changed the insulating refrigerant material numerous times to meet EPA standards, causing applicators to change their temperatures and process details.
6. It is a sustainable and green roof system (renewable, minimizes the need to remove the existing roofing system and lightweight).
7. The SPF industry has had difficulty regulating itself, resulting in many SPF roof failures.
8. Properly installed SPF roof systems have performed very well. The industry has always remained less than 3% of the roofing industry due to their inability to regulate the performance of their contractors.
9. SPF roof systems require a coating system to protect it from UV degradation.
10. Confusion on the performance of different coating and SPF roof systems (hail resistance, UV degradation and ability to sustain roof traffic).

11. Warranties are used by sales/marketing personnel to attempt to identify performance.
12. Warranties are used as marketing and are not related to performance.
13. In 2001, when coated SPF systems failed at Dallas Independent School District (DISD), and the manufacturers did not honor the warranty, DISD stopped using coated SPF roof systems.

An example of illogical warranty and marketing information was provided by Factory Mutual (FM), (one of the two largest building insurance groups), who put out a report that all coated SPF systems, offer hail protection against 1-3/4 inch size hail based on their hail testing. Research group known as Performance Based Studies Research Group (PBSRG) testing in 1996 could not verify their results. Their published results identified silicone coating as the most hail resistant, and urethane coatings as offering the worst protection. PBSRG tests found it was the exact opposite (Kashiwagi & Pandey 1996). FM testing was done only on new coatings and coating systems that were weathered using artificial weathering. When actual aged systems in the field were tested, the results verified that the Alpha urethane coating was the only coated SPF roof system that offered protection against 1-3/4 inch size hail (Kashiwagi & Savicky 2003).

Only one SPF coating system has documented high performance in heavy hail areas. The Alpha system, made by Neogard, is the only coated SPF system with documented protection against hail. Other urethane coatings have not documented the same protection after being exposed to the elements.

One of the school districts in Dallas (DISD) used the design-bid-build procurement approach to award contractors to install SPF roof systems. The resulting poor performance of SPF roof systems led to a DISD policy of “no SPF” roof systems on DISD roofs. It has not been proven that the price based approach can be used to utilize the value of the hail resistant Alpha SPF roof system.

### **Dallas Independent School District**

From 1987-2001, DISD had a few high performing Alpha SPF roof systems, but the majority of the SPF systems failed. It was common for the coating and SPF manufacturers to offer warranties but not honor those warranties. Since DISD could not utilize their warranties and due to poor performing SPF roof systems, in 2002, DISD banned the installation of SPF roof systems.

DISD is in a heavy hail area, and is self-insured against hail damage. DISD identified that the Alpha roof system (with sufficient urethane coating) on the Casa View School roof showed 16 year performance with no maintenance. In 2002 DISD allowed the installation of the Alpha SPF roof system in a Best Value Procurement test to identify if the same high performance could be duplicated. The results showed that the Alpha SPF roof systems were installed with high performance (Kashiwagi & Savicky 2003). Due to the dominant performance results, DISD changed their policy and allowed the installation of the Alpha SPF roof systems.

In addition to the test results, the Neogard Corporation supported the Alpha roof system with a joint and several warranty, covering the performance of the SPF and the Alpha coating system. These warranties held the insured parties (Alpha coating manufacturer, SPF manufacturer, and the Alpha contractor) joint and severally, liable for any defects of the system that included blistering and delamination. Defects that were not covered by the SPF industry were covered by the warranty (leaking was the only recognizable defect covered by warranties). The joint and several warranty, along with the proven performance of the Alpha roof system in hail areas, differentiated the Alpha SPF roof system and helped convince the DISD to continue to install the Alpha roof system.

In 2005, DISD had a bond program to renovate their school buildings. The bond program eventually ran short of funding. Due to the shortage of funding, DISD did not utilize the Alpha SPF roof system and its warranty, but utilized a ten year SPF system, with a more traditional 10 year warranty. The 10 year urethane coated SPF system (no joint and several warranty) was still at a much lower cost compared to the traditional built up and modified roof systems. The contractor’s bids were shopped and one of the contractors used a SPF system that was not utilized in the Alpha program.

Table 1 shows the SPF roof performance of the Alpha roof systems at DISD based on the physical inspections of 98 roofs. Evaluating roof coverings using physical inspection and reporting the repair or replacement conditions to the owner have been used for other roofing systems (Coffelt et. al. 2010, Sharara et. al. 2009). Table 2 compares the blisters and repairs at DISD for the last 4 years.

Table 1			
<i>Overall DISD SPF roof performance</i>			
No.	Criteria	Unit	Performance
1	Oldest job surveyed	Years	22
2	Average age of jobs surveyed	Years	7
3	Age sum of all projects inspected	Years	675
4	Average total repairs on each roof	SF	348
5	% of roof repaired	%	0.79%
6	Average total existing blisters on each roof	SF	16
7	% of roof blistered	%	0.035%
8	Average blister size	In.	4”
9	Average job area (of jobs surveyed and inspected)	SF	43,128
10	Total job area (of job surveyed and inspected)	SF	4.3 M
11	Total number of jobs inspected	#	98

Table 2

***Blister and repair comparison at DISD***

No	Criteria	Unit	2015	2014	2013	2012
1	% of total roof area blistered	%	0.035%	0.038%	0.098%	0.131%
2	Total blisters	SF	1,525	1,599	3,915	4,117
3	% of total roof area repaired	%	0.79%	0.62%	0.38%	0.27%
4	Total repairs	SF	34,137	26,046	14,946	8,721
5	Total job area	SF	4.3 M	4.2 M	4.0 M	3.2 M

Despite the low-bidding and shopping of the Alpha roof contractors bids, DISD has received performance from the roofs that were installed. One of the reasons for using the Alpha roof system was the Alpha program required their contractors to maintain 98% customer satisfaction and no leaking roofs on an annual basis to continue to be allowed to install the Alpha roof system. This included all roofs that were installed by the roofing contractor. If they had issues that resulted in customer dissatisfaction, they were required to fix the roof. This resulted in many of the DISD roofs being maintained by the contractors, not as a warranty requirement, but as a requirement to get further work at DISD.

However, the following factors led to a degradation of the some of the contractor's roof system performance:

1. The Alpha roofing contractors are shopped for price through general contractors and traditional roofing contractors.
2. A relatively new contractor, who needed work, took the majority of the work due to their very low-prices.
3. The low-price contractor used substandard SPF due to a shortage of SPF material.
4. The low-price contractor had an excessive amount of work and ended up cutting corners, such as installing SPF in marginal conditions.

In studying the defects of the Alpha system, it is clear that the majority of the problems were contractor generated. Requiring the manufacturers to pay for the repair of the defects under a 10 year warranty, cannot be enforced. Once the contractor is paid, there has not been a way to force the contractor to fix the defects. If the defects are large, the contractor will go out of business. If the roofing system did not have a joint and several warranty, the roof owner has no recourse but to install another roof.

The low-price contractor installed 62 out of the 98 roofs and there were 16 roofs which had defects that required maintenance. The contractor did not charge enough to maintain their roofs through the ten year warranty period (DISD expectation). The roofing manufacturers (Alpha coating and SPF manufacturer) continued to sell their materials to the contractor. DISD continued to hire and utilize the contractor. The contractor began to have issues with their roofs, and was not doing their maintenance work to keep the roofs performing. The contractor ended up going bankrupt in 2015. DISD requested Neogard to cover the warranties, but with the ten year warranty, Neogard and their SPF manufacturing partner BASF, did not cover the SPF roof defects. Table 3 shows the number of roofs installed at DISD every year.

Table 3

**Roofs installed per year**

Year	# of roofs installed
1987	1
1992	1
2002	3
2003	1
2004	15
2005	28
2006	11
2007	4
2008	1
2010	5
2011	12
2012	9
2013	6
2015	1
<b>TOTAL</b>	<b>98</b>

Another analysis of the roofs show that the majority of the problem roofs were installed in 2014 and 2015 during the beginning of the 2004/2005 bond program (Table 3). Ten years later the roofs show the problems which could have been avoided with more careful installation, and better materials. Despite a number of poor performing roofs, the number of performing roofs outnumbers the poor performing roofs (Figure 1). To identify the performance of a few nonperforming roofs due to extenuating circumstances in the bond program, with the performance capability shown on other roofs that are installed correctly would minimize the value that the DISD could receive from the Alpha SPF roof system.

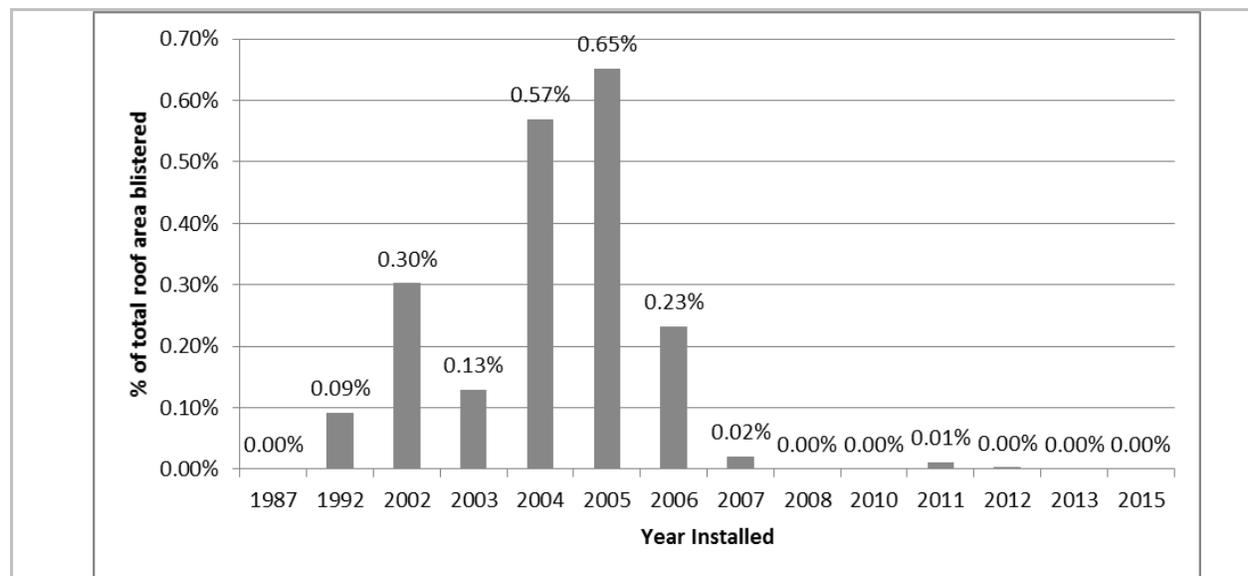


Figure 1

**Yearly roof analysis**

## **Problem**

The warranties accompanying the coated SPF roof systems could not be enforced. The warranty is provided by the manufacturer to the buyer as a protection (Agrawal et. al. 1996). Since the manufacturer provides the warranty, it is written by their legal representatives (Murthy & Djamaludin, 2002), and contains exclusion that will void the warranty if encountered (Christozov et. al. 2009). Hence warranties have no proven correlation to the actual performance of the product; however, contractors still use them for marketing purposes (Kashiwagi, 2012). Similar to the history of the SPF roof industry, where warranties were used as marketing tools to convince building owners that a longer warranty meant that they had a longer performing roof system with protection against defects, DISD found themselves with a few SPF roofs with problems which were not protected by the warranty.

DISD is aware of the value of the SPF roof systems when they are installed correctly. They are also aware of the impact of the “low-bid” delivery system on the value and performance of the roof system.

There were additional problems that DISD and the Alpha coating manufacturer (Neogard) encountered:

1. Neogard did not get the needed support from the SPF manufacturer that they had partnered with. The SPF manufacturer charged a higher price for the Alpha SPF, but offered no added support for the needed maintenance repairs.
2. Neogard no longer wanted to cover the liability for the correct installation of the SPF.
3. The contractors did not have the sufficient business acumen to take needed steps to minimize the risk of SPF roof defects.
4. The bonding companies were charging unaffordable rates to cover joint and several warranties. Due to this the contractors were not willing to sign the joint and several warranty.
5. DISD had 4M SF of the Alpha system installed and had seen it was a good value proposition.

However, DISD wanted a joint and several warranty, and none of the vendor parties were interested in taking on the liability.

The challenge to the Alpha coating manufacturer and DISD is:

1. To create a system that self-motivates the contractors to install a quality roof system.
2. Motivate the SPF manufacturer to take accountability of the SPF performance.
3. Minimize the risk of non-performance at key points in the installation process, therefore minimizing and not transferring risk of non-performance to non-responsible parties.

Table 4 lists the roofs that have high damage.

Table 4

**Roofs with high damage (over 1% blistered)**

School	Roof Area in SF	Date Installed	Contractor	Total SF of Blisters	% of Total Roof Area Blistered	# of Blisters over 1 SF	# of Open Blisters
Russell ES	27,295	May-04	Alpha Contracting	1,050	3.85%	10	5
Samuel HS	147,500	Aug-05	Alpha Contracting	4,000	2.71%	27	0
Spruce HS	85,000	Aug-05	Alpha Contracting	2,150	2.53%	25	7
Lincoln HS – Flat	12,000	Oct-06	Alpha Contracting	230	1.92%	4	1
Hawthorne ES	45,200	Jul-05	Alpha Contracting	660	1.46%	6	3
Russell ES - Old Admin Bldg.	10,500	Aug-04	Alpha Contracting	150	1.43%	0	0
Terry ES	28,400	Dec-04	Alpha Contracting	320	1.13%	4	3
Peabody ES	32,600	Aug-05	Alpha Contracting	350	1.07%	7	4

Note. All high damaged roofs were installed in 2004, 2005 and 2006 and account for 66% of all blisters at DISD

### Approach and Solution to the Problem

The steps to the solution of this opportunity must include the following:

1. Identify the DISD delivery system of construction and construction systems.
2. Identify the value of the Alpha roof system.
3. Identify the source of risk caused by non-performance and create a new system that minimizes risk due to the structure of the approach and does not depend on a warranty to minimize non-performance (has not worked at DISD in the past 10 years).
4. Create a Best Value structure that minimizes the risk of non-performance.
5. Create a transparent environment that clearly identifies expertise and the source of risk.

#### *Description of the DISD Procurement/Delivery System*

The DISD delivery system of construction is a design-bid-build (DBB) delivery system. The designers in the system do not have accurate information of the performance of different roofing systems and therefore do not have the expertise to select or design highly technical roof systems. They also do not have the legal liability or accountability of the roof system performance over the duration of the roofing system’s lifespan. Due to the lack of information, the designer’s decision making increases risk. The only party that does have the responsibility of roof system performance is the DISD roofing maintenance expert. He has the responsibility to resolve all roofing issues. Any change in roof system policy requires the DISD roofing expert’s support.

The SPF roofing contractors and manufacturers in the DISD environment have shown the following characteristics:

1. Vendors who cannot accurately price roof systems accept the accountability of the performance of the roof for the duration of 10 or more years. The Alpha SPF roof system should never be competed based on price.
2. Manufacturers of both the Alpha coating system and the SPF have not consistently exhibited leadership or control over the vendors pricing, installation and maintenance activities. Neither have consistently understood or supported the vendors at key times in the beginning of a project and at the end of the project to ensure the minimization of risk.
3. The Alpha SPF roof system has not consistently and successfully been competed among the SPF contractors. Rather than assume the cause of this lack of success, the Alpha SPF roof system should only be an alternate to the traditional modified or built up roof system, and should only be installed when there is tremendous value for DISD (cost savings of 30% or higher).
4. Warranties have shown minimal value in protecting the client against SPF defects and should not be used to protect the building owner. The more DISD depends on the warranties, the greater will be DISD's risk.

*Value of the Alpha SPF Roof System to the DISD*

The DISD is in a heavy hail geographical area and is a self-ensured organization/entity. The Alpha SPF roof system has the following characteristics:

1. When installed correctly, the roof has a proven 20 year history of performance in hail areas with the ability to withstand 1-3/4 inch size hail. It has been documented to resist larger hail, but due to the uniqueness of the hail shape and hail storm characteristics, expectations of hail resistance for larger hailstones must be tempered.
2. DISD documentation showing that the Alpha SPF roof system at DISD has exceeded 25 years (Foster Elementary and Casa View) and has the capability to be recoated for an additional 15 years (total of 40 years). The aged Alpha SPF system's ability to withstand hail damage shows no degradation over time.
3. The Alpha SPF system does not require the removal of the existing Built-up Roof (BUR). Together with the BUR it forms a better waterproofing system. It does not require the throwing away of the existing roofing system, which is also an environmentally friendly solution (Knowles 2005).
4. The Alpha SPF system is renewable through recoating.
5. The SPF is the highest quality known insulating material, and is monolithic, which increases the insulation value.
6. The documented and observable value of the Alpha SPF system is 40 – 50% less than the price of the traditional BUR of modified roof system. This is established from the DISD base price of \$16/SF for BUR vs the SPF pricing of Wattle & Daub (Tisthammer, identified as the best SPF performing vendor in the United States, 2015).

### *Risk of Defects in the Alpha SPF Roof System*

Due to inconsistency in performance of the same roofing system, it has been observed that the craftspeople installing the SPF roof system commit easily avoidable errors that lead to SPF defects. The industry expert (has been doing research for the longest duration, has help create the Alpha program for SPF roof systems, and has the most dominant performance in the SPF industry in the U.S.) stated, “the SPF system may exceed the planning and technical capabilities of the average SPF roofing manpower force” (Tisthammer, 2015). The defects observed over the past 20 years in the SPF industry are attributed mainly to applicator error (Bailey & Bradford 2005). The number of occurrences that are due to material problems have been rare. The sensitivity of the chemistry of the SPF system when installed (temperature, ratio of the two components, not stepping on the cured system before it is cured, sensitivity to moisture, and not installing on a substrate with moisture), increases the need for expertise to follow specific installation instructions.

The defects require a system to assist installers to identify and mitigate risk that the installers may not instinctively do. This issue is not unique to the SPF industry, but is observable in the construction industry in general. Oftentimes, if the SPF installers have a discussion with the manufacturers’ representatives, DISD roofing expert and other DISD involved stakeholders, many of the issues that cause risk can be eliminated. By observing the DISD Alpha SPF roof performance history, and having an on-site clarification meeting where the vendor’s experts clearly articulate their concerns and challenges and then get input from the DISD and other stakeholders, would have minimized most of the risks and defects encountered over the last 13 years at DISD.

The second observation of the DISD Alpha SPF roof history performance is that lab testing of the installed Alpha roof system must be performed, and the results should be analyzed not only for the newly installed roof, but compared with the physical characteristics of all other installed SPF roofs at DISD. The results of the tests and analyses should be accessible to all stakeholders and to the industry. The current DISD environment has a lack of transparency with their technical metrics.

The third observation of the history of DISD Alpha SPF roof system performance is that any warranty documentation must be simple and the responsibility of the SPF and coating defects must be clearly stated. Once the Alpha coating and SPF physical metrics are checked and approved, the Alpha coating manufacturer is responsible for the coating defects, and the SPF manufacturer is responsible for the SPF defects. Another option is for the contractor to be responsible for all SPF defects. However, if the contractor is responsible, the risk is greater and the owner may require a performance bond due to the financial instability of roofing contractors.

### **Creation of a Best Value Structure for the Alpha Program**

A Best Value structure is required for the DISD use of the Alpha SPF roof system. As previously identified, the Alpha program must have transparency, show responsibility and accountability

and show expertise of the vendor to successfully install and maintain their Alpha SPF roof systems. This structure includes:

1. The inspection of a minimum of 50 performing SPF roof systems.
2. Have 98% of roofs not leaking and customer satisfaction of all SPF roof systems installed.
3. Annual surveys of all SPF roofs installed.
4. An inspection every other year of 25 or more roofs being installed.
5. Response to a leak or customer dissatisfaction within a week, and fix the defect within two weeks unless given more time by the owner's representative.

Any vendor who fails to meet any of these requirements at any time shall be suspended from the Alpha program. Re-entry into the program will require the above five steps to be redone.

*Transparent Environment Built by the Manufacturers, Contractors and DISD*

The Best Value environment is transparent. When an environment is transparent, the following characteristics are observable:

1. Consensus: All stakeholders will know the performance of any building system, vendor or system.
2. Metrics: All performance will be delivered in terms of relative number of years the roofs have been performing, initial and repair costs, number of leaks, was the leak fixed, the duration of time it took to be fixed and customer satisfaction.

The Alpha SPF roof system cannot be consistently and successfully specified and installed. The Alpha SPF system can only be selected and installed if the following is observed:

1. The budget for the traditional roof system is exceeded, and the Alpha SPF system can be installed within the constraints.
2. The Alpha SPF roof system is a dominant value (30% or more in cost savings of the specified system).
3. The alternative option which warrants all coating and SPF defects (with verifiable information that the manufacturer's system has been operational in covering defects). The options that identify that the manufacturer will cover defects caused by their material has no value. It must state that the SPF manufacturer covers all SPF defects. This forces SPF manufacturers to cover the risk of applicators who do not respond to installation problems.

### **Conclusion**

The Alpha SPF roof system has shown tremendous value for the Dallas Independent School District (DISD). However, the following are observations of the last 13 years of DISD attempting to deliver the Alpha SPF roof system using the low-bid environment:

1. A few of the Alpha SPF roofing contractors have not been able to escape the low-bid pressures that have led to occasional non-performance issues.
2. A high performance Alpha SPF roof system cannot be consistently delivered in the DISD low-bid environment as lower performing contractors win jobs with low-prices.
3. The Alpha coating and SPF manufacturers and DISD have not been able to regulate the contractor performance by proper quality control and the use of performance information.
4. There are Alpha SPF contractors who do not have the management and planning expertise and discipline to identify and minimize sources of SPF performance risk at the beginning of the project.
5. The Alpha SPF manufacturers have not provided the transparency that would have minimized DISD risk by testing for performance metrics at the end of the project, and continually comparing the project metrics to existing DISD Alpha SPF roof metrics.

Instead of using the traditional warranties which are difficult to enforce, the Alpha SPF manufacturers (Alpha coating and SPF) must create a new risk mitigation environment. The risk shall be minimized by identifying the sources of risk, and eliminating the sources of risk before the project begins instead of passing the risk to another party (traditional warranty system). The DISD will also participate in the program by following simple rules of Best Value. The new environment will minimize risk sources regardless of who causes the risk.

The following are the risk mitigation mechanisms:

1. The SPF Alpha system should only act as an alternative to the traditional modified BUR system and can only be selected if it shows tremendous value for DISD (a minimum of 30% cost savings). The Alpha roof system is already identified as an alternate roof system in the DISD approved specifications.
2. The SPF alternative proposal will be selected if the SPF manufacturer covers all SPF defects regardless of cause (and shows an operational process that has been in place) and still shows dominant value over the traditional specified system (minimum of 30% cost savings).
3. A clarification period will be held on every Alpha SPF project that is approved that requires the manufacturers' representatives and DISD stakeholders to attend. The Alpha contractor should clarify how they will install the Alpha system, present a list of risks and risk mitigation and have a schedule that will be tracked throughout the project.
4. The contractor will have third party inspection of the roof of coating thicknesses and SPF density, compressive strength and material stability. The testing metrics will be in a system that is accessible to all and easy to understand, creating transparency in the event that there are performance issues during the service period of the Alpha SPF roof system.
5. The contractors will show their level of expertise by belonging to an Alpha performance program that monitors the performance of all their SPF roof applications.
6. This Alpha program suspends the contractor if they do not follow any of the requirements of a high performance contractor (maintains their roof systems, maintains customer satisfaction and roofs not leaking to a 98% level of performance, and fixes any deficiencies within two weeks of notification).

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