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Demonstration of Improved Technologies for Rehabilitating Metal Roofing in Severely Corrosive Environments

Final Report on Project F07-AR08

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Katharine Sweeton, Lawrence Clark,
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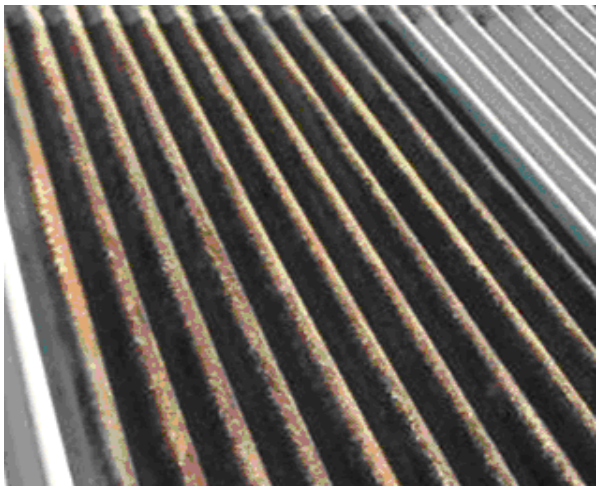

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Final Report

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Abstract

The objective of this project was to successfully demonstrate and evaluate two technologies for extending in place the service life of failed metal roofs on two different buildings at Wheeler Army Airfield, which is located in a severely corrosive marine environment. A polyurea-hybrid coating was applied to a leaking corrugated aluminum-panel roof on a barracks building, and a structural standing-seam metal roofing (SSSMR system) with an innovative sub-purlin framing system was used to re-cover a severely corroded metal roof over the Bowling Center.

Because both technologies allowed the existing metal panel roof to remain in place, rehabilitation could be completed more quickly and cost-effectively than a full replacement. The projected return on investment (ROI) for these technologies ranged from 21.6 to 28.7 depending on assumptions. Additional benefits not quantified in the ROI analyses include deferred roof-removal costs; reduced costs for restoring protection of building occupants and interior furnishings; and reduced disruptions of building operations during rehabilitation.

When full replacement of a failed metal roofing system is being considered, Army facility managers should also evaluate the feasibility of using one or both of the demonstrated technologies to reduce roof rehabilitation time and cost burdens.

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Preface

This demonstration was performed for the Office of the Secretary of Defense (OSD) under Corrosion Prevention and Control Program Project F07-AR08, "Rehabilitation of Metal Roofing at Wheeler Army Airfield"; Military Interdepartmental Purchase Request MIPR7CCORB1019, dated 21 November 2006. The proponent was the US Army Office of the Assistant Chief of Staff for Installation Management (ACSIM) and the stakeholder was the US Army Installation Management Command (IMCOM). The technical monitors were Daniel J. Dunmire (OUSD(AT&L)), Bernie Rodriguez (IMPW-E), and Valerie D. Hines (DAIM-ODF).

The work was performed by the Materials and Structures Branch (CEERD-CF-M), Facilities Division (CF), US Army Engineer Research and Development Center – Construction Engineering Research Laboratory (ERDC-CERL), Champaign, IL. The ERDC-CERL project managers were Dr. L. D. Stephenson and Mr. David M. Bailey. Quality assurance and technical representation were provided by Katharine Sweeton, Louisville District. At the time this report was prepared, the Vicki L. Van Blaricum was Chief, CEERD-CF-M; L. Michael Golish was Chief, CEERD-CF, and Martin J. Savoie, CEERD-CV-ZT, was the Technical Director for Installations. The Deputy Director of ERDC-CERL was Dr. Kirankumar Topudurti and the Director was Dr. Ilker Adiguzel.

Project support was provided by Mr. Gary Gerdes (CEERD-CF-E). The contributions of Mr. Brent Cullinan, Color Dynamics Incorporated (CDI), and Mr. Red Coleman, Aztech Consulting LLC, are also acknowledged. The following Wheeler Army Airfield (AAF) personnel are gratefully acknowledged for their support and assistance in this project:

- Mr. Alan Goo, P.E. – Director of Public Works
- Mr. Gene Arter – Facility Manager Supervisor, Directorate of Public Works (DPW)
- Mr. Dean Kissinger – Facility Management Staff, DPW
- All residents of Building 118 and all employees in Building 835.

COL Kevin J. Wilson was the Commander and Executive Director of ERDC, and Dr. Jeffery P. Holland was the Director.

Executive Summary

This Corrosion Prevention and Control Program demonstration tested two market-available technologies for rapidly and cost-effectively rehabilitating failed corroded metal roofs. One is a high-build polyurea-hybrid membrane-producing coating, and the other is a structural standing-seam metal roof (SSSMR) system that uses a customized sub-purlin system that can be fastened through the failed roof.

A polyurea coating can be used to extend the service life of a damaged metal roof for many years. Different formulations are used to achieve a range of physical properties. These coatings are typically field-applied onto existing metal roofs to provide a flexible, impermeable membrane for long-term protection against water intrusion.

The demonstrated sub-purlin framing system can be custom-fabricated with slot depth and spacing to nest over the profile of an existing metal roof and provide a level surface for placing new metal roof panels. The metal panels marketed today provide many improved material properties compared with those available in the 1980s when metal roofs began to appear in significant numbers on military installations. They can be formulated to reduce building cooling loads and for improved resistance to chipping, peeling, fading, and chalking, helping to reduce building life-cycle costs.

This report documents the demonstration of each technology on separate buildings at Wheeler Army Airfield, Hawaii. Lessons learned related to site selection and application parameters particularly with the polyurea coating.

An exposure rack with coupons for evaluating the polyurea coating and the PVDF coated metal was erected on a building at Wheeler AAF. The coupons will be evaluated in the laboratory on a yearly basis to assess performance.

Unit Conversion Factors

Multiply	By	To Obtain
degrees Fahrenheit	(F-32)/1.8	degrees Celsius
feet	0.3048	meters
gallons (U.S. liquid)	3.785412 E-03	cubic meters
inches	0.0254	meters
mils	0.0254	millimeters
square feet	0.09290304	square meters

1 Introduction

1.1 Problem statement

Metal roofing has seen a continual increase in use on Department of Defense (DoD) installations since the 1980s. In 1999, metal roofing was estimated to make up 21% of the total amount of roofing on nonfamily housing buildings on Army CONUS installations (Bailey 1999). This percentage is probably much larger today, and standing-seam metal roofing is most often specified both for new buildings and for steep-sloped conversions of low-slope membrane roofs.

Metal roofing system components on buildings located in severely corrosive environments often fail prematurely due to advanced material degradation. Common failure mechanisms include weakening of roof member attachment points or perforation of the roofing sheet material. Contributing factors include continual wet and humid climates, aerosolized chloride contamination from close proximity to sea water, and accumulation of industrial pollutants or soil on roof surfaces. Roof design issues that may contribute to poor performance include selection of inappropriate coating materials and poor roof detailing. Of significant concern is that degraded roofing structures exposed to natural phenomena such as high winds associated with tropical storms can cause catastrophic structural failures. Four typical examples of metal roof corrosion are shown in Figure 1[1].

As older metal roofs of lower quality are degraded by severe corrosion, Army Departments of Public Works (DPWs) must plan for rehabilitation or replacement. Properly selected roof-rehabilitation strategies offer DPW facility managers low-risk, high-payback facility sustainment options. Innovative technologies and approaches can avoid conventional tear-off and replacement, and extend the service life of roofs already in place while reducing construction and demolition waste.

1.2 Objective

The objective of this demonstration was to install and evaluate the effectiveness and costs of applying either a polyurea coating or a roof re-

[1] All figures are presented in sequence immediately following reference list.

covering technology for failed metal roofing systems in a severely corrosive environment.

1.3 Approach

Wheeler Army Airfield (AAF), Hawaii, was selected as the demonstration site owing to its location in a marine coastal environment. A polyurea-hybrid coating was applied to a leaking corrugated aluminum panel roof on a barracks building (Bldg. 118); and a severely corroded metal roof over the Bowling Center (Bldg 835) was re-covered with structural standing-seam metal roofing (SSSMR) system using an integral sub-purlin framing system. The ease of application, cost effectiveness, and functionality of these technologies were assessed.

The AAF DPW selected a barracks building and a recreational center housing bowling lanes for the demonstrations. Both buildings had recently been inspected by the DPW and determined to need roof replacements.

The work on each building was performed at separate times during spring and summer of 2008. Individual contracts were issued for each technology demonstration. Preliminary onsite meetings were held with representation from ERDC-CERL, USACE, DPW, the prime contractor (Mandaree Enterprise Corporation) and the subcontractors to plan, program, and execute the project with minimal disruption to facility operations. Health and safety plans, work plans, and quality control plans were provided and approved by the government before work began.

Metrics were established to quantify the success of each demonstration. The metrics for the polyurea hybrid test coating addressed color, thickness, and aesthetic properties; effective sealing capabilities; and the availability of a 15-year warranty. The metrics for the roof re-covering system included corrosion treatment and coating properties; availability of a 20-year warranty; ability to meet wind uplift requirements as attached over the existing metal roof; and minimal use of exposed fasteners.

Follow-on condition evaluations of the demonstrated materials will be performed over a 3-year period. This will be done through the evaluation of coupons mounted on an exposure rack at Wheeler AAF.

2 Technical Investigation

Wheeler AAF is located in the central area of Oahu, HI, approximate latitude: 21 29'05" N, longitude – 158 02'23" W. The test site is approximately 10 miles west, 9 miles north, 11.6 miles east, and 12 miles south inland from the Pacific Ocean at an elevation of 837 ft (255 m) above sea level. This site was chosen because it is located in a highly corrosion-prone area and an environment with high wetness and ultraviolet (UV) exposure that severely degrade roofing systems.

2.1 Polyurea coating

2.1.1 Technology description

All polyurea coatings consist of two components: an A-side (polyisocyanate pre-polymer) and a B-side (resin blend formulation). The resin blend consists of amine-terminated molecules of varying sizes and types. The choice of particular amines and the ratio of the selected amines included in the coating will determine the performance and the properties of the polyurea. A *pure polyurea* has no hydroxyls intentionally added to the system. If hydroxyl-containing products (polyols) are included, the coating is considered a *polyurea hybrid*. A polyurea hybrid resin blend may contain catalysts for system reactivity, and it may also contain additives such as pigments dispersed in a polyol carrier. For the current project, a polyurea hybrid resin blend was used.

2.1.2 Project roof overview

Building 118, a three-story troop barracks building, was selected for the technology demonstration. Its existing corrugated aluminum roof (Figure 2) is part of the original 1980 building construction and measures approximately 20,000 square feet. As the result of a 2005 real property condition assessment, the roof was determined to require replacement due to its age and recurring water leaks. The service order history for this roof indicated that only minor repairs were performed over the service life period, but an acrylic-based coating had been applied during this time. Defects noted were typically leaks around roof penetrations. In August 2005, the Wheeler AAF DPW submitted an Engineering Work Request for the Building 118 roof replacement action.

During the selection process, the logistics of coating this fully occupied barracks with vehicles surrounding it was analyzed to determine the many contingencies that would have to be addressed during the coating process. These included the limited staging area, the close proximity of a child care center (Figure 3), the many vehicles that could be affected by overspray, the need to isolate the fumes from the barracks air-handling system, the effect of weather on the application process, and the necessity that the coating pigment match the building's copper color requirement.

2.1.3 Project design

Building 118 is one of many structures at Wheeler AAF designated as historic, and therefore is required to conform with certain exterior color requirements. In the original project narrative, the specified test coating color was an aluminum/silver color. However as the project design was developed, a color change from silver to a copper was required by the government. The copper coating was slightly more expensive than the silver.

The demonstration materials selected for use on this project are the VFI™-11 primer and the VFI™-535 polyurea-hybrid topcoat, manufactured by Volatile Free, Inc. (VFI), Brookfield, WI. The topcoat material contains a copper-colored pigment that gives the appearance of a metallic coating when properly applied. The coating product data sheets are shown in Appendix 1B (*VFI Polyurea-Hybrid Test Coating Information*).

The polyurea-hybrid topcoat is advertised by the manufacturer as having been tested using the following ASTM International tests and achieving the following results:

1. Solids: — 98% by weight
2. Tensile per ASTM D-412 — 1800 psi
3. Elongation per ASTM D-412 — 500%
4. Permanent Set per ASTM D-412 — 10% max.
5. Hardness Shore A per ASTM D-2240 — 60 + 3
6. Tear Resistance per ASTM D-624, Die C — 250 pli
7. Water Vapor Permeability per ASTM E-96 — 0.025 perm In.

The VFI-11 epoxy primer is applied using a conventional airless paint spray unit. The VFI-535 copper topcoat is applied using a plural component spray system (Figure 4) with a heated fluid line for each component A and B to reduce the viscosity for spraying. As the combined A and B mate-

rial leaves the spray gun it immediately begins to crosslink. The setup time of the material is several seconds, dry to touch in 45 seconds, and easily handled within several minutes after the material cools. It should be noted that polyurea coatings can be formulated for shorter and longer setup times. The short setup and cure times are necessary to prevent runs and sags in the coating that would normally be experienced when spraying high-build coatings using high-volume spray equipment on a sloped roof. The short setup time also facilitates coating applications where inclement weather may be a factor. Because of the heated lines and fast setup times, the polyurea materials can be effectively sprayed in cold weather where conventional coatings cannot.

2.1.4 Installation

The coating team consisted of a coating manufacturer representative trained in surface inspection and preparation, an onsite team leader employed by the coating manufacturer, and two applicators. Upon arrival at Building 118, the team assembled the required man-lift, air compressors, electrical generator, and spray equipment. Next, they conducted a visual inspection of the roof surface. The roof coating appeared to be a baked-on finish with no peeling or flaking. There was minor surface corrosion noted on and around fasteners, signs of missing seam sealant/tape, gaps in sealant, and large areas having mold and mildew on the surface. However, there were no signs of deterioration to the coating other than color fading. The substructure, which was not included in this evaluation, was noted to have significant corrosion.

The contractor pressure washed the roof to remove mold, mildew, and chalking from the existing roof surfaces. In areas where mold and mildew remained, a mixture of 80% water, 15% bleach, and 5% of a mildewcide was applied. All gutters obstructed with debris were subsequently cleaned to allow proper drainage of water from the roof.

After cleaning, the applicators sealed all areas having open seams, exposed fasteners and gaps occurring between roof panels and at flashed penetrations. A gun-grade, one-component dark bronze polyurethane construction sealant was used for this purpose. The team leader then visually inspected the roof surfaces for any defects such as holes, missing caulking or sealant, and missing fasteners. All anomalies were corrected. The coating application process was allowed to proceed only after the coating manufac-

turer's technical representative was satisfied the surface was prepared properly.

A coating material application trainer provided instruction to the two applicators prior to spraying the roof. The applicators were instructed on proper operation and handling of the equipment (Figure 5). During the training period, they destructively collected coating thickness measurements during the spray applications. Within 40 seconds of spraying the coating onto a primed substrate, the applicators would cut slices of the coating. The applicator would then manually pull the slices from the substrate before final coating cure. The slices were visually evaluated by the applicators to roughly estimate the coating thickness that a typical pass of the spray gun would achieve. This allowed the applicator to develop their personal spray rate/rhythm/overlap techniques. It was also done to avoid the need for destructive testing the roof after the coating was applied.

Over a three-day period, the entire roof was primed with a two-component water-based epoxy primer using a conventional airless spray system (Figure 6). The topcoat was applied (Figure 7) using the two-component proportioner system and spray gun with a No.1 spray tip and 2,000 psi back pressure. The polyurea-hybrid coating line heat was set and maintained at 150 °F. Shortly after starting the operation, the applicators changed to a No. 2 spray tip and reduced back pressure to 1,500 psi and then to 1,200 psi. The No. 2 spray tip provided a more oval and even pattern, and the lower back pressure reduced overspray.

During the spraying operations, the contractor noticed some of the seam tape lifting. This seam tape had been previously applied over rows of exposed fasteners that were used where adjacent panels overlapped . The applicators used the polyurea, with its quick setup properties, to re-adhere the seam tape to the surface. The applicators then applied the polyurea material over the top of the seam tape to effectively seal the area. Around roof penetrations, the contract required application of the polyurea 6 inches up from the base of the ventilation stacks and vents to ensure that the sprayed membrane would not allow water to wick in around the base of the stack or vent.

The close proximity of the surrounding buildings, parking areas, and streets provided very limited space for staging of equipment and materials. These constraints imposed several challenges to the applicators. Parking

areas adjacent to the building were cordoned off, and covers were placed over some vehicles to protect from overspray. At times the three-story building had overspray occurring as far as 100 feet from the building, putting more cars and property at risk of damage than first anticipated.

Several application delays were caused by adverse weather conditions. Weather conditions were monitored through data supplied by the automated weather monitoring equipment at Wheeler AAF. Those environmental conditions and other comments are noted on the Daily Quality Control Reports (Appendix 1D, *Daily Quality Reports*) that were entered by the general contractor while he was onsite or provided by the coating team when the general contractor was not onsite. The finished appearance can be seen in Figure 8 and Figure 9.

2.1.5 Project plan deviations

Shortly after coating operations began, a distinct sheen variance between the original beige color of the barracks roof and the newly applied polyurea-hybrid copper color was very apparent, and considered unacceptable by the prime contractor and the coating contractor. The coating representative said that the shinier copper color was expected immediately after application and would become more evenly dull in appearance in a matter of days. In addition, the vents and stacks were not originally in the coating contract. The color contrast with the light beige on the flashings and the new coating was not acceptable. Once verifying that enough material was available for the entire project it was agreed that the applicators should spray the entire outer surfaces of the ventilation stacks and vents with the polyurea-hybrid system to ensure color uniformity.

Due to the man-lift safety issues, access to the roof was limited to the two coating applicators only. Because they were fully engaged with the coating operations, the continual recording of the surface temperatures during spraying operations was not feasible. As noted in the Daily Quality Control reports, the ambient temperature during the application period was well within normal coating application requirements. Additionally, the in-line coating temperature was kept constant at 150 °F during spraying applications.

Because the dual-component material begins to gel and harden immediately upon mixing at the spray tip, the normal wet-film thickness gage used in spray painting was not appropriate for tracking the real-time coat-

ing thickness. To ensure optimum coating thickness and coating service life, the project instead required the dry-film coating thickness measurements. For this purpose, the contractor purchased a ferrous metal magnetic dry-film coating thickness gage based on the contract requirements for compliance with SSPC PA2, "Measurement of Dry Coating Thickness with Magnetic Gages." The gage was brought to the jobsite shortly after the coating process had begun, but there were enough uncoated, primed, and topcoated areas available to conduct the baseline measurements. When the contractor began calibrating the thickness gage using the roof material standard, it was discovered that the as-built drawings of the barracks had mistakenly identified the roof material as steel, but it is actually aluminum. Consequently, the magnetic gage could not be used to measure coating film thickness.

Based on observations of the application process, coating thickness taken from the test coupons already sprayed, and calculations of the theoretical coverage of the coating available, the contractor chose to hire a National Association of Corrosion Engineers (NACE) certified coating inspector to verify the coating thickness requirement. The inspector acquired the coating thickness measurements after the application was completed. The NACE coating thickness report is shown at Appendix 1F (*Coating Thickness Report*). Based on the observations noted above and the approved 15-year coating manufacturer's and applicator's warranty (Appendix 1G – *Coating and Labor Warranties*), the thickness requirements were determined to have been met.

Bare aluminum test coupons were coated during the priming and topcoating operations to evaluate the spray characteristics of the coating material. The test coupons were divided to allow evaluation of the primer alone and separate evaluations of multiple passes of the spray material over the primer. The test coupons and roof coating application processes were virtually the same, except that more of the topcoat material was applied to the roof. The prime contractor recorded dry-film coating thickness of the primer on the coupons consistently averaging 3–5 mils and dry-film coating thickness of the topcoat averaging 24–27 mils for each pass of the spray gun.

2.2 Metal roof re-cover

2.2.1 Technical description

Standing-seam metal roofs have an uneven profile of alternating sections of pan and raised rib, so they do not provide a flat substrate conducive to overlaying with a replacement roofing system using standard purlins. However, with the use of a customized sub-purlin framing system that is attached to the supporting substructure, a failed metal roof can be left in place and re-covered with a new structural standing-seam metal roof (SSSMR). By not removing the existing roofing system, disruption of regular building operations can be minimized, removal and disposal of the old roofing materials can be eliminated, and a more energy-efficient roof system can be obtained by adding an air space between the old and new roof.

The manufacturer of the (Roof Hugger[1]) sub-purlin system used for the demonstration of Building 835 custom-fabricates the sub-purlins, enabling them to overlay a large variety of existing metal panel systems. The sub-purlins are long, slotted 16 gage galvanized steel zee-channels that are placed over the existing standing-seam metal roof. They are typically fabricated in 10 ft lengths and with a profile height ranging from 3/8 in. to 1/2 in. above the top of the existing panel rib. The sub-purlins have prepunched pilot holes and are fastened with screws to the existing sub-purlins, providing support and holding down the original roof. The manufacturer fabricates the sub-purlins with slot depth and spacing to nest over the existing metal roof profile and provide a level surface to place the new metal roof panels. The clips for the new metal roof are attached to the sub-purlins, with spacing determined by the sub-purlins. Enhanced attachment may be achieved by increasing the fastener size and/or gage of the clip. Structural load testing of various designs are made available by the manufacturer.

The coating for the new SSSMR was specified to be a long-lasting cleanable or self-cleaning system to improve performance in the Hawaiian environment, which has excessive soiling and vegetation growth on the roofs contributing to coating failure and corrosion. Polyvinylidene fluoride (PVDF) coatings factory-applied to galvanized and galvalume steel roofing panels have such characteristics and produce a high-quality finish with

[1] Roof Hugger is a trademark of Roof Hugger, Lutz, FL.

high reflectance and high emissivity. They are typically warranted against chipping, peeling, fading, and chalking for various periods of time.

2.2.2 Project roof overview

The failed roof on Building 835, which serves as a bowling center and snack bar, is part of the original 1985 building construction. Its standing-seam metal roof was displaying severe paint deterioration/flaking (Figure 10) and some corrosion, but it remained structurally sound. There was evidence that the roof had been repainted but the coating did not properly adhere to the substrate. As a result, the recoating material recently starting to peel off in large sheets. According to the Wheeler AAF DPW Facility Manager, the roof and entire building exterior was scheduled for repainting. Typically, when repainting, the new coating is not expected to have the same service life as a factory-applied baked-on finish. And in this case, because of severity of coating failure and corrosion, the surface would have required extensive surface preparation; making it an excellent candidate for re-cover.

2.2.3 Project design

The contract specifications for the demonstration required that the SSSMR meet the following criteria:

- The SSSMR assembly, including metal roof panels, fasteners, connectors, and roof securement components must be tested and approved in accordance with ASTM E1592, *Standard Test Method for Structural Performance of Sheet Metal Roof and Siding Systems by Uniform Static Air Pressure Difference*, to meet the local wind-uplift requirements.
- The panel material must be 22 gage.
- All roof accessories and their fasteners must be capable of resisting the specified design wind-uplift forces and allow for thermal movement of the roof panel system. Any exposed fasteners must not restrict free movement of the roof panel system resulting from thermal forces.

Specific requirements for the SSSMR coating included the following:

- The roof coating must have high reflectivity and high emissivity on the exposed side. Color is to match the color of the existing roof of Building 835.

- The coating was to be not less than 2 mil thick (dry-film thickness [DFT]), which is greater than the industry standard of 1 mil.
- A sample of the coated sheets must withstand a cyclic corrosion test for a minimum of 2016 hours in accordance with ASTM D5894, including the scribe requirement in the test. Immediately upon removal of the panel from the test, the coating shall receive a rating of not less than 10; no blistering, as determined by ASTM D714; no rusting, as determined by ASTM D610; and a rating of 6, over a 2 1/16 to 1/8 inch failure at scribe, as determined by ASTM D1654.
- When subjected to testing in accordance with ASTM D522 Method B, 1/8 inch diameter mandrel, the coating film must show no evidence of cracking to the naked eye.
- A sample of the sheets must be tested in accordance with ASTM G154, test condition UVA-340 lamp, 4h UV at 140 °F followed by 4h CON at 122 °F for 2,000 total hours. The coating shall withstand the weathering test without cracking, peeling, blistering, loss of adhesion of the protective coating, or corrosion of the base metal. Protective coating with an adhesion rating less than 4B when tested in accordance with ASTM D3359, Test Method B, shall be considered as an area indicating loss of adhesion. Following the accelerated weathering test, the coating shall have a chalk rating not less than No. 8 in accordance with ASTM D4214 test procedures, and the color change shall not exceed 5 CIE or Hunter Lab color difference (delta E) units in accordance with ASTM D2244. For sheets required to have a low gloss finish, the chalk rating shall be not less than No. 6 and the color difference shall be not greater than 7 units.
- Exposed sealant shall be colored to match the applicable building color and shall cure to a rubber like consistency.

The roofing contractor employed an engineering consultant to perform design calculations and engineering of the roof assembly and determine the wind uplift requirements. See Appendix 2D (*Design Calculations Report*) for a comprehensive review of the calculations and engineering. During ASTM E1592 testing, a proposed two-piece hold-down clip did not provide acceptable results. Therefore, a one-piece fixed clip with a sealed seam was used in the test assembly, passing the test criteria. The information from the testing was used in combination with ASCE-7 wind uplift criteria to determine the proper clip spacing. Typically, fixed clips should only be used in roof panels shorter than 40 feet or one clip per rib to create the line of fixity.

The contractor's submitted design called for a 22 gage SSSMR prefinished with the BASF Ultra-Cool™ coating (a 70% PVDF resin-based coating system supplied as Kynar® 500) attached to the Roof Hugger sub-purlin framing system. Self-drilling fasteners were specified for installing the sub-purlins to the existing purlins and roof clips to the sub-purlins. This design would increase wind uplift resistance as compared with the existing roofing system owing to the "box" configuration created by the added purlins and roof panels. The above-sheathing ventilation between the old and new roof should improve the thermal performance in cooling and wet climates (see Appendix 2K, *Cool Metal Roofing Coalition Report*).

The installation design for the sub-purling framing system is in Appendix 2I (*Roof Hugger™ Guide Specification*). The design details for fascia, roof penetrations, and other details were accomplished by the roofing contractor (see Appendix 2A, *Hi-Tec Roofing MRS 200 Project Details*).

Several designs using different metal gage, clip types, and spacings, and rib design were considered. However, due to time and cost constraints, only the selected system (22 gage, fixed clip, 180-degree vertical rib and 5 ft clip spacing) was tested to ASTM E1592 standards.

2.2.4 Installation

The project work sequence included preparing the existing roof; removing the old fascia and gutters; attaching the sub-purlin framing system; installing new fascia and gutters; fabricating, placing and securing the metal pans; and applying new flashings at terminations and around roof penetrations. All of the work was performed by the roofing contractor's crew, which on a daily basis consisted of a team leader, a detail applicator, and six to eight roof mechanics. They were only allowed to start the installation after their Health and Safety Plans (Appendix 2B – *Contractor Health, Accident Prevention and Safety Plans*) and Project Work Plan were approved by the government.

Before work began, the crew assembled the required man-lifts, scaffold, electric power generator, panel-forming equipment, roof seamers, and other specialty sheet metal equipment. For this job, a new and more sturdy mechanical seamer was required to bend 22 gage sheets to a 180 degree vertical rib seam. Next, they began preparing the surface of the existing main metal roof by pressure-washing the metal panel surfaces to remove any mildew and loose paint (Figure 11). Corroded areas were scraped to

remove rust, which was necessary due to the advanced deterioration of the finish and significant amount of corrosion that existed. After the pressure washing, all of the corroded areas on the upper roof were treated using a rust-inhibiting coating (see Figure 12 and Annex 2, Appendix 2E).

Next, the crew removed and disposed of the old gutter and fascia. Due to the adjustment for a raised profile of the new roof and a change in the new fascia and gutter detail, approximately 2 in. of the existing roof had to be trimmed back. The sub-purlins were then installed (see Figure 13) over the entire upper roof section following the manufacturer's guidelines. They were attached to the existing underlying purlins using self-tapping, corrosion-resistant fasteners. As this was being done, the installation of the new fascia and gutters began (see Figure 14). These operations were done simultaneously as the fascia and gutter installation had to be complete before the new upper roof could be installed.

The new metal panels were fabricated to the correct profile from coil stock using roll-forming equipment and cut to the required lengths (Figure 15 – Figure 17). Each panel was put into place and secured to the sub-purlins using one-piece clips and screws. The standing seam between adjacent panels was formed using an automatic seamer (Figure 18) that folds the seam with a 180 degree profile. After seaming, the end of each panel was locked in place at the roof edge by folding it over a cleat at the fascia/drip edge, thereby eliminating the use of through-panel fasteners. The final step in the process was to install all base flashings, counter flashings, pipe seals, ridges and final sealants along tops of exposed counterflashing (see Figure 19 and Figure 20).

The lower roof sections, which were smaller in area, were not addressed until the upper main roof was completed because they required complete demolition to remove the old roofing. Removal was necessary due to the limited clearance from the roof above and the numerous curbs that would have required additional structural support if raised to the required height. The installation process was the same as for the main upper roof except that the new panels were installed directly to the original purlins that once supported the original roof panels. Large vents and curbs were located on these sections, requiring significant effort and workmanship to install properly (Figure 21).

During installation, the crew's team leader remained onsite full time and provided quality control. Areas of focus included

- accuracy of cuts/seam placement/panel quality
- minimized use of exposed fasteners
- proper seating of fasteners
- protection of installed panels from damage.

Protection of the new roofing during installation was of high importance Workers performed some seaming and detailing work with wood planks wrapped with rubber roofing membrane placed beneath them to avoid scratching of the metal coating. Extra measures were also taken to prevent loose red soil near the worksite from being tracked onto the newly installed roofing panels and scratching them.

Except for two days when overhead work required the kitchen to be closed, the Bowling Center remained open and fully functional during the installation process. This minimized disruption in availability to residents and loss of revenue. The level of quality and final appearance can be seen in Figure 22 and Figure 23.

2.2.5 Project plan deviation

Before work began it was discovered that an addition had been constructed on the south end of the building after the project contract was awarded. The addition had an asphalt shingle roof over a plywood deck and wood fascia, so the scope of work had to be revised to include removal of the shingles and sheathing and addition of a new SSSMR with new metal fascia and soffit (Figure 24 and Figure 25). The two roof planes were not in alignment, so an expansion joint with a batten cap was used to tie the two roofs together.

2.3 Technology operation and monitoring

An exposure rack for evaluating the polyurea coating and the PVDF-coated test coupons was erected on a building in close proximity of both the demonstration buildings.

The polyurea test coupons were fabricated by applying the coating to a flat, galvanized steel plate using techniques, coating thicknesses, and drying times similar to those used during the demonstration project. The PVDF

coupons were cut from panel stock identical to that used for the demonstration roof. Cut edges were coated with a material recommended by the coating manufacturer.

From both sets of coupons, eight from each set were placed on the exposure rack (Figure 26). The remaining four from both sets were sent to the USACE Paint Technology Center at ERDC-CERL for evaluation. The rack was set at an angle of 45 degrees from vertical. Each coupon was scribed to base metal in accordance with ASTM Test Method D 1654, "Standard Test Method for Evaluation of Painted or Coated Specimens Subjected to Corrosive Environment." These coupons will be removed from the rack on a yearly basis and evaluated in the laboratory. Performance indicators will include visible corrosion and coating degradation (ASTM D1654-05) as well as adhesion (ASTM D3359). Monitoring will be performed by conducting site inspections of the installed roof sections after 1 year.

3 Discussion

3.1 Polyurea coating

3.1.1 Metrics

The performance metrics for the polyurea-hybrid coating were as follows:

- The material must meet ERDC-CERL specifications for properties, color, dry-film thickness, and appearance.
- The coating must effectively seal areas around vents, stack, and seams.
- The finished roof must be atheistically acceptable to Wheeler AAF DPW and garrison senior leadership.
- The coating must have a minimum 15 year warranty.

As noted in the previous chapter, there was initial concern about coating appearance because it was brighter than expected at the time of application. The coating consultant stated that the uneven sheen of the bright copper color would age to a darker copper color and within a few months would not be noticeable, and this turned out to be the case. The Wheeler DPW personnel subsequently expressed high satisfaction with the appearance of the pigmented polyurea-hybrid material.

The coating thickness was to be measured in accordance with the Society for Protective Coatings (SSPC) SSPC-PA2, “Paint Application Specification No.2, Measurement of Dry Coating Thickness with Magnetic Gages.” However, a magnetic gage was not used because the as-built drawings indicated that the roof was steel, but it was actually aluminum. The VFI-535 Copper material was to be applied at a minimum thickness of 40.0 mils on all flat surfaces and 80 mils on all seams, fasteners and penetrations. This thickness was required to achieve the 15 year warranty. If a thinner application was provided, the warranty would have been of lesser duration. A Positector 6000 FN was used to measure the total dry film thickness of the coating, including the original coat. This gage accommodates both ferrous and nonferrous substrate coating measurements. It was determined that the average thickness of the finished coating met the project thickness requirements.

3.1.2 Results

The project began on 6 March 2008 and was successfully completed 24 March 2008. The result of the work was the extension of a deteriorated roof's service life by 15 years, avoiding the extra costs and disruptions of a complete replacement.

The coating manufacturer's consultant provided coating operations, application, and maintenance training to the applicator. Information on the care, inspection, and maintenance of the coating is contained in Appendix 1A (*VFI™ Coating Manual*).

There were a number of constraints experienced by the contractor that impacted the application processes. The very limited parking access and the coating operations on a fully occupied barracks were overcome by close coordination among installation facility managers. Recurrent rain showers and wind gusts, as noted in Appendix 1D (*Daily Quality Reports*), required the contractor to frequently delay the coating operations. However, due to the fast set and cure times of the polyurea-hybrid material, the rain did not negatively impact coating properties. This was a distinct advantage of using the polyurea material because most coating systems do not set up so rapidly.

The coating manufacturer has approved the 15-year coating warranty for the material and its installation, as shown in Appendix 1G (*Coating and Labor Warranties*). The stipulation was made that the warranty needed to be applied for before the coating task commenced and that additional submittals be provided at the conclusion of the work. That information included such items as coating application process, area being coated, and materials used. The details of what criteria have to be met to obtain this warranty or a 20 year warranty are provided in the Appendix 1G (*Coating and Labor Warranties*).

3.1.3 Lessons learned

3.1.3.1 Site-selection lessons

The use of a barracks building was ideal from the perspective of demonstrating a roof-coating application in an area with continual personnel and vehicle traffic to show that the material could be safely and effectively applied. The building was fully occupied, limiting the crew's time onsite in

order to avoid disturbing the occupants. The contractor established a daily preparation and painting operations schedule to accommodate most of the occupants during their normal duty hours.

Overspray and resulting damage, particularly to nearby vehicles and adjacent facilities, is always a concern for these types of applications. The contractor used *no-parking* stanchions to attempt to restrict vehicles from areas potentially affected by overspray. With parking around the building being very limited, military personnel often times moved aside the stanchions and signs and parked in the restricted spaces. When this occurred, the contractor placed tarps over those vehicles to protect them from spray damage. At times there were not enough tarps on hand, pointing to the need to appropriately address this requirement in future project specifications.

The Wheeler AAF climate, with its frequent rain showers and wind gusts throughout the year, also provided a useful challenge for applying the polyurea-hybrid coating. The dual-component system proved adaptable to varying spraying schedules.

3.1.3.2 Application lessons

Several lessons were learned during application of polyurea-hybrid coating on Building 118. These included the importance of highly qualified applicators or supervision to ensure proper mixing of the individual components, maintaining the material components at the proper temperature, using proper spraying techniques, and fine-tuning of the spray gun parameters to conform to site conditions.

Both the A-side and B-side components of the polyurea must be thoroughly mixed in their respective storage containers before changing out drum sets to ensure complete mixing. This is especially important if the coating is pigmented to ensure the pigments are properly suspended in the coating resin vehicle. It is also critical to keep both components separated during mixing. Even small amounts of cross-contamination can immediately start the polymerization process in the storage container. For this reason, a separate stirring motor for each component side also should be used.

Keeping the fluid spray lines maintained near a target temperature is very important. The target temperature, which for this project was 150 °F, is required to reduce the viscosity of both the A-side and B-side components

to their proper levels to ensure proper material flow through the fluid lines. Setup before spraying included a 30 minute preheating on each side using inline 7,000 watt heating elements wrapped around the fluid hoses. A 200 ft length of heated hose was used on this project. The maximum length for this specific piece of application equipment was 310 ft. To protect the crew, insulation should be wrapped around these very hot hoses.

The quick setting of the material did not allow overspray to blend into newly sprayed areas. In many cases the amount of overspray detected was attributable to the standoff distance of the spray gun to the surface, the angle of impact of the sprayed material, wind gusts, the proportioner's back pressure, and spray tip selection. Figure 27 illustrates the overspray observed during this project. As seen in Figure 28, the polyurea-hybrid overspray droplets do not flash or coalesce, and they cure almost immediately upon contact. Overspray was visible as dull areas on shiny surfaces, creating a "halo effect." The following observations about overspray were noted during the application process:

- Normally the applicator will position the spray gun 2.0–2.5 ft from the surface being coated. If the applicator raises the spray gun any higher, the potential for overspray increases.
- The applicator should apply the coating at a 90-degree angle to the surface to minimize overspray. The team noted that when the applicator flexed his wrist side-to side or when he extended his arm out at an angle to reach the edges of the roof, overspray occurred. Also, as noted during the applicator training, higher spraying pressure and higher material temperature will produce more overspray.

At the beginning of the spraying operation, the coating consultant set the spray equipment for 2,000 psi initial back pressure at gun tip. He later decreased the back pressure to 1,500 psi, then finally to 1,200 psi to reduce overspray. The original spray gun fluid tip selection was a No. 1 tip that produced a round pattern, not oval as expected. This tip was switched out for a No. 2 tip which produced the desired pattern. From these experiences it is clear that adjusting the spraying operation for the particular equipment, coating material, and weather environment is necessary for acceptable results.

A spray gun filter screen is typically used to prevent small particles of material from flowing through the lines. However, the coating consultant ad-

vised that the filter be removed when spraying the copper-pigmented coatings because the copper powder will plug the filter screen. It was also emphasized to keep the pumps delivering at the correct ratio during spraying operations or the material will not cure properly. An observer should be available to monitor the barrel pumps and coating levels in storage drums to avoid running out of material during spraying. The observer must stop operations before a drum completely empties to ensure that air pockets do not form in the fluid line.

The coating consultant instructed the applicators to apply the polyurea-hybrid material one section at a time. Normal painting practice has the applicator initially accomplish detail work such as inside corners and crevices, metal panel laps and fasteners, and then apply the coating on the remaining surfaces. Following this practice for such a high-output/high-build coating would waste material and cause coating thickness variations and excessive overspray.

In this project, there were no limited-clearance areas to be sprayed. Some roofs may have features that reduce clearance for coating spray application. In such areas, special attention is required, and if leaks occur these areas should be investigated thoroughly.

Metallic coatings are often sprayed to allow the metallic pigments to "leaf" together in order to produce a consistent appearance. The application angle must be kept fairly constant to achieve consistent texture and minimal cold joints in the finish. For this project, it appeared that the lay-up of the copper pigments produced different reflectant qualities when viewing the roof surface in sunlight from varying angles and locations. It is possible that this effect may have been caused by the quick setting of the coating. Figure 29 illustrates the gloss of the coating material. Despite the variance in reflectance, the appearance of copper pigment dispersed throughout the coating was consistent. The cross-section of the coating shown in Figure 30 highlights the distinct layering of the product as it was applied.

3.2 Metal roof re-cover

3.2.1 Metrics

The metrics for an acceptable application of the SSSMR system were as follows:

- The SSRM system must meet ERDC-CERL's specified performance parameters, color, thicknesses, and appearance.
- The system must be tested using ASTM E1592 to verify that clip spacing is adequate to provide wind-uplift resistance as determined by ASCE-7.
- The system must use emerging technologies to avoid demolition and resulting disruption of facilities/operations.
- The system must provide a complete roofing system that effectively seals areas around vents, stack, curbs, and seams.
- The system must be atheistically acceptable to Wheeler AAF DPW and the garrison's senior leadership.
- The metal coating for the system must have a minimum 20-year materials and finish warranty.

With the exception of a leak at a roof vent flashing, which was corrected by the installer, the roofing system met all metrics and remains watertight. The final SSSMR has been accepted by Wheeler AAF personnel, who are very satisfied with the quality of the installation and its appearance.

3.2.2 Results

The demonstration project began on 18 July 2008 and was successfully completed on 11 August 2008. The project resulted in effectively extending the service life of a deteriorated roof by 25 years without the expense of inconvenience of a full tear-off and reconstruction. This customized sub-purlin system for re-covering an existing standing-seam metal roof showed significant advantages for use in a wet climate.

3.2.3 Lessons learned

In general, this demonstration project was completed without complications. Several factors figured into the success. The roof installer did significant pre-planning, preparation for staging, and provided excellent onsite management and quality assurance.

3.2.3.1 Site-selection lessons

The building and surrounding grounds provided very few obstacles for the roof installer. The crew was able to minimize its disruption of facility operations by cordoning off the work and laydown areas with delineators and barricade tape. A man-lift/scaffold provided access to the roof on all sides

of the building. Plywood sheets were laid on the surrounding grounds to minimize damage, especially at times immediately following rain.

While the work space around building 835 was adequate, most buildings at Wheeler AAF are close together and do not provide as much access. Limited space and access during a complete roof demolition creates considerable nuisances and dangers to both the work crew and building patrons. By being able to leave the existing metal roof in place, many of these problems are eliminated. Additionally, disruption of building operations are minimized.

3.2.3.2 Application lessons

Selection of a coil-stock manufacturer proved to be difficult for the roof installer in terms of meeting project requirements for panel thickness, finish, and metal gage. The coils meeting these requirements weighed 600 lb apiece as manufactured and initially could not be mounted onto the roll-forming equipment. A special assembly line had to be used until the coil size was reduced enough for the available equipment.

After the existing roof substrate was pressure-washed and repaired, a week was dedicated to defining and improving details. Evaluating the edge detail designs (Figure 31) during this time proved to be very beneficial. Once sections of the existing gutter and fascia were removed, many areas of the roof edges were found not to be square and plumb. To accommodate these conditions, fascia and gutter details were redesigned. The final design added an extra piece of 22 gage galvanized sheet metal drip edge to close up gaps as well as provide for a solid plate to attach the new fascia, drip edge, and gutter system. This changed caused minor delays.

The installation of the sub-purlins proved to be a very straightforward task. Locating the original purlins for attaching the sub-purlins to was not difficult. However, the attachment clips of the original roof create slight bulging at the seams. A special tool was used for installing the self-drilling fasteners, and it worked very well for the task.

Oil canning, or panel deflection, became visible when outdoors temperature increased. The extent to which this occurred was not expected with the 22 gage thick stock that was specified. This seems to have been caused by the dark color, panel width, and tension applied to the metal panels during the seaming process, and does not appear to have been avoidable.

One means of minimizing this problem would be to reduce panel width to 12 in. Another approach would be to use a panel which has pencil ribs or striations.

As noted in section 2.2.4, the preventive measure of using 2 x 12 (nominal) wood planks wrapped in rubber roofing materials worked very well to protect the installed metal panels from impact, abrasion, and panel deformation as the crew performed detail work.

4 Economic Summary

These technology applications demonstrate two different ways a failed metal roof can be rehabilitated without demolition and removal of the existing roof. Separate return on investment (ROI) analyses for each technology were performed by comparison with demolition and removal of a existing failed roof and replacement with a new SSSMR. Actual design and installation costs for each technology are used in the calculations. The combined overall costs of contract and project management for both demonstrations were distributed to the individual projects in proportion to the cost of design and construction of each individual demonstration.

The ROIs do not include the benefits gained by reducing disruption of ongoing operations as no evacuation of the premises is required. For the metal roof recover, it also does not include the potential energy savings realized in having a ventilated space between the old and the new roof.

4.1 Costs and assumptions

- The installed cost of a new SSSMR is $14.00/SF. The costs for demolition and disposal of a metal roof are $3.00/SF. These costs were based on estimates provided by the Cost Engineering Branch of the Corps of Engineers–Honolulu District (Bailey 2009).
- The expected service life for a new SSSMR is assumed to be 30 years. This is a conservative value, compared with industry claims which vary from 25 years (Cash 1999) up to 50 years (NIBS 2009).
- The annual maintenance and repair costs are relatively small compared to other roofing systems and will be assumed to be negligible for this ROI calculation.
- For both Building 118 and Building 835, the existing roof was defined as failed or failing, and was approved for replacement in the first year of the base case analysis.
- The Barracks Complex (Building 118) has 20,000 SF of roof. The installed cost of the polyurea technology, excluding all demonstration unique costs, is $5.90/SF ($118,000/20,000 SF). The polyurea technology has a 15-year warranty. However, we will assume that the roof will have to be replaced 10 years after the coating is applied due to failure of other system components.

- The Bowling Center (Building 835) has 15,000 SF of roof. The installed cost of the metal roof recover is assumed to be equal to the cost of installing a new SSSMR - $14.00/SF. (Project costs attributable to construction costs alone were not discernible from the overall demonstration costs). The expected service life of the metal roof re-cover is also assumed to be equal to a newly constructed SSSMR – 30 years. It should be noted that a lighter-gage metal roof panel and a 90 degree vertical rib could reduce the expense of the system.
- The Army has approximately 120 million SF of metal roofing. Using an average service life of 30 years for these roofs, one-thirtieth of the roofs are assumed to fail each year. Five percent of the failed roofs are assumed to be good candidates for polyurea coating as a repair. Ten percent of the failed roofs are assumed to be good candidates for using the metal roof re-cover and sub-purlin framing system.
- The ROI analysis will evaluate the cost effectiveness of the demonstrated technology by comparing the standard practice of roof removal and replacement (base case) to the installed costs unique to the demonstrated technology. As specified in OMB Circular No. A-94, comparing the cost effectiveness of a proposed alternative is required perform a Life Cycle Cost (LCC) analysis using the real discount rate (with the estimate for inflation removed), as published in the annual revision to Appendix C. The OMB approved 30 year real discount rate is 7.00%. The standard LCC spreadsheet was modified to allow for the adjustment of the discount rate from a standard 7.00%.

4.2 Projected ROI for polyurea coating

The baseline annual SSMR cost applied to the polyurea coating ROI analysis is $2.8M (1/30 * 120M SF * 5% * $14/SF), using the assumptions and logic given in section 4.1. The annual new-system cost for rehabilitating select SSMRs with the polyurea coating technology for Years 1 – 10 is $1.18 M (1/30 * 120M SF * 5% * $5.90/SF). Starting in Year 11, however, the annual new-system cost for these roofs increases to $3.98M since the polyurea coating cannot be reapplied and the roof will need to be replaced. The annual new-system benefit gained by avoiding SSMR demolition before polyurea coating application is $600,000 (1/30 * 120M * 5% * $3/SF). That benefit will not apply at Year 11 and beyond where the expired polyurea-rehabilitated roof is replaced by a 30-year SSMR. The use of the polyurea system does not eliminate the need for roof demolition but defers the cost for 10 years, and discounts it, by extending a failed roof's service life.

Based on the costs and assumptions in section 4.1, the expected ROI for recoating of the Army's failed metal roofing with the polyurea coating is 21.66 (Table 1).

Table 1. ROI calculation for polyurea rehabilitation of Building 118.

Return on Investment Calculation								
					Investment Required			426,500
					Return on Investment Ratio	21.66	Percent	2166%
					Net Present Value of Costs and Benefits/Savings	32,952,286	42,189,580	9,237,294
	A	B	C	D	E	F	G	H
	Future Year	Baseline Costs	Baseline Benefits/ Savings	New System Costs	New System Benefits/	Present Value of Costs	Present Value of Savings	Total Present Value
	1	2,800,000		1,180,000	600,000	1,102,828	3,177,640	2,074,812
	2	2,800,000		1,180,000	600,000	1,030,612	2,969,560	1,938,948
	3	2,800,000		1,180,000	600,000	963,234	2,775,420	1,812,186
	4	2,800,000		1,180,000	600,000	900,222	2,593,860	1,693,638
	5	2,800,000		1,180,000	600,000	841,340	2,424,200	1,582,860
	6	2,800,000		1,180,000	600,000	786,234	2,265,420	1,479,186
	7	2,800,000		1,180,000	600,000	734,786	2,117,180	1,382,394
	8	2,800,000		1,180,000	600,000	686,760	1,978,800	1,292,040
	9	2,800,000		1,180,000	600,000	641,802	1,849,260	1,207,458
	10	2,800,000		1,180,000	600,000	599,794	1,728,220	1,128,426
	11	2,800,000	600,000	3,980,000	600,000	2,175,958	1,615,340	-560,618
	12	2,800,000	600,000	3,980,000	600,000	2,033,520	1,509,600	-523,920
	13	2,800,000	600,000	3,980,000	600,000	1,900,700	1,411,000	-489,700
	14	2,800,000	600,000	3,980,000	600,000	1,776,124	1,318,520	-457,604
	15	2,800,000	600,000	3,980,000	600,000	1,659,792	1,232,160	-427,632
	16	2,800,000	600,000	3,980,000	600,000	1,551,246	1,151,580	-399,666
	17	2,800,000	600,000	3,980,000	600,000	1,450,028	1,076,440	-373,588
	18	2,800,000	600,000	3,980,000	600,000	1,355,222	1,006,060	-349,162
	19	2,800,000	600,000	3,980,000	600,000	1,266,370	940,100	-326,270
	20	2,800,000	600,000	3,980,000	600,000	1,183,472	878,560	-304,912
	21	2,800,000	600,000	3,980,000	600,000	1,106,070	821,100	-284,970
	22	2,800,000	600,000	3,980,000	600,000	1,033,706	767,380	-266,326
	23	2,800,000	600,000	3,980,000	600,000	965,922	717,060	-248,862
	24	2,800,000	600,000	3,980,000	600,000	902,718	670,140	-232,578
	25	2,800,000	600,000	3,980,000	600,000	843,636	626,280	-217,356
	26	2,800,000	600,000	3,980,000	600,000	788,676	585,480	-203,196
	27	2,800,000	600,000	3,980,000	600,000	736,922	547,060	-189,862
	28	2,800,000	600,000	3,980,000	600,000	688,832	511,360	-177,472
	29	2,800,000	600,000	3,980,000	600,000	643,948	478,040	-165,908
	30	2,800,000	600,000	3,980,000	600,000	601,812	446,760	-155,052

4.3 Projected ROI for metal roof re-cover

The baseline annual SSMR cost applied to the metal roof recover analysis is $5.6M (1/30 * 120M SF * 10% * $14/SF). As explained in section 4.1, the annual new-system cost for the roof re-cover technology also equals $5.6M (1/30 * 120M SF * 10% * $14/SF). The annual new-system benefit accrued by avoiding demolition of the failed SSMR is $1.2M (1/30 * 120M * 10% * $3/SF).

Based on the costs and assumptions used, the ROI expected to be realized by implementing the metal roof re-cover using the sub-purlin framing system on Army installations is 28.72 (Table 2).

Table 2. ROI calculation for metal roof re-cover for Building 835.

Return on Investment Calculation							
				Investment Required			518,500
				Return on Investment Ratio	28.72	Percent	2872%
				Net Present Value of Costs and Benefits/Savings	69,488,720	84,379,160	14,890,440
A	B	C	D	E	F	G	H
Future Year	Baseline Costs	Baseline Benefits/ Savings	New System Costs	New System Benefits/	Present Value of Costs	Present Value of Savings	Total Present Value
1	5,600,000		5,600,000	1,200,000	5,233,760	6,355,280	1,121,520
2	5,600,000		5,600,000	1,200,000	4,891,040	5,939,120	1,048,080
3	5,600,000		5,600,000	1,200,000	4,571,280	5,550,840	979,560
4	5,600,000		5,600,000	1,200,000	4,272,240	5,187,720	915,480
5	5,600,000		5,600,000	1,200,000	3,992,800	4,848,400	855,600
6	5,600,000		5,600,000	1,200,000	3,731,280	4,530,840	799,560
7	5,600,000		5,600,000	1,200,000	3,487,120	4,234,360	747,240
8	5,600,000		5,600,000	1,200,000	3,259,200	3,957,600	698,400
9	5,600,000		5,600,000	1,200,000	3,045,840	3,698,520	652,680
10	5,600,000		5,600,000	1,200,000	2,846,480	3,456,440	609,960
11	5,600,000		5,600,000	1,200,000	2,660,560	3,230,680	570,120
12	5,600,000		5,600,000	1,200,000	2,486,400	3,019,200	532,800
13	5,600,000		5,600,000	1,200,000	2,324,000	2,822,000	498,000
14	5,600,000		5,600,000	1,200,000	2,171,680	2,637,040	465,360
15	5,600,000		5,600,000	1,200,000	2,029,440	2,464,320	434,880
16	5,600,000		5,600,000	1,200,000	1,896,720	2,303,160	406,440
17	5,600,000		5,600,000	1,200,000	1,772,960	2,152,880	379,920
18	5,600,000		5,600,000	1,200,000	1,657,040	2,012,120	355,080
19	5,600,000		5,600,000	1,200,000	1,548,400	1,880,200	331,800
20	5,600,000		5,600,000	1,200,000	1,447,040	1,757,120	310,080
21	5,600,000		5,600,000	1,200,000	1,352,400	1,642,200	289,800
22	5,600,000		5,600,000	1,200,000	1,263,920	1,534,760	270,840
23	5,600,000		5,600,000	1,200,000	1,181,040	1,434,120	253,080
24	5,600,000		5,600,000	1,200,000	1,103,760	1,340,280	236,520
25	5,600,000		5,600,000	1,200,000	1,031,520	1,252,560	221,040
26	5,600,000		5,600,000	1,200,000	964,320	1,170,960	206,640
27	5,600,000		5,600,000	1,200,000	901,040	1,094,120	193,080
28	5,600,000		5,600,000	1,200,000	842,240	1,022,720	180,480
29	5,600,000		5,600,000	1,200,000	787,360	956,080	168,720
30	5,600,000		5,600,000	1,200,000	735,840	893,520	157,680

4.4 Projected ROI for combined CPC technology demonstration cost

Table 3 shows that the projected ROI for the entire CPC project investment of $945,000 is 25.53.

Table 3. Project-specific ROI for combined demonstration costs.

Return on Investment Calculation

SSSMR Replacement - Bowling Center (Building 835) and 6 Hangar buildings

	Investment Required		**$ 945,000**
Base Year 2009	**OMB Cir A-94 30 Year Real Discount Rate**		
	Return on Investment Ratio	**25.53**	**Percent** **2553%**
Net Present Value of Costs and Benefits/Savings		**$102,443,862**	**$ 126,572,220** **$ 24,128,358**

A Future Year	B Baseline Costs	C Baseline Benefits / Savings	D New System Costs	E New System Benefits / Savings	F Present Value of Costs	G Present Value of Savings	H Total Present Value
1	$ 10,200,000		$ 6,780,000		$ 6,336,449	$ 9,532,710	$ 3,196,262
2	$ 10,200,000		$ 6,780,000		$ 5,921,915	$ 8,909,075	$ 2,987,160
3	$ 10,200,000		$ 6,780,000		$ 5,534,500	$ 8,326,238	$ 2,791,739
4	$ 10,200,000		$ 6,780,000		$ 5,172,430	$ 7,781,531	$ 2,609,102
5	$ 10,200,000		$ 6,780,000		$ 4,834,046	$ 7,272,459	$ 2,438,413
6	$ 10,200,000		$ 6,780,000		$ 4,517,800	$ 6,796,691	$ 2,278,890
7	$ 10,200,000		$ 6,780,000		$ 4,222,243	$ 6,352,047	$ 2,129,804
8	$ 10,200,000		$ 6,780,000		$ 3,946,022	$ 5,936,493	$ 1,990,471
9	$ 10,200,000		$ 6,780,000		$ 3,687,871	$ 5,548,124	$ 1,860,253
10	$ 10,200,000		$ 6,780,000		$ 3,446,608	$ 5,185,163	$ 1,738,555
11	$ 10,200,000		$ 10,180,000		$ 4,836,445	$ 4,845,947	$ 9,502
12	$ 10,200,000		$ 10,180,000		$ 4,520,042	$ 4,528,922	$ 8,880
13	$ 10,200,000		$ 10,180,000		$ 4,224,338	$ 4,232,637	$ 8,299
14	$ 10,200,000		$ 10,180,000		$ 3,947,980	$ 3,955,736	$ 7,756
15	$ 10,200,000		$ 10,180,000		$ 3,689,700	$ 3,696,949	$ 7,249
16	$ 10,200,000		$ 10,180,000		$ 3,448,318	$ 3,455,093	$ 6,775
17	$ 10,200,000		$ 10,180,000		$ 3,222,727	$ 3,229,059	$ 6,331
18	$ 10,200,000		$ 10,180,000		$ 3,011,895	$ 3,017,812	$ 5,917
19	$ 10,200,000		$ 10,180,000		$ 2,814,855	$ 2,820,385	$ 5,530
20	$ 10,200,000		$ 10,180,000		$ 2,630,705	$ 2,635,874	$ 5,168
21	$ 10,200,000		$ 10,180,000		$ 2,458,603	$ 2,463,433	$ 4,830
22	$ 10,200,000		$ 10,180,000		$ 2,297,760	$ 2,302,274	$ 4,514
23	$ 10,200,000		$ 10,180,000		$ 2,147,439	$ 2,151,658	$ 4,219
24	$ 10,200,000		$ 10,180,000		$ 2,006,953	$ 2,010,896	$ 3,943
25	$ 10,200,000		$ 10,180,000		$ 1,875,657	$ 1,879,342	$ 3,685
26	$ 10,200,000		$ 10,180,000		$ 1,752,950	$ 1,756,394	$ 3,444
27	$ 10,200,000		$ 10,180,000		$ 1,638,271	$ 1,641,490	$ 3,219
28	$ 10,200,000		$ 10,180,000		$ 1,531,095	$ 1,534,103	$ 3,008
29	$ 10,200,000		$ 10,180,000		$ 1,430,929	$ 1,433,741	$ 2,811
30	$ 10,200,000		$ 10,180,000		$ 1,337,317	$ 1,339,945	$ 2,627

5 Conclusions and Recommendations

5.1 Conclusions

This OSD CPC project successfully demonstrated the use of two market-available technologies for rehabilitating failed corroded metal roofs: a high-build polyurea-hybrid membrane-producing coating and a structural standing-seam metal roof (SSSMR) system with integral sub-purlin system that can be fastened through a failed roof. The results confirm that the costs for removal of failed roofs can be deferred, and analysis indicates that this approach can contribute to a significant reduction in the life-cycle cost of roof rehabilitation. Disruptions of building operations during installations are also greatly minimized.

The setup and application of polyurea coatings proved to be more difficult than standard paint spray-on or brush-on coatings, requiring special application equipment and training. Polyurea is very sensitive to moisture and requires special mixing, handling, and storage controls. It is a very high-build, fast-cure, high-solids (90-100%) coating that uses or emits no solvents. The polyurea-hybrid coating should extend the service life of the roof for an estimated 10 years by providing a moisture-impermeable membrane that will effectively seal the surface defects such as pinholes and seam leaks.

It should be noted, however, that the top-surface coating will not affect any corrosion occurring from the underside of roof if attic spaces have persistent high humidity and high levels of aerosolized chlorides or other soluble minerals. Corrosion of the bottom side of the panels can be prevented using proper building moisture management practices. The coating's moisture-impermeability and vapor inhibitor characteristics should be considered as part of roof rehabilitation project design in highly corrosive environments.

The SSSMR re-cover demonstration has shown that use of the Roof Hugger sub-purlin system makes it feasible to install a new SSSMR over a structurally sound metal roof that has failed in terms of corrosion and water intrusion. With careful detailing at the eaves and curbs that account for the new, slightly elevated roof plane, the demonstration roof should pro-

vide similar service life to a complete roof replacement involving tear-off and waste disposal.

5.2 Recommendations

5.2.1 Applicability

The polyurea-hybrid material used for the coating demonstration has favorable material handling, application, and appearance qualities. In addition to the specific coating formulation used, there are other formulations in the polyurea family of coatings that could provide similarly desirable properties for use in roof repair and rehabilitation.

Polyurea coatings have properties that may be highly suitable for other applications. These properties include little or no solvent content, excellent chemical resistance, fast setup times, ability to cure in a wide range of temperatures, and good durability. Other potential uses to investigate include:

- spray-on liners of structures such as retaining walls and piers
- emergency spray-on liners over sandbags to prevent water penetration
- liners for chemical containments and buffering ponds walls
- in-place encapsulation of lead-based paint
- coating fiber-reinforced polymer and metal pipes
- coating high-wear interior areas such as gym floors.

For some applications, a single formulation probably would not meet worldwide performance requirements. A study would be needed to determine appropriate polyurea formulations that would best meet expected performance requirements for different corrosion severity zones and construction materials.

As an alternative to tearing off and replacing a deteriorated metal roofing system that is still structurally sound, DoD facility managers should consider re-covering using an SSSMR and retrofit sub-purlin framing system. Where extensive water intrusion has occurred, detailed inspection of the existing roof should be performed before committing to this approach. Roof coatings that reflect or readily dissipate solar heat should also be considered for any metal roof in continually warm climates where the budget permits.

In addition to the improvements and savings validated in this project, both demonstrated technologies can provide several other obvious benefits:

- reduction of material going to landfills
- significant reduction in safety risks on the work site through avoidance of the demolition and waste-handling phases of roof rehabilitation
- improved safety for crews working over in-place roof panels instead of exposed trusses and purlins
- avoidance of costs related to temporary relocation of activities or shut-down of operations during rehabilitation work
- reduction in total project work time.

5.2.2 Implementation

The following documents concerning maintenance and repair of roofing should be reviewed and modified to assist in the proper selection and use of these technologies whenever major rehabilitation of metal roofs becomes necessary:

- UFC 3-110-03, Roofing
- UFC 3-110-04, Roofing Maintenance and Repair
- UFC 3-320-03A, Structural Considerations for Metal Roofing
- UFC 3-330-02A, Commentary on Roofing Systems
- UFC 3-190-06, Protective Coatings and Paints
- UFC 4-030-01, Sustainable Development
- UFC 3-130-07, Buildings: Arctic and Subarctic Construction
- Whole Building Design Guide (WBDG) - Building Envelope Design Guide - Roofing Systems.

The DoD should fully evaluate the applicability of using polyurea in the widest applications possible. As polyurea coating technology is currently being used in industry, there are already industry standards for polyurea application, including:

- SSPC-Paint 39, T*wo-Component Aliphatic Polyurea Topcoat Fast or Moderate Drying, Performance-Based*
- Polyurea Development Association (PDA), *Polyurea/Geotextile Elastomeric Lining Systems*
- NACE RP0892-2001, *Coatings and Linings over Concrete for Chemical Immersion and Containment Services*

- NACE Technical Committee Report 6A198, *Introduction to Thick-Film Polyurethanes, Polyureas, and Blends*.

References

ASCE-7, *Minimum Design Loads for Buildings and Other Structures*, American Society of Civil Engineers, 01-Jan-2006 / 424 pages, ISBN: 0784408092.

ASTM D2244 - 11 Standard Practice for Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates

ASTM D522 Standard Test Methods for Mandrel Bend Test of Attached Organic Coatings, *Book of ASTM Standards*, vol 06.01 (ASTM).

ASTM D5894 - 10 Standard Practice for Cyclic Salt Fog/UV Exposure of Painted Metal, (Alternating Exposures in a Fog/Dry Cabinet and a UV/Condensation Cabinet)

ASTM D610 Standard Practice for Evaluating Degree of Rusting on Painted Steel Surfaces, *Book of ASTM Standards*, vol 06.02 (ASTM).

ASTM D714 Standard Test Method for Evaluating Degree of Blistering of Paints, *Book of ASTM Standards*, vol 06.01, (ASTM).

ASTM D1654 Standard Test Method for Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments, *Book of ASTM Standards*, vol 06.01, (ASTM).

ASTM D3359 Standard Test Methods for Measuring Adhesion by Tape Test, *Book of ASTM Standards*, vol 06.01, (ASTM).

ASTM D4214 Standard Test Methods for Evaluating the Degree of Chalking of Exterior Paint Films, *Book of ASTM Standards*, vol 06.01, (ASTM).

ASTM E1592 Standard Test Method for Structural Performance of Sheet Metal Roof and Siding Systems by Uniform Static Air Pressure Difference, *Book of ASTM Standards*, vol 04.11, (ASTM).

ASTM G154 Standard Practice for Operating Fluorescent Light Apparatus for UV Exposure of Nonmetallic Materials, *Book of ASTM Standards*, vol 14.04, (ASTM).

Bailey, David M., *Army Roof Management and Improvement Opportunities,* ERDC-CERL Special Report 99/62, ADA326781 (CERL, July 1999).Bailey, D. M., 2009.

Personal communication with Gary Y. Nip. February 2009, U.S. Army Corps of Engineers – Honolulu District, Fort Shafter HI.

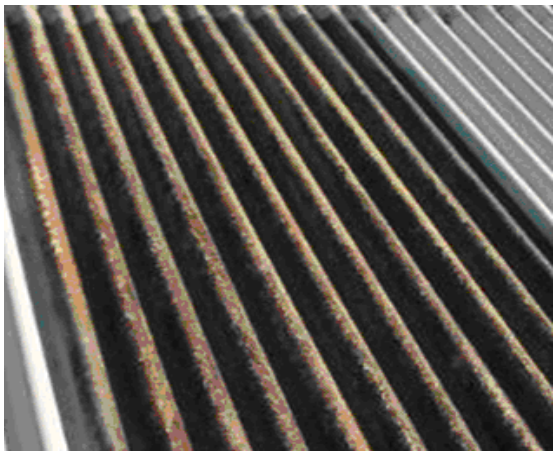
Cash, C. “The Relative Durability of Low-Slope Roofing”, Proceedings of the Fourth International Symposium on Roofing Technology, Gaithersburg, MD (1997), pp 119-124.

NACE RP0892-2001, Standard Recommended Practice - Coatings and Linings over Concrete for Chemical Immersion and Containment Services.

National Institute of Building Sciences (NIBS), Whole Building Design Guide, http://www.wbdg.org/design/074113.php.

General Standard: Polyurea / Geotextile Elastomeric Lining Systems. Kansas City, MO: Polyurea Development Association.

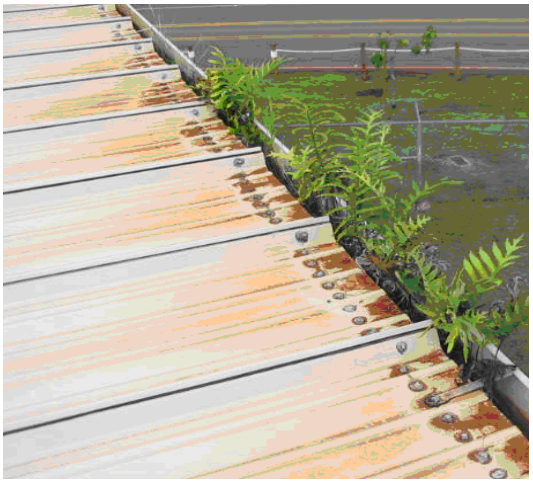
Figures



a. Metal roof showing general corrosion.

b. Badly corroded steel around exhaust stack

c. Severe corrosion around air vent.



d. Severely corroded hangar medal roof edges.

Figure 1. Typical metal roof details on buildings at Wheeler AAF, Honolulu, HI.

Figure 2. Existing roof on Building 118 prior to demonstration.

Figure 3. Barracks Building 118 and surroundings.

Figure 4. Plural component proportioner system.

Figure 5. Applicator training.

Figure 6. Spraying primer coat.

Figure 7. Spraying topcoat.

Figure 8. Top view of Building 118 roof after completion. An uneven high gloss was visible from the ground

Figure 9. Finished appearance of vent stack. – Note the patch and thicker coating applied over the metal roof lap

Figure 10. Roof of Building 835 before re-cover. Paint was peeling off in large sheets.

Figure 11. Pressure washed and rust-treated roof areas.

Figure 12. Pressure washing upper roof

Figure 13. Installed custom manufactured sub-purlin system designed to bridge underlying metal roof panel ribs..

Figure 14. Installation of fascia flashing.

Figure 15. Coil material fed to former.

Figure 16. Panel former.

Figure 17. Fabricated panels with pieces of rubber sheets protecting the PVDF finish.

Figure 18. Automatic seamer for rolling a 180° vertical rib of 22 gage metal roof panel.

Figure 19. Installation of vent flashing support purlins.

Figure 20. Sealant applied at clip locations to create a wet seal.

Figure 21. Demolition of lower roof above kitchen area.

Figure 22. Finished edge detail and wall flashing. (Note that there are no exposed fasteners in these cleated eave details.)

Figure 23. Finished detail work of fascia and gutter.

Figure 24. Building addition with asphalt shingles prior to metal roof installation.

Figure 25. Building addition with finished standing seam roof.

Figure 26. Exposure rack.

Figure 27. Topcoat being applied with overspray evident.

Figure 28. Example of appearance of topcoat overspray on a test coupon.

Figure 29. Gloss appearance of topcoating on test coupon.

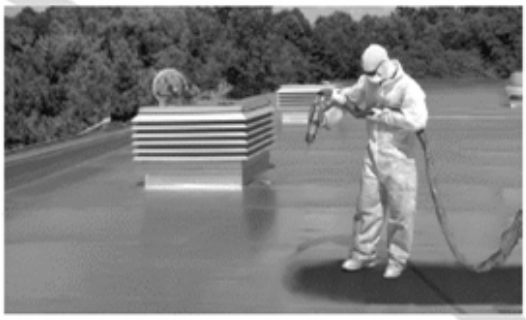
Figure 30. Distinct coating layers visible in cross section.

Figure 31. Mockup of fascia and gutter detail option considered by contractor.

Annex 1: Supplementary Information and Data for Polyurea Recoating Task

Appendix 1A: VFI™ Coating Manual

VOLATILEFREE INC
MANUFACTURERS OF HIGH PERFORMANCE POLYMERS



MAINTENANCE PROCEDURES GUIDE

For fluid applied membrane over foam or other roofing substrates

The adherence to these procedures will ensure the continued coverage of a Volatile Free, Inc. roof coatings warranty.

Be Informed About Your Roof System

■ Warranty or Guarantee?

Determine if your roof system has a *warranty* or *guarantee* and from whom. If it does, make sure your roof maintenance and inspection procedures conform to the manufacturer's warranty or guarantee specifications. If there are any questions about these requirements, contact the issuer of the warranty for clarification.

Generally, "acts of God", abuse, or vandalism are not covered by a roof system warranty. However, these occurrences may be covered by your building insurance policy. Check with your insurance carrier for claim information.

If damage occurs, notify the issuer of the warranty, the contractor and the manufacturer in writing. This procedure is usually outlined in the warranty.

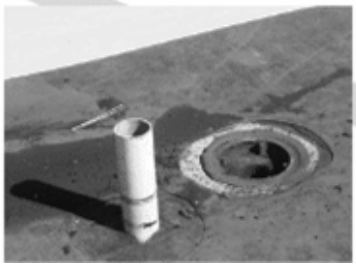
Periodic Roof Inspections

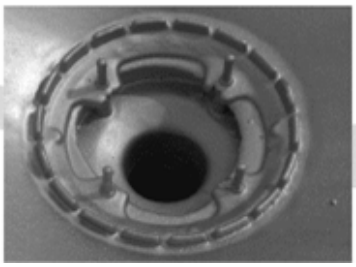
Inspections are highly recommended each spring and fall and after work is completed on a rooftop unit or penetrations such as vents and scuppers. A Roof Maintenance Inspection Checklist should be used to assist in the inspection procedure. An inspection checklist is located in the back of this guide for your use. This will help to ensure a complete and thorough inspection. Notes and photos should be taken and a sketch completed illustrating areas of concern. Reports of prior inspections should be reviewed before every roof inspection.

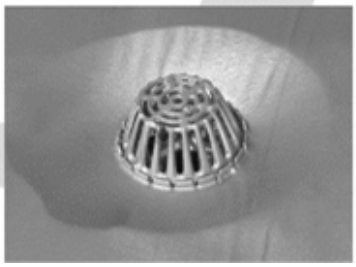
What To Inspect

■ Gutters, Scuppers & Drains

Inspect all gutters, scuppers and drains for twigs, leaves, dirt and debris. They can cause damage, and restrict or plug normal flow, preventing positive drainage. Check the screens, strainers, fasteners and seals to assure that there is no leakage.







Preventative Maintenance *(cont)*

■ Repair Of Small Punctures And Holes

- Repair small damaged areas with a urethane caulk according to the following steps:
- Thoroughly clean the roof surface around the damaged area. Remove all dirt, dust or other contaminates with a rag and clean water or solvent. Allow to dry completely.
- Use a knife to carefully cut out (at a 45° angle) any loose, wet or damaged foam and/or coating and leave a clean beveled depression in the system.
- Apply urethane caulk into the hole so that the caulk overfills the hole. Feather and smooth the edges. This will insure that the final surface is higher than the surrounding area so that water will not pond in the repaired area.

  Two coats of VFI-550 should be applied over the top of the cured caulk to complete repair

■ Repair Of Cracks Or Splits

- Trim away dirty and wet material from the crack with a knife so that a V-shaped groove is formed and extends beyond the edges of the original crack.
- Thoroughly clean and dry the area surrounding the crack.
- Prime inside of the V-shaped groove and two inches beyond the edges of the V-shaped groove with VFI-1007 Primer.
- After the primer is dry, apply urethane caulk inside of the groove so that the V-shaped groove is overfilled.
- Trim and feather the edges of the urethane caulk.
- Brush on two 25 mil coats of VFI-550 onto and beyond the edges of the urethane caulk to complete the repair.

  (Note: Cracks at the edge of a metal flashing and the roofing system should be trimmed back from the metal to form a ½ inch V-shaped groove. The metal must be cleaned thoroughly and dried.)

■ Repair Of Seams On Flashings And Metal Coping

- Thoroughly clean and prime the metal in preparation for coating.
- Center a bead of urethane caulk over the seam. Insert a 3/8 inch backer rod on top of the urethane caulk and imbed the backer rod slightly into the urethane caulk.
- Center the butyl tape over the backer rod so that it extends equally on both sides of the seam.
- Brush 25 mil coats of VFI-550 onto and beyond the edges of the butyl tape to complete the repair.

■ Repair Of Small Blisters

Although blisters are sometimes not aesthetically pleasing, they should not be removed and/or repaired unless it appears that they will adversely affect the water resistance of the sprayed polyurethane foam system. This also applies to blisters in built-up and single-ply membrane system.

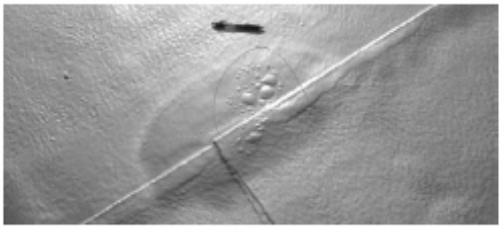
The unnecessary repair of blisters in a sprayed polyurethane foam roofing system can lead to leaks and premature roof problems.

Blisters that are likely to become leaks in the future must be repaired in the recommended manner.

- Blisters in the coating and/or foam system should not be broken or cut into until beginning the repair procedure.
- Blisters that are an inch in diameter or smaller, and less than 1" deep, can be repaired without contacting the original contractor. Larger blisters should always be repaired by a professional contractor.
- No repair procedure should be attempted on a degraded or moist surface. Dry the surface and remove the degraded area before repairing it.
- Cut out and remove all loose material from the blister and create an edge free from defects. Bevel the cut at 45° angle sloping inward.
- Fill the void with urethane caulk material. Overfill the void above the roof level and two to three inches beyond its edge. Feather the edge of the caulk and let it cure.
- Apply two 25-mil coats of VFI-550, overlapping beyond the repaired area.

■ Repair Of Large Blisters

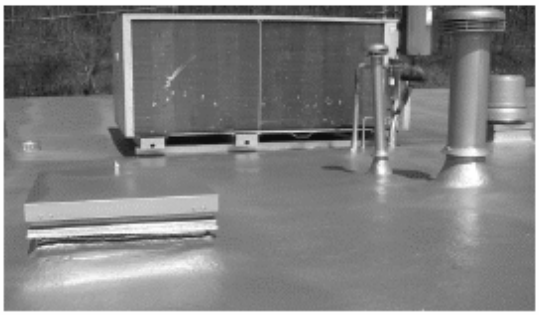
Although a blister may be fairly large, it should be repaired only when it appears that it is ruptured, or foot traffic might cause it to rupture in the future. In this case, contact the system contractor. The contractor will make the repair using foam with the same density and compressive strength as was used in the original roof system. The foam must then be coated with two 25-mil coats of VFI-550.



■ Possible Sources Of Leaks

- It is important to determine the frequency and location of the leak.
- Regarding metal decks, the direction of the roof's flute and slope are important in determining a leaks origin. Water flows to its lowest point, therefore you must backtrack the moisture path to find the leak.
- Condensation may be the cause of moisture dripping in poorly insulated roofing assemblies.
- On roofs where the existing roofing material was left in place, some minor leaks might be the result of moisture entrapment at the time of the installation.
- Inspect the roof penetrations, drains, expansion joints, pipes, flashings, etc. to locate cuts, punctures or damaged field splices.

What To Inspect *(cont)*

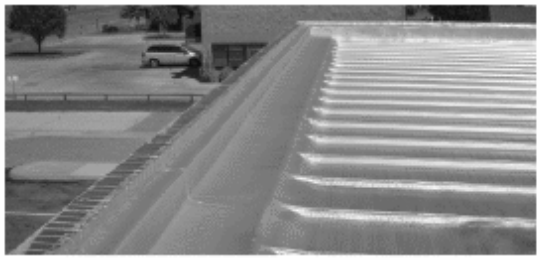


■ Rooftop Units And Penetrations

Inspect rooftop penetrations for seals that might have been broken during maintenance procedures. Reseal any broken seals with coating. The higher the coating is applied up the base of the protrusion, the less chance that water will leak into the roof system. Hatches and skylights must be sealed from the weather. Insure that stacks have rain caps and their seams are thoroughly caulked. The drains on HVAC must be piped to the nearest drain. Inspect the coating around all these areas to insure there is no damage to the surrounding roof system.

■ Inspect Flashings, Roof Edges, Expansion and Control Joints and Other Roof System Terminations

Look for cracks and splits in the roofing system in these areas. Thoroughly inspect metal flashing and coping joints to insure that they are sealed effectively. Masonry walls should be checked for moisture penetration, deterioration or delaminating of the coating.



■ Inspect the Surface Area or the Field of the Roof System

Check for blisters and interlayer separation in the roof system. Check for physical and mechanical damage caused by tools, hail, vandalism, and excessive foot traffic, etc.

■ Defects in the Roof Surface

Check for coating erosion, pinholes and cracks. If there is foam, or built up roofing system under the coating, check for moisture in this area. You can do this by cutting a small V in the roofing system, inspecting it and then patching the v-cut, or by using a nondestructive moisture meter.

When To Call Your Contractor

Before ANY roof alterations are made, call your contractor for alteration details.

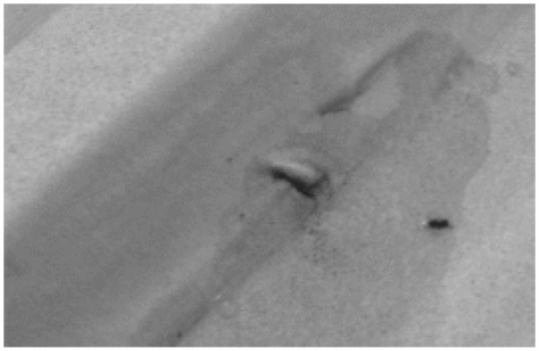
If large blisters or leaks or other defects are noted, the installing contractor should be contacted. The defects might be covered in the warranty. Contact the company that issued the warranty in writing and inform them of the defect.

At some point, the system may require rejuvenation or renewal. Contact your original contractor for an inspection.

The contractor can set up a Maintenance Program with periodic inspections.

If there are any questions concerning the system, contact your contractor. If the concerns are not adequately addressed, contact the system manufacturer.

Preventative Maintenance

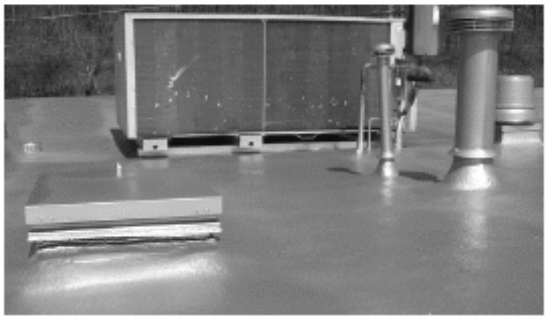


Roofs should not be used for storage of HVAC repair parts, lumber, signs or unnecessary equipment.

Limit foot traffic as much as possible. Maintenance personnel should be the only foot traffic on the roof. Walkways should be installed to protect the roof if regular foot traffic occurs.

Prevent damage to the roof system from exposure to harmful chemicals or substances, such as, but not limited to, petroleum based products, solvent, kitchen wastes and products that promote rapid decomposition or deterioration. Vents should not exhaust harmful materials onto the roof surface. Pipes should not lie directly on the coating.

What To Inspect *(cont)*



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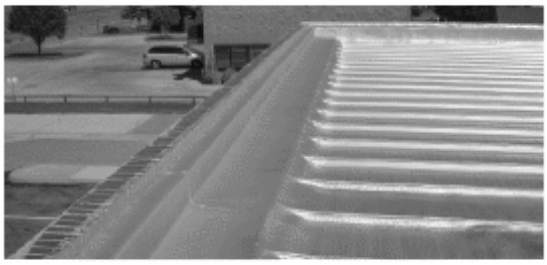

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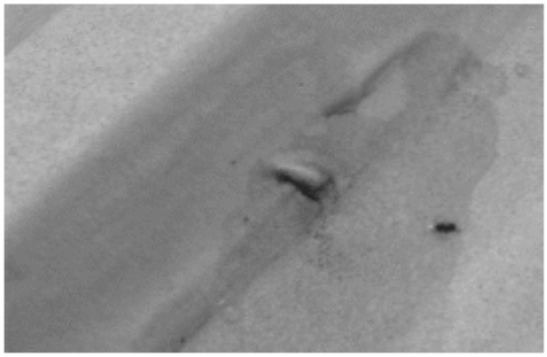

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Limit foot traffic as much as possible. Maintenance personnel should be the only foot traffic on the roof. Walkways should be installed to protect the roof if regular foot traffic occurs.

Prevent damage to the roof system from exposure to harmful chemicals or substances, such as, but not limited to, petroleum based products, solvent, kitchen wastes and products that promote rapid decomposition or deterioration. Vents should not exhaust harmful materials onto the roof surface. Pipes should not lie directly on the coating.

SEMI-ANNUAL MAINTENANCE INSPECTION CHECKLIST

ROOFING SYSTEM SUBSTRATE:_____ APPLICATOR:_____

BUILDING:_____ ROOF SECTION:_____

INSPECTED BY:_____ COMPLETION DATE:_____

WARRANTY TERM:_____ INSPECTION DATE:_____

	PROBLEM			REPAIRS	
	YES	NO	OBSERVATIONS	O/A*	DATE
I. ROOF CONDITION					
A. GENERAL					
Debris					
Walkways					
Substrate					
Contaminants					
Leaks					
B. DRAINAGE					
Roof Drains					
Scuppers					
Gutters					
Downspouts					
Ponding					
C. FOAM COVERINGS					
Bare Spots					
Exposed Foam					
Blisters					
Adhesion					
Cracks					
Pinholes					
Mechanical Damage					
D. FOAM					
Blisters					
Cracks					
Mechanical Damage					
Bird Damage					
Storm Damage					
Soft & Spongy					
Wet					
II. FLASHING					
Base Flashing					
Counter Flashing					
Coping					
Gravel Stop/Fascia					
III. PENETRATION					
Pipes					
A/C Units					
Vents					
Skylights					
Expansion Joints					
Ducts					
Walls					

*Indicate who performed repairs ("O" for Owner or "A" for Applicator/Contractor)

Use the following symbols when preparing a roof sketch:

P>	Photographs	EX	Excessive Ponding	UC	Uncurred Coatings	CC	Coating Cracks
O	Roof Drains	P	Pinholes	DT	Flashing or Edge Treatment Defect	E	Exposed Foam
X	Mechanical Drainage	S#	Slit Number			OS	Overspray
FB	SPF blister	TC	Thin Coating	FC	SPF Cracks	OF	Off Ration SPF
CB	Coating Blister	FT	Rough Foam Texture				

COMMENTS:

_____

_____

_____

_____

Corporate Office: P.O. Box 344 / Brookfield, WI 53008 / 800-307-9218 / 262-787-0400 / Fax: 262-787-0500 / www.volatilefree.com

Appendix 1B: VFI™ Polyurea-Hybrid Test Coating Information

VOLATILEFREE INC
MANUFACTURERS OF HIGH PERFORMANCE POLYMERS

Data Sheet
VFI-11

Two Component Water Based Epoxy Primer

Description
VFI #11 Primer is a two component, water based epoxy.

Usage
A general purpose primer which may also be used as a masonry block filler. It adheres well to most metals, organic polymers, wood, masonry and vitreous surfaces. Do not use on copper or silver. Usage in the food processing industry is approved for contact with dry food products. VFI #11 Primer meets the requirements of the U.S. Department of Agriculture for incidental contact with meat and poultry products.

Color
Standard color is salmon.

Consistency
Part A is a slightly viscous liquid. Part B is a liquid. When combined, the resulting product becomes a thixotropic primer.

Physical Properties

Weatherability
Chalk resistance is poor. Durability without top coat is only fair.

Chemical Resistance
Excellent alkali resistance. Good solvent and fair acid resistance.

Hardness
Cures to form a hard lusterless coating material. However, approximately 7 days at 60°F to 80°F is required to achieve maximum hardness.

Water Vapor Permeability
Cures to form a solvent and vapor resistant film.

Flammability
Part A is Non-flammable. Part B is a combustible liquid.

Toxicity
Part B contains a polyamide resin which is non-sensitizing, however, care should be taken to thoroughly clean with soap and water any skin areas that are contacted by VFI #11 Primer.

Undiluted vinegar is very effective in neutralizing coating that contacts the skin. If the coating should get in the eye, flush with water and call a physician. Use a particulate matter respirator to avoid inhalation of paint when spraying.

Adhesion
Excellent adhesion to most surfaces. Most coating materials have excellent adhesion to VFI #11 Primer. To much primer will reduce adhesion.

Liquid Component Properties

Coverage
Applied to a smooth surface, the coverage rate is 350 to 400 square feet per gallon. See specification for other applications.

Solids
Weight: 60.0%
Volume: 42.5%

Flash Point
Above 212°F T.O.C. for the mixed product and for the Part A side. Flash point for the Part B side is above 110°F.

Air Pollution Control
The volatile organic solvent content is 80 grams per liter (high flash, aromatic solvent contained in Part B).

Storage Stability
One year. Protect from freezing in shipment and storage.

Application

Thinning

Thin with water. Clean up with water supplemented with soap or a small quantity of vinegar. Methyl Ethyl Ketone is recommended for both cleaning and drying spray equipment in order to avoid corrosion.

Mixing Instructions

The two components are prepackaged in the correct proportions (9 parts by volume of Part A to 1 part of Part B). For a five gallon kit, 4.50 gallons of epoxy emulsion supplied in a 5 gallon can and 0.5 gallons of polyamide resin is supplied in a ½ gallon can. For a one gallon kit, 0.90 gallons of epoxy is supplied in a 1 gallon can and 0.1 gallons of polyamide resin is supplied in a pint container. The mixing ratio by volume is 9 parts of epoxy to 1 part of curing agent. By weight, the mixing ratio is 14 to 1. After combining, mix thoroughly. Power mixing is recommended for quantities over 1 gallon.

Pot Life

The pot life is 4 hours at 75°F. This can be extended to 6 hours by thinning with water to achieve the original consistency. Pot life at 55°F is doubled, but at 100°F it is reduced to 90 minutes.

Primer Application

Use long nap (3/4" to 1") rollers when VFI #11 Primer is used as a block filler for porous concrete. If blowholes form as the primer dries, make a second pass with a relatively dry roller. Allow 8 to 10 minutes between passes. For application to smooth surfaces, add up to one pint of water per gallon of VFI #11 Primer. Use a 1/4" or 3/8" nap roller or nylon brush. VFI #11 can be sprayed using conventional equipment, but the applicator must take precautions against inhalation of particulate matter. Use of a proper respirator is necessary. Do not apply to surfaces, which are below 50°F or above 130°F unless special instructions are secured from Volatile Free, Inc.

Application Of Top Coats

Most coatings can be applied over VFI #11 Primer as soon as it is thoroughly set. This degree of dryness is normally achieved in two to three hours. Best adhesion of most coatings are achieved when applied to #11 Primer that has cured 1 to 3 days. All Volatile Free, Inc. elastomers and most commercial paints will adhere well to cured VFI #11. It is recommended practice to keep recoat times below 7 days. Primer cured over 7 days should be cleaned and re-primed prior to top coating.

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VOLATILEFREE INC
MANUFACTURERS OF HIGH PERFORMANCE POLYMERS

Data Sheet
VFI-535 COPPER

POLYUREA HYBRID ROOFING ELASTOMER

Description
VFI-535 is a 100% solids by volume, two component one-to-one by volume polyurea hybrid coating.

Usage
VFI-535 Copper is intended for use as a spray applied protective roof coating for use over concrete, metal, polyurethane foam and smooth built-up roofs. VFI-535 Copper should not be used directly over rough built-up roofs unless polyurethane foam is used to create a smooth surface. VFI-535 Copper can also be used over various single-ply membranes. Contact Volatile Free, Inc. for more information.

Color
Red tone copper. Note: Copper color is dispersed in the isocyanate component.

Physical Properties

Weatherability
Excellent.

Chemical Resistance
Good salt and solvent resistance. Fair resistance to acid and alkali.

Tensile
ASTM D-412

Strength:	1800 psi min.
Elongation:	500% min.
Permanent Set:	10% max.

Hardness
ASTM D-676

Shore A	60 ± 3

Tear Resistance
ASTM D-624

Die C	250 pli

Abrasion resistance
Excellent

Water Vapor Permeability
ASTM E-96

Method BW	0.025 perm In.

Liquid Component Properties

Solids

Weight:	100%
Volume:	100%

Viscosity
Poly Component:
550 ± 75 cps @ 77°F
Iso Component:
1500 ± 100 cps @ 77°F

Density
Poly Component:
8.33 lbs./gal. (S.G. 1.00)
Iso Component:
10.00 lbs/gal. (S.G. 1.20)

V. O. C
Contains no Volatile Organic Compounds.

Flash Point
ASTM D-56 (TCC)
Greater than 200°F.

Toxicity
Iso component contains polymeric isocyanate requiring fresh air supply respirator, gloves, and protective clothing during application.

Storage

Warning
VFI-535 Copper is sensitive to moisture. Store in a dry place between 45° and 85°F. Shelf life is six months for the "A" Side (ISO) and one year for the "B" Side (POLY) in original unopened containers. All containers must be sealed when not in use.

Containers that have been opened should be used within one week. To prolong the shelf life of opened containers, it is recommended that a blanket of nitrogen be applied to the container or desiccant cartridge inserted into the container opening.

Storage When High Humidity Is Present

Upon opening of the "A" Side, one of the two following procedures must be followed:

Desiccant Cartridge

Upon opening of the "A" Side for use, a desiccant cartridge should be inserted into one of the bung openings and the transfer pump tightly sealed in the other. To store unused portion of material, remove transfer pump and reseal drum plug. Leave desiccant cartridge in the drum during storage.

When contents of the drum have been used, the desiccant cartridge can be used on another drum. You can continue to transfer the cartridge from drum to drum until the color indicates replacement.

Nitrogen Blanket

Nitrogen being heavier than air, can be put into a partially filled drum of the "A" Side forming a protective layer which will prevent any moisture from reaching the material in the drum. It takes only a small quantity of the nitrogen to form this layer and it will not mix with or contaminate the Iso.

Application

Mixing

Care should be taken to ensure proper mixing of VFI-535 Copper. Drums must be power mixed. Mix all "A" Side (ISO) drums with a 1½ horsepower air driven mixer for a minimum of 15 minutes on the day it will be applied. The shaft must have collapsible blades to fit through the bung opening in the drum and should be long enough to reach the bottom of the drum. Three or four drums of the "A" Side (ISO) can be mixed in an hour when you start up in the morning. The ultra violet protection in VFI-535 Copper coating is copper pigment. The copper pigment settles to the bottom of the drum during shipment and storage. Therefore, the "A" Side (ISO) drum has to be thoroughly mixed before spraying; otherwise the copper pigment will be left on the bottom of the drum. Product sprayed with copper pigment still on the bottom of the drum will not perform as designed and the coating will not last as long. The coating finish may also appear streaky if all drums are not mixed properly.

Thinning

Do not thin.

Equipment

Plural component spray equipment capable of maintaining a constant temperature of 130° - 160°F, 2500 psi minimum pressure and a 1:1 volume mix ratio. It is recommended that only a Probler gun with a #1 or #2 tip be used for spraying. The Probler gun offers ease of application along with the best spray pattern. Through testing, it has been determined that installation at the proper temperature of 130° to 150°F, 2500 psi minimum pressure at the Probler gun utilizing a #1 mixing chamber, will produce the optimum membrane. Any deviations from this whether it may be temperature, pressure, size, type of gun, will all contribute to the production of a lesser product than the physicals stated on the V.F.I. Product Data Sheet. In other words, a #2 or #3 mixing chamber, may give you a wider spray pattern and apply more uniformly, but not have the same physical properties that are achieved with a #1 chamber.

A gap gun or a GX-7 gun will produce a cured membrane but will not achieve the finished film that is specified by Volatile Free, Inc. Therefore, if a ten year full systems warranty is required from V.F.I., you must use a Probler gun.

Reactivity

Tack free time is 10-30 seconds when sprayed with hot plural component airless spray equipment.

Cure Time

Applied coating will set in 2-10 minutes at 70°F, depending on the film thickness and substrate temperature. Product can be placed into service after four hours of cure time at 70°F minimum.

Surface Preparation

Please refer to V.F.I. Roofing Specifications relating to your particular project.

Surface Preparation for Asphalt Contamination

Material applied over thick uncured asphalt will cause bleed through and possible delamination. We even find "black jack" type products on metal roofs, where repairs were attempted around stacks, units and even on seams and fasteners to be a problem. Whether the asphalt is totally cured or not has to be the contractor's determination, NOT Volatile Free, Inc.'s. If the asphalt product is old, hard and totally cured out, there is no problem going right over it with VFI-535 Copper. If the asphalt is soft and you can move it with your finger, it is not totally cured. This means that there still might be oil present that could leach out and cause discoloration and/or delamination. If the asphalt is not too thick and you see no signs of oil, we have found it extremely helpful to coat those areas with 1 to 1½ gallons per 100 sq. ft. of our VFI-550 Aluminum Single Component Moisture Cured Urethane. Let the VFI-550 Aluminum cure and then recoat with VFI-535 Copper. This forms a barrier between the asphalt and VFI-535 Copper. If the asphalt is too thick or uncured, it must be removed.

Corporate Office: P.O. Box 344 / Brookfield, WI 53008 / 800-307-9218 / 262-787-0400 / Fax: 262-787-0500

Appendix 1C: Contractor Health, Accident Prevention, and Safety Plans

JOB SITE HAZARD ANALYS & ACCIDENT PREVENTION

Job Number: **07-132** | Job Name: **Wheeler AAF Bldg. 118** | Estimated Start Date:

Rehabilitation of Metal Roof

Mark X If To Be Utilized	PRINCIPAL TASKS	IDENTIFIED HAZARDS	RECOMMENDED CONTROLS
	1. Sanding,scraping and concrete chipping	1. Objects in eye-inhaling silica dust- cuts	1. Wear protective goggles- respirators with HEPA filters-wear leather gloves
	2. Prep of lead paint surfaces	2. Inhalation of hazardous airborne particles	2. Wear HEPA filter respirators, contain debris and remove with HEPA vac
	3. Mildew Removal	3. Skin/eye hazard - electrical shock	3. Wear goggles - use respirators - rubber gloves with Clorox - avoid power lines
X	4. Protecting other surfaces	4. Tripping on dropcloths	4. Keep dropcloths spread out evenly and keep walkway areas clean and free of tools or debris
X	5. Painting	5. Inhalation of fumes	5. Wear respirators when spray painting, painting with toxic products or when ventilation is poor
X	6. Working Above	6. Injury from falling debris	6. Working platform enclosed with mesh - Hardhats to be worn by employees working below
	7. Working from Suspended Scaffolding	7. Falling - Electrical Shock	7. Cable tiebacks-Safety lines, lanyards, harnesses- keep cables clear of power lines
X	8. Working on ladders	8. Missing a step, falling - electrical shock	8. Stabilize ladder-Step carefully up & down-do not use around power lines-no step on top 2 rungs
	9. Working on Frame Scaffolding	9. Injury from falling and from falling debris	9. Work platform to be fully planked - Do not tie off to scaffold frame - Use ladder access only
X	10 Working from boom or manlift bucket	10 Injury from falling or electrical shock	10 Attach lanyard to work platform rail - machine on level ground - care around power lines
	11 Working on rolling stage scaffolds	11 Injury from falling or electrical shock	11 Locked wheels-guardrails-Ht not over 4x width-do not use around power lines
X	12 Spray Painting	12 inhalation of fumes - skin injection	12 Use respirator, eye & skin protection - Shut down equipment before changing or adjusting tips
X	13 Water Blasting	13 Injection through skin - electrical shock	13 Shut down equip before touching tips-always point wand safely- no spray at power lines
X	14 Working around gasoline equipment	14 Chemical burns and fire	14 Equipment off before fueling - approved gas containers - fire extinguishers - No smoking
X	15 Working around loud equipment	15 Hearing Loss	15 Muffle sound if feasible - Wear ear protection - Allow only 4 hour exposure per day
X	16 Working Outside in Sun	16 Skin Cancer	16 Wear long pants and long sleeve shirts, sunscreen, hats, UV protection sun glasses
	17		
	18		
	19		
	20		
	21		
	22		
	23		
	24		

EQUIPMENT TO BE USED	INSPECTION REQUIREMENTS	NOTES
1. Ladders	1. All ladders to be inspected before use	1. If ladders are broken, tag "Do Not Use" and return to shop for repair or destroy
2. Gasoline powered equipment	2. Inspect daily for gas leaks and no loose parts	2. If equipment leaks or is otherwise in need of repair, tag "Do Not Use" and return to shop
3. Air and Electric powered tools	3. Tools and equipment inspected daily	3. If equipment is broken or not working properly, tag "Do Not Use" and turn in for repair
4. Electric Extension cords	4. Inspect for cuts and ground plug	4. If cut or if end is loose tag "Do Not Use" and return to shop for repair or destroy
5. Vehicles	5. Check tires and look for leaks - secure load	5. Service vehicle before driving to jobsite or returning to shop - Tag if cannot fix
6. Scaffolding and lifelines	6. Check rigging and lifelines daily	6. If ropes or cables are frayed, replace before use. Tag "Do Not Use" if questionable
7. HEPA vacuum	7. Be sure it is emptied safely and in good condition	7. Test vac for a good seal - tag and return if not working properly-replace before working

Job Foreman Sign and Date _____

Report discussed with work site employees on _____

Superintendent or Safety Officer

ACCIDENT PREVENTION PLAN

Rehabilitation of Metal Roof.

Wheeler AAF Building 118

Schofield, HI

CDI #07-132

Prepared by:

COLOR DYNAMICS, INC.
816 Gulick Avenue
Honolulu, Hawaii 96819
Ph: (808) 848-7000
Fax: (808) 842-0800

SAFETY SHALL BE OF THE UTMOST IMPORTANCE IN THE DAILY OPERATIONS OF COLOR DYNAMICS, INC. ALL PERSONNEL HAVE THE RESPONSIBILITY TO MAKE THE SAFETY OF THEMSELVES, AND CO-WORKERS, OF PARAMOUNT CONCERN AND ACTION. THIS OBJECTIVE IS FUNDAMENTAL TO THE WELL BEING OF ALL PERSONNEL ON THE PROJECT AS WELL AS TO THE EFFICIENT OPERATION OF OUR BUSINESS. SAFETY SAVES BOTH LIVES AND MONEY AND PLAYS A MAJOR ROLE IN THE SUCCESSFUL COMPLETION OF CONTRACTING ACTIVITIES.

ACCIDENT PREVENTION PLAN

SIGNATURE SHEET

Plan Prepared By:

Company: Color Dynamics, Inc. Name: Joyce Racadio
Phone: (808) 848-7000 Title: Contract Administrator
Fax: (808) 842-0800

COLOR DYNAMICS, INC.
This Accident Prevention Plan has been prepared by:

Signature: _____
Joyce Racadio, Contract Administrator

Plan Approval By:

Company: Color Dynamics, Inc. Name: Brent Cullinan
Phone: (808) 848-7000 Title: Vice President
Fax: (808) 842-0800 Cellular: (808) 479-0349

COLOR DYNAMICS, INC.
This Accident Prevention Plan has been reviewed and approved by:

Signature: _____
Brent Cullinan, Vice President

Plan Concurrence By:

Company: Color Dynamics, Inc. Name: Brent Cullinan
Phone: (808) 848-7000 Title: Gen. Superintendent,
Fax: (808) 842-0800 Safety Officer
Cellular: (808) 479-0349

COLOR DYNAMICS, INC.
This Accident Prevention Plan has been reviewed and approved by:

Signature: _____
Brent Cullinan, General Superintendent, Safety Officer

PROJECT FOREMAN

Company: Color Dynamics, Inc. Name:
Phone: (808) 848-7000 Title: Foreman
Fax: (808) 842-0800

COLOR DYNAMICS, INC.
This Accident Prevention Plan has been reviewed and approved by:

Signature: _____

ACCIDENT PREVENTION PLAN
Wheeler AAF Building 118
Rehabilitation of Metal Roof

JOB NO.: 07-132

EMERGENCY RESPONSE NUMBERS

- **FIRE – POLICE - AMBULANCE CALL 911**

FIRST AID INJURIES:

Kaiser On-The-Job	
PENSACOLA – 1010 Pensacola St., 2nd floor	432-2000
Moanalua Clinic 3288 Moanalua Rd, 2nd floor	432-8200
Windward – Koolau Clinic, 45-605 Kam Hwy	432-3880
Waipio Clinic 94-1480 Moaniani St. 1st Floor	432-3103

SERIOUS OR LIFE-THREATNING INJURY OR ILLNESS:

Queens Medical Center	538-9011
St. Francis Medical Center West	678-7000
Kuakini Medical Center	536-2236
Kapiolani Medical Center (24 hr. emergency)	983-8633
Straub Medical Center	522-4000
Poison Center	941-4411
The Gas Company (trouble only)	526-0066
Hawaiian Electric (trouble only)	548-7961
Board of Water Supply (trouble only)	527-5200
Military Police	438-7105
Chemical / Oil Spills	586-4249

RESPONSIBILITIES AND LINES OF AUTHORITIES

Identification and Accountability of Personnel:

Color Dynamics, Inc. has appointed Brent Cullinan Safety Manager, under the direct supervision of David L. Onerheim, President and Safety Director, to be accountable to monitor and enforce the policies and procedures as set forth in this Accident Prevention Plan.

Lines of Authority:

The following listed Color Dynamics, Inc. personnel shall have the authority to intervene and suspend work in the interest of safety policy compliance:

1. David L. Onerheim, President and Safety Director
2. Brent Cullinan, Vice-President, Safety Officer and General Superintendent
3. , Project Foreman

GAS CHARGE CARDS

Our policy is to temporarily issue gas card to selected employees. Gas must be purchased at the Kalihi Aloha Gas station only. Charges at other locations are prohibited except for emergency. Gas charges are authorized only for company vehicles and for gas cans filled for jobsite equipment.

When the charge is initiated at the pump, the vehicle mileage must be input. When the receipt prints out, the description of the vehicle or license number must be noted on the receipt.

If cans are being filled for use with jobsite equipment, the code number must be input. Then when the receipt prints out, the job name/number and the description of gas operated equipment should be written on it before turning it in to the office.

Abuse of the charge cards will result in suspension of the card and a return to the old "pay and submit for reimbursement" system.

PERSONAL HAND TOOLS

There are certain tools that Employees are required to possess as a condition of employment with Color Dynamics. These tools are to be maintained in proper working condition by each Employee. Failure to keep the required minimum tools in good condition may result in suspension from work. Periodic inspection of these tools by Foreman, Superintendent or Employer may be expected. The list of tools required (see attached) may be changed from time to time as Management deems necessary.

The purchase of personal tools by charging CDI's account at a vendor's store without authorization from David or Brent will result in an employee payroll deduction to reimburse Color Dynamics for the cost of the tool(s). If a payroll deductions is necessary you will be informed in advance and the detail shown on your check stub.

COLOR DYNAMICS, INC.

FIELD PERSONNEL

POLICY MANUAL

Revised

October 27, 2005

816 Gulick Avenue ~ Honolulu, HI 96819 ~ Tel: (808) 848-7000 ~ Fax: (808) 842-0800 ~ BC #11207

Color Dynamics, Inc. is a General Contracting firm primarily engaged in painting, waterproofing and concrete restoration work in both private and public sectors. Contracts are typically to repair concrete, waterproof and/or coat exterior of high rise and commercial buildings, metal and concrete roof tops, parking and pedestrian decks, military facilities and family housing repainting.

Color Dynamics is an Equal Opportunity Employer and will not discriminate against an Employee or an Applicant for employment because of race, color, religion, creed, age, sex, and national origin or ancestry.

The guidelines within this policy have been prepared for the convenience of Employees. It contains general descriptions of some of Color Dynamics procedures and/or policies. Neither this booklet nor any other communication by any management representative, either written or oral, made at the time of hire or during the course of employment, is intended in any way to create an "employment contract". Our relationship is one of voluntary employment "at will" of the Company. Employees are subject to discharge at any time, with or without cause.

Management reserves the right to add to, alter and/or eliminate the following procedures, benefits and/or policies at any time.

Your cooperation in assisting with the implementation of this policy is requested.

POLICIES PERTINENT TO ALL JOB CATEGORIES

Equal Employment Opportunity (EEO) and non-segregated facilities are general policy, regardless of the job category and/or term of employment.

Alleged violations or misadministration of this policy should be reported immediately to the Corporate President, David Onerheim, or to appointed EEO Officer. We ask that Employees help recruit minorities and females into the Company work force by encouraging them to apply.

Claims of sexual or racial harassments should be reported immediately in writing to the Corporate President, David Onerheim and delivered to Office Administrator. A confidential interview will then be scheduled to discuss the appropriate measures to be taken. Harassment will not be tolerated under any circumstances.

PERSONAL DATA

Because we engage in Government contracts, we are required to furnish certain personal data to the government contract agencies and installations in order to comply with contractual requirements. This data includes: date of birth, birthplace, citizenship and vehicle information.

You are required to promptly report any changes in your name, residence, marital status, dependents, vehicle information, etc. It is also very important that we have the names and current phone numbers of persons we should contact in case of emergency.

HOLIDAYS

Color Dynamics will observe the following eight (8) holidays:

New Years Day	Memorial Day
4th of July	Labor Day
Veteran's Day	Thanksgiving Day
Christmas Eve	Christmas Day

When these holidays occur on a weekday, Employees need not report to work. These holidays are not paid holidays. Field Employees are paid only for time actually worked on Color Dynamics projects.

REPORTED WORK HOURS

Recorded work hours begin when production work commences. Only time spent on production work should be recorded on the time cards. Time spent for transportation to and from work and during lunch break is not paid time. When work is delayed due to rain or wind conditions the time of delay is not paid time. If the job is shut down early due to inclement weather, then paid time ends when production stops during the day. When no work can be accomplished in a day because of inclement weather or any other reason, there will be no paid time on that day. Evening or early morning phone contact with job foreman can sometimes prevent unnecessary travel to a jobsite when work has been called off.

Setting up scaffolding and equipment for work or mixing of materials etc. is considered production time and will be paid for. This time should be reported on the time cards in the appropriate category.

Each work day, the Employee should check to make sure his/her time recorded on the time sheet matches the Employee's time recorded on the Foreman's log. If it does not, then the discrepancy should be discussed and resolved on site immediately. If it cannot be resolved then the disputed time should be brought up to Brent, the General Superintendent or to David Onerheim, President, for a final decision on the matter.

ASSIGNMENT OF EMPLOYEES TO PROJECTS

Employees may be transferred between Public and Private Projects if it is determined by Employer or Superintendent that it is in the Company's best interest to do so. Transfers of Employees may be made without prior notice and may result in changes in pay scale and/or fringe benefits. Employees will not be paid less than their "private sector base rate" regardless of where they work.

FRINGE BENEFITS

MEDICAL: Employees are invited to join HMSA. Color Dynamics will pay the monthly medical premium on Single Plan Coverage only. As an option, additional family members may be covered at Employee's expense through payroll deduction. Any new employee who opts not to join HMSA or any Employee who decides to drop HMSA coverage must fill out and sign a waiver form.

401K: Employees are invited to participate in Color Dynamics' 401K retirement plan. Qualifying contributions made by employees are tax deferred.

PROFIT SHARING: The Company may elect, in certain years, to share a portion of profits with qualified employees. These contributions would be placed into the Employee's account within Color Dynamics' qualified plan. The amounts, if any, to be distributed would be determined sometime between the July 31 fiscal year end and December 31, however the contributions may not be placed into the accounts until April 15 of the following year.

ANNUITY: Color Dynamics exercises its option to contribute a portion of the prevailing wage (public project) fringe benefit amount of Employee's earnings to the Contractors and Employees Retirement Trust. Employees have the option of deciding among several types of investments for their retirement contributions, from lower risk "money market" funds to higher risk "growth" funds, all of which accumulate "tax deferred" to help provide for a secure environment.

YOUR PAYCHECK

A record of all hours worked for Color Dynamics must be kept and ready for inspection. All Employees are paid weekly, within 7 days of the end of each weekly pay period. Time sheets are to be submitted on Friday PM of each week to the job Foreman who will check time reported against his/her own log and then submit the foreman report along with the time sheets to the office by early Monday morning. If the timecards do not reach the office by Monday morning, the processing of the paycheck and it's issuance to the Employee may be delayed. When timecards are turned in on time, Paychecks will be available the following Friday, unless it is a Holiday, in which case, the checks will be available on Thursday PM.

Deductions from your paycheck will be made from your gross earnings for the following:

• Social Security (FICA)	Currently 7.65 of your paycheck Employer matches the same amount
• Federal Income Tax	In accordance with published regulations
• State Income Tax	In accordance with published regulations
• Medical Insurance	See "Fringe Benefits" (Family members only)
• Prevailing Wage Annuity	When Employee works on Govt. projects
• 401K	When Employee elects to contribute

For tax purposes, it is important that an accurate and complete W-4 is on file so the correct deductions are withheld from your paycheck. Eligible Employees will not be allowed to work without filling out an HMSA health insurance coverage form or a health insurance waiver form.

OVERTIME WORK

OVERTIME WORK MUST BE PRE-AUTHORIZED BY DAVID ONERHEIM OR BY BRENT CULLINAN. If authorization is given, it is for a day at a time, and if overtime is to be worked on a regular basis, then authorization for overtime must be in writing.

Overtime work will generally be voluntary on the part of the employee, however there may be times when overtime work is required in order for the Company to meet contractual requirements or to avoid liquidated damages etc. Employees must be ready and willing to adjust their schedules to accommodate Overtime Work as much as possible if it is needed by the Company.

Overtime work for typical hourly workers is defined as all hours worked over and above 40 hours in a calendar week payroll period. For these additional hours worked, the compensation will be 1.5x the regular base wage. On Public projects, the overtime rate is 1.5x the "base rate" of the required wage; however fringe benefits are paid at the straight time (1.0 x) for overtime hours worked.

The Color Dynamics "work week" begins on Sunday morning each week, so Sunday work would not be considered overtime (except for State of Hawaii projects).

GARNISHMENTS

Garnishments are legal attachments on an Employee's pay for unpaid debts. We are required by law to withhold wages due an Employee if a garnishment is served on the Company's direct payment of your wages.

LOANS AND ADVANCES

Loans and advances are strictly prohibited. Requests for loans or wage advances will not be considered.

GENERAL WORK RULES

Work rules are standards of conduct which Color Dynamics requires its Employees to observe. All Employees are expected to govern their activities and behaviors in accordance with *professional standards of conduct* and to show respect in their relationships with personnel from other companies, fellow employees, supervisors, employer, customers and the general public.

Social activities and/or communications not relating to company business must be curtailed during work hours. Non-employees of Color Dynamics are strictly prohibited from being in the office, shop, on our jobsites or in our vehicles for any non-business related purpose at any time. Radios are not allowed on the jobsites - all attention focused on working as safely and productively as possible.

Full time Field Employees are required to report to work each work day at the prescribed time and to leave only after eight (8) hours of work has been performed and logged on the timesheet. The exception would be when the Foreman or Superintendent shuts down the project early for bad weather or for some other valid reason. Paid time will only be for production hours worked.

A lunch break is required and is not considered "paid time". The lunch break will be one hour unless <u>all employees</u> on the project agree to bring their lunch each day, in which case a request to the Superintendent can be made for a 30 minute lunch break for that project.

For your safety and for professional appearance, appropriate work clothing is required. This will include steel toe work boots, long pants, company-issued short or long sleeve T-shirts (tank tops, sleeveless or cut-off shirts are not allowed). In addition to the proper clothing, employees are expected to keep their hearing protection devices, safety glasses and respirators close at hand for use as required.

Profanity is not allowed. Employees must strive to conduct themselves in a professional manner and all employees and the general public must be treated courteously and with respect.

CELL PHONES AND PAGERS: Cell phones and pagers, whether company issued or personal, are not to be used for personal reasons during working hours, unless there is an emergency. Employees are responsible for reimbursing Company for all personal or long dist calls on the cell phones that do not directly relate to the project at hand.

Company owned cell phone lines may be monitored by satellite GPS during the normal transportation and work times of 6 AM to 6 PM on workdays. These cell phones must be turned on and carried on your person at all times during work hours. If a phone is turned off during work hours it will be assumed that the person to whom the phone is assigned is not working during that period. It is recommended that company paid Nextel phone lines be turned off after work hours.

ABSENTEEISM: Reliability is crucial to the Company and each employee is expected to be at work every day on time. As soon as an Employee knows he/she will be late or absent from work, a call should be made to the office. Unexcused absences will be reflected in the Employee's personnel file and can be cause for lack of promotion and eventually can lead to termination of employment.

ALCOHOL AND DRUG USE: Alcohol and illegal drug use before or during working hours is strictly prohibited and may result in immediate termination of employment. (See: Drug Free Workplace Policy).

FIELD EMPLOYMENT POSITIONS

JOURNEYWORKERS: These Employees, whether regular or occasional hires, will be responsible for performing any and all tasks required for the projects they are assigned to. They will most likely be experienced in preparation of various surfaces, concrete restoration, waterproofing and/or painting application.

Journeyworkers are expected to be consistent producers of high quality work. They must set good examples for apprentices and must act professionally at all times. They must also demonstrate responsibility, honesty, efficiency, patience with others and must keep themselves and their tools neat and as clean as circumstances allow. They are expected to continually strive to improve production, quality and harmony within the crews and to assist the company in maintaining a competitive position in the industry.

Journeyworkers must assume responsibility for maintaining safe working conditions for all projects. They are expected to stop work on the project if unsafe conditions become evident and if the problem cannot be immediately remedied with means at their disposal. If unsafe conditions are discovered they must be immediately reported on the daily report form and via telephone to the office and to the Superintendent (Brent).

JOB LEAD JOURNEYWORKERS: Journeyworkers who are assigned the responsibility of leading a project will temporarily assume the responsibilities of the foreman for the duration of the job or until further notice by Management. A job lead journeyworker will also be assigned to temporary job leadership responsibilities during any absence of the assigned foreman from the jobsite.

FOREMEN: Foremen are skilled and experienced Journeyworkers who are regularily assigned the responsibilities of field leadership of projects. Foreman on most typical projects will be considered to be "working foremen", meaning that they will be a "hands on worker" in addition to safety, quality control and production management duties. The daily reports are to be filled out at the end of each work day. Toolbox safety meetings will be held each Monday morning, at the beginning of each job or new phase of a job, and also when new employees come on to an existing job. The jobsite foreman should never leave a jobsite during working hours unless there is no other reasonable alternative. Whenever possible, materials and equipment needs should be planned for in advance and delivered to jobsites by suppliers, or picked up at the beginning or end of the work day. If something must be purchased mid-day, the order should be phoned in by the foreman and another employee should drive to pick it up.

APPRENTICES AND TRAINEES: Apprentices have committed to our extensive training program as directed by the State of Hawaii, Dept. of Labor and Industrial Relations, and they agree to all of its conditions. Wage rates and classifications for apprentices are referenced in the Company Apprenticeship Agreement with the State of Hawaii. This document is available for review in our office upon request.

Apprentices and trainees may be employed on a particular job site as determined by Management or Superintendent, with consideration given to contract terms, safety, skills and efficiency required for work on the project etc. Apprentices must also acquire and maintain the same hand tools as required of other

Employees. In addition, Apprentices must maintain and turn in *daily progress report forms* at the end of each month to receive their work hour credit toward advancement in the program. Apprentices must attend class and receive passing grades or they will not advance in classification or in pay.

Apprentices and Trainees are also expected to do their best to help maintain a safe work environment and must immediately report all conditions which are deemed to be unsafe. Employees must never enter into a work situation which they think might be unsafe, regardless of whether they are told to do it or not. In this situation, the issue needs to be discussed in an on site meeting with the Trainee, the Foreman and the General Superintendent to resolve the situation to the complete satisfaction of all.

SAFETY

Jobsite safety is of utmost concern and violation of safety standards should be communicated immediately to Office Administrator or directly to David Onerheim, preferably in writing. Color Dynamics strives to abide by State of Hawaii OSHA (HIOSH) standards. There can be additional regulations on Federal Government projects as well. Every project should be analyzed for Hazards and Accident Prevention and we need all Employees' assistance and cooperation constantly to keep our work places safe for all. **Attendance at scheduled safety meetings is mandatory for all Employees. Unfavorable consequences can be expected for those not in attendance.**

Reporting unsafe conditions and assisting to the best of their ability to prevent accidents is a condition of employment for all Color Dynamics employees.
A complete first aid kit is to be on all jobsites and in each Company vehicle. Employees are expected to familiarize themselves with the contents and be prepared to use the kit if necessary.

All employee's who are assigned to lead paint removal projects, must be certified for such work prior to commencement. These employees must also have a lead blood test prior to any such work and after completion of each lead paint removal project.

Color Dynamics intends to stock regularly replaced personal protective items such as respirator filters and valves, clear and tinted safety glasses, gloves and ear plugs at the office. Do not buy this equipment at Safety Systems or any other vendors. Turn in your old ones to replace with new or request extras for your jobsite from David or Brent.

ACCIDENTS

If any accident or illness should occur on the job, it must be reported immediately to Office Administrator or directly to David Onerheim. Safety is of utmost concern and violations of prudent safety standards should be communicated immediately in the same manner. If an on-the-job illness or injury occurs, but is not an emergency, then treatment will be administered as soon as possible at the Medical Corner, Airport Branch, along with a required drug screen test.

Each job site should have a booklet of Material Data Safety Sheets (MSDS) for all products being used on site. This booklet must be located where each employee can access it at all times. Each employee should be familiar with the hazards of the products they use and know how to deal with a spill or accident involving these products.

COMPANY EQUIPMENT

Company owned equipment cannot be used for side work and will not be loaned out or rented to Employees or others. Employees are reminded that contracting without a contractor's license, the required insurances etc. is illegal.

Any equipment returned to the shop should be in GOOD WORKING ORDER AND CLEAN. If a piece of equipment is broken or not working correctly, then it should be tagged as such and set out for repair.

SHOP

Any and all equipment, material or vehicles returned to the shop should be put away neatly or hung in its proper place. Be sure all paints are labeled accurately. Hang up rags or place in water if they have been used with flammable paints or solvents to prevent fire.

TRANSPORTATION

PERSONALLY OWNED VEHICLES USED DURING WORKING HOURS:

(1) Any personally owned vehicle that an Employee operates to or on any jobsite or for the purpose of conducting Company business, either on a regular or on a temporary basis, must be properly insured by the Employee Owner of the vehicle. **All Employee owned vehicles must be covered by the required insurance and have current registration. Any Employee who drives any vehicle while working for Color Dynamics must have a valid driver's license, and must submit a copy of the license and insurance card upon hire and again each time the license is renewed. Employees must notify Office Administrator in writing if driver's license or insurance is revoked or becomes invalid for any reason.**

(2) Alcoholic beverages and/or illegal drugs are strictly prohibited from any job-related activity and must never be placed in any Company owned vehicle at any time, or in an Employee owned vehicle when in use for transporting employees or Company equipment.

COMPANY OWNED VEHICLES:

Violation of the following will result in immediate suspension and possible termination of employment.

1) Under no circumstance may anyone other than a regular employee of Color Dynamics operate or ride as a passenger in company vehicles at any time, without express (written permission) from Employer (David Onerheim).

2) Under no circumstance may Color Dynamics employees operate a Company owned vehicle for personal reasons, errands or for any non-work related reason unless it is a grave emergency or unless they have been given express permission by Employer. Any special permission given will be only for a specific time and will not be construed as "ongoing permission" to use the vehicle at the Employee's discretion.

3) Under no condition will any Employee operate a Company owned vehicle who has consumed any alcohol within 8 hours prior. The same rule applies to the use of drugs, prescription or otherwise, which could impair driving ability.

4) Employees who get or who have had "Moving Violations", Driving Under the Influence of Alcohol or Drugs offenses, or other serious traffic offenses or any physical impairment or condition (i.e. requirement for eye glasses, epilepsy, etc.), must report this status or change in status immediately to the Office Administrator. In the case of any of the above conditions, written permission to operate a Company vehicle would then be required.

5) Employees who do not possess a current and valid driver's license are absolutely prohibited from operating any Company vehicle.

6) Passengers riding in a Company vehicle must sit in passenger seats and use the seat belt. Under no condition may Employees ride in the back of a pickup truck.

VEHICLE MAINTENANCE

Employees who are issued Company owned vehicles must be responsible for obtaining regular maintenance of these vehicles. The office staff tracks mileage of these vehicles and you should get oil changes and service as soon as possible after being notified by the office to do so. Please keep all receipts for the office records. If tires are getting worn or there are mechanical problems, please request permission from Brent or David to get the work done. The general mechanic we like to use is Gentech, located on Bannister Street, a block away from our shop.

GAS CHARGE CARDS

Our policy is to temporarily issue gas card to selected employees. Gas must be purchased at the Kalihi Aloha Gas station only. Charges at other locations are prohibited except for emergency. Gas charges are authorized only for company vehicles and for gas cans filled for jobsite equipment.

When the charge is initiated at the pump, the vehicle mileage must be input. When the receipt prints out, the description of the vehicle or license number must be noted on the receipt.

If cans are being filled for use with jobsite equipment, the code number must be input. Then when the receipt prints out, the job name/number and the description of gas operated equipment should be written on it before turning it in to the office.

Abuse of the charge cards will result in suspension of the card and a return to the old "pay and submit for reimbursement" system.

PERSONAL HAND TOOLS

There are certain tools that Employees are required to possess as a condition of employment with Color Dynamics. These tools are to be maintained in proper working condition by each Employee. Failure to keep the required minimum tools in good condition may result in suspension from work. Periodic inspection of these tools by Foreman, Superintendent or Employer may be expected. The list of tools required (see attached) may be changed from time to time as Management deems necessary.

The purchase of personal tools by charging CDI's account at a vendor's store without authorization from David or Brent will result in an employee payroll deduction to reimburse Color Dynamics for the cost of the tool(s). If a payroll deductions is necessary you will be informed in advance and the detail shown on your check stub.

DRUG–FREE WORKPLACE POLICY

Revised October 2002

816 Gulick Avenue ~ Honolulu, HI 96819 ~ Tel: (808) 848-7000 ~ Fax: (808) 842-0800 ~ BC #11207

In 1988, Congress passed the "Drug Free Work Place Act". Effective March 18, 1989, this Act addresses any drug abuse in the work places of US Government contractors and grant recipients.

In response to the federal requirements for drug-free work places, and in keeping with Color Dynamics' concern for the health and safety of its work force, Color Dynamics, Inc. has instituted and maintains the following Drug-Free Work Place Policy:

I. POLICY STATEMENT

Color Dynamics prohibits company employees from reporting to work and or working with:

- Detectable levels of illegal drugs in their systems.
- Alcohol levels which could impair their ability to perform their jobs or adversely affect the safety or security of employees, the public or the Company.
- Prescription drugs or over-the-counter medication which could, in the opinion of the company physician, have adverse affects on the safety or security of the employees, the public or the Company.

Color Dynamics also restricts the following items from being brought on, or being present on Company premises or on the Company's jobsites or in the Company's vehicles: Illegal drugs and paraphernalia.

II. TYPES OF TESTING REQUIRED

All employees shall be subjected to the following types of testing:

A. Pre-employment Testing. All Company applicants for employment will be advised of our drug testing policy and then the selected applicants will be tested in accordance with the Company substance abuse program. Selected applicants must pass the required drug test and receive NIDA certification that they are drug free prior to being hired. Individuals who have taken leaves of absences of six months or longer shall also be subject to the pre-employment drug test. Time spent in testing for job applicants are not compensated for by the Company; however the cost of the test will be paid for by the Company.

B. Post-Accident Testing. Employees whose performance has contributed to an accident or cannot be completely discounted as a contributing factor to an accident shall be required to take a drug test. The employee shall be tested as soon as possible after the accident. A decision whether or not to administer a test under this section will be made by the employee's supervisor or employer.

C. Reasonable Cause Testing. Color Dynamics shall test each employee who is reasonably suspected of using an illegal drug. The decision to test an employee under this section shall be based on a reasonable belief that the employee may be using a prohibited drug.

D. Random Testing. Initially all employees will be tested. Thereafter, testing may be done on a random basis by drawing. All time spent by an employee in testing shall be considered compensatory, except for the time spent by an employee for testing for re-instatement of employment after a previous positive test result. The cost of the testing shall be at Company expense except that employee will pay for cost of testing required for re-instatement of employment after testing positive. Employees selected will take the drug test as soon as possible but in no case later than 24 hours from the time of selection for the test. Any employee who refuses to be tested will be presumed to have tested positive and dealt with accordingly.

E. Return to Duty - Testing. Each employee successfully completing a drug rehabilitation program approved by the Company and the Medical Review Officer shall be subject to unannounced testing for a period of not less than one year or more than five years. Such testing shall be monitored and determined by the Company and the Medical Review Officer. Individuals must pass all tests under this section as a condition of their continued employment.

III. SUBSTANCES TESTED FOR.

A. Employees will be tested for evidence of the following substances or evidence of metabolites of the following substances.

1. Marijuana
2. Cocaine
3. Opiates
4. Phencyclidine (PCP)
5. Amphetamines
6. Ethanol
7. Barbiturates
8. Benzodiazepines
9. Methadone
10. Alcohol

IV. VIOLATION OF COMPANY DRUG-FREE WORKPLACE POLICY

A. Violation of this substance abuse policy by employees shall result in disciplinary action up to and including termination of employment.

1. The following may be grounds for immediate suspension or termination.

   a. Testing positive for substances listed in Section III.

   b. Refusing to submit to any of the tests listed in Section III.

   c. Being found with possession of or selling of any illegal substance on the Company premises, jobsites or in or around Company Vehicles.

B. Other abuses, such as being under the influence of over-the counter or prescription medication or alcohol, at any time while on Company premises, on Company jobsites or in or around Company vehicles.

C. Employees taking prescription medication must consult with their physicians to determine possible side effects which could adversely affect the safety and security of the employee, fellow employees, the public or the Company. Employees must also report to Supervisor and to the Office, the intended use of over-the-counter or prescription medications which could impair performance.

VI. TREATMENT OF SUBSTANCE ABUSE

The health and safety of employees is a top priority for Color Dynamics. Any substance abuse which imperils the health and well being of our employees, or threatens our business, will not be tolerated. The use of illegal drugs and abuse of other substances, while on or off duty, which is inconsistent with the law abiding behavior expected of all citizens. Employees who use illegal drugs and other controlled substances on or off duty tend to be less safety conscious, less productive and less reliable. This, in turn, can result in increased costs, delays and risks to the Company's business. Drug use in the work place puts the health and safety of the abuser as well as all other workers around him or her at increased risk. All employees should have the right to work in a drug-free and safe work environment.

Early recognition and treatment of drug abuse is important for successful rehabilitation. Whenever possible, Color Dynamics will assist employees in overcoming drug abuse by providing information on treatment opportunities and programs. The final decision however, to seek diagnosis and accept treatment for substance abuse is primarily the individual employee's responsibility.

Employees with drug abuse problems should request assistance from Brent Cullinan or David Onerheim. Problems could also be reported in a note given to Office Manager. The Company will treat all such requests confidentially and will refer the employee to the appropriate treatment and counseling services. Employees who voluntarily request the Company's assistance in dealing with a drug abuse problem may do so without jeopardizing their continued employment provided they participate in an authorized treatment program and stay drug free.

Voluntary requests for assistance from employees will not, however, prevent disciplinary action for violation of Color Dynamics' Drug-Free Work Place Policy or any other Company Policies.

Color Dynamics Drug Free Work Place Policy is a "zero tolerance" policy, and Color Dynamics is committed to maintaining safe work places free from the influence of controlled substances and alcohol. All employees and subcontractors are hereby notified that Color Dynamics will comply with the requirements of the Drug-Free Work Place Act of 1988, and all applicable regulations issue hereunder, as well as, when applicable, any more stringent rules promulgated by other Federal agencies.

COLOR DYNAMICS INC

FALL PROTECTION SAFETY PLAN

Revised May 15, 2003

816 Gulick Avenue ~ Honolulu, HI 96819 ~ Tel: (808) 848-7000 ~ Fax: (808) 842-0800 ~ BC #11207

PURPOSE:

The purpose of Color Dynamics' Fall Protection Plan is to safeguard employees while on the job and to minimize the possibility of injury or death due to fall hazards on the jobsite.

SCOPE:

This plan will lay out the general requirements and Company policy regarding proper training and use of fall protection equipment on our jobsites. It will not deal with the details of scaffolds or structures, but will explain who will be responsible for preparing each job-specific rigging plan, to include fall protection and hazard analysis communication with the crews.

PROGRAM:

EQUIPMENT:

Body belts are no longer acceptable as part of a personal fall arrest system. Only full body harnesses are to be used.

Lifelines, safety belts and lanyards shall be used only for employee safeguarding. Any lifeline, safety belt, or lanyard actually subjected to in-service loading shall be immediately removed from service and shall not be used again for employee safeguarding.

Lifelines shall be secured above the point of operation to an anchorage or structural member capable of supporting a minimum dead weight of 5,400 lbs.

Lifelines used in areas where the lifeline may be subjected to cutting or abrasion shall be a minimum of 7/8-inch manila or equivalent, with a minimum breaking strength of 5,400 lbs.

Safety belt lanyard shall be a minimum of 1/2 inch nylon, or equivalent, with a maximum length to provide for a fall of no greater than 6 feet. The rope shall have a nominal breaking strength of 5,400 lbs.

All safety belt and lanyard hardware shall be drop forged or pressed steel, cadmium plated in accordance with type 1, Class B plating specified in Federal Spec QQ-P-416. Surface shall be smooth and free of sharp edges.

All safety belt and lanyard hardware, except rivets, shall be capable of withstanding a tensile loading of 4,000 lbs without cracking, breaking, or taking a permanent deformation.

Guardrail systems must have a pop edge height of 42 inches (+ or - 3 inches) above the walking/working level. When conditions allow, the height of the top edge can exceed 45 inches, provided the system meets all other criteria. Install midrails, screens or equivalent intermediate structural members between the top edge of the guardrail and the walking/working surface when no wall or parapet wall at least 21 inches high exists. Install midrails midway at a height between the top edge of the guardrail system and the walking/working level. Screens and mesh must extend from the top rail to the walking/ working level and along the entire opening between top rail supports. Intermediate members must be no more than 19 inches apart. Install other structural members such that there are no openings in the guardrail system.

When using man lift equipment, the lanyard must be attached to the guardrail of the basket or cage. It must not be attached to any other part of the man lift.

TRAINING:

Each supervisory employee who is involved in erecting, disassembling, moving, operating, repairing, maintaining, or inspecting a scaffold shall be trained by a competent person to recognize hazards associated with the work. Generally, the foreman on each project will have been trained for this by Color Dynamics Assistant Safety Manager and "Competent Person", Brent Cullinan, who has had several years of experience as a scaffold rigger.

The training will include the following:

1. The nature of scaffold hazards
2. The correct procedures for erecting, disassembling, moving, operating, repairing, inspecting, and maintaining the type of scaffold in question:
3. The design criteria, maximum intended load-carrying capacity and intended use of the scaffold.

When Brent Cullinan, Competent Person, or David Onerheim, Safety Officer, has any reason to believe that a supervisory employee lacks the skill or understanding needed for safe work involving the erection, use or dismantling of scaffolds, the Competent Person shall re-trai such employee so that the requisite proficiency is regained. Re-training is required in at least the following situations:

1. Where changes at the worksite present a hazard about which an employee has not been previously trained:

2. Where changes in the types of scaffolds, fall protection, falling object protection, or other equipment present a hazard about which an employee has not been previously trained.

3. Where inadequacies in an affected supervisory employee's work involving scaffolds indicate that the employee has not retained the required proficiency.

4. Where it is apparent that the employee is not able or willing to communicate the hazards associated with the scaffolding and associated fall protection systems to all other employees on the job.

Other employees on the project who work on a scaffold, but who are not responsible for erection, assembly or disassembly, repair, maintenance or inspection, must be trained by Brent Cullinan, Competent Person or by the Supervisory employee on site (Foreman) to recognize hazards associated with the type of scaffold being used and to understand the procedures to control or minimize these hazards. The training shall include the following topics:

1. The nature of any electrical hazards, fall hazards and falling object hazards in the work area.
2. The correct procedures for dealing with electrical hazards and for erecting, maintaining and disassembling the fall protection systems and falling object protection systems being used.
3. The proper use of the scaffold, and the proper handling of materials on the scaffold.
4. The maximum intended load and the load-carrying capacities of the scaffolds.

COLOR DYNAMICS INC

RESPIRATORY PROTECTION PROGRAM

Revised May 15, 2003

816 Gulick Avenue ~ Honolulu, HI 96819 ~ Tel: (808) 848-7000 ~ Fax: (808) 842-0800 ~ BC #11207

1.0 PURPOSE

Color Dynamics, Inc. has determined that our Field Employees are sometimes exposed to respiratory hazards during routine operations. These hazards include concrete demolition dust, other particulates and vapors, which in some cases may represent *Immediately Dangerous to Life or Health* (IDLH) conditions. The purpose of this program is to ensure that all Color Dynamics employees are protected from exposure to these respiratory hazards.

Engineering controls, such as ventilation and substitution of less toxic materials are the first line of defense at Color Dynamics, however engineering controls and administrative controls have not always been feasible for some of our operations, or have not always controlled the identified hazards. In these situations, respirators and other protective equipment must be used. Respirators may also be needed to protect employee's health during emergencies. The work processes requiring respirator use at Color Dynamics are outlined in the Scope and Application section of this program.

In addition, some employees have expressed a desire to wear respirators during certain operations that do not require respiratory protection. Color Dynamics provides each field employee with a respirator and, assuming that the use of the respirator does not jeopardize the health or safety of the worker, will generally allow voluntary use in these circumstances.

2.0 SCOPE AND APPLICATION

This program applies to all employees who are required to wear respirators during normal work operations, and during some non-routine or emergency operations such as the spill of a hazardous substance. This includes employees who may be working or loading materials in the shop or job-site storage area, or employees who are grinding or prepping concrete or painted surfaces on our field projects. It also would include application of paints by spray, brush and roller in poorly ventilated locations.

In addition, any employee who voluntarily wears a respirator when a respirator is not required is subject to the medical evaluation, cleaning, maintenance and storage elements of this program, and must be provided with certain information specified in this section of the program. (Employees who voluntarily wear paper dust masks are not subject to the medical evaluation, storage, cleaning and maintenance provisions of this program).

Employees participating in the respiratory protection program do so at no cost to them. The expense associated with training, medical evaluations and respiratory protection equipment will be borne by the company.

3.0 RESPONSIBILITIES

Program Administrator (David Onerheim)

The Program Administrator is responsible for administering the respiratory program. Duties of the Program Administrator include:

- Identifying work areas, processes or tasks that require workers to wear respirators, and evaluating hazards
- Selection of respiratory protection options
- Monitoring respirator use to ensure that respirators are used in accordance with their certifications.
- Arranging for and/or conducting training.
- Ensuring proper storage and maintenance of respiratory protection equipment.
- Conducting or arranging for qualitative fit testing with Safety Systems
- Administering the medical surveillance program
- Evaluating the program
- Updating the written program, as needed

SAFETY SYSTEMS HAWAII INC. (Safety Equipment Supplier & Trainer)

- Training of Color Dynamics employees in the use of respirators
- Selection of the proper type of respirators for use
- Fit testing of all Color Dynamics employees with their respirators
- Supply of all Respirators, filters, canisters and replacement parts as needed by employees
- Repair or disposal of malfunctioning respirators
- Instructing Color Dynamics employees on proper cleaning, maintenance and storage of respirators
- Assisting with the periodic updating and evaluation of the Color Dynamics Respiratory Protection Program

SUPERVISORS (Jobsite Foreman)

Supervisors are responsible for ensuring that the respiratory protection program is implemented on their project sites. In addition to being knowledgeable about the program requirements for their own protection, supervisors must also ensure that the program is understood and followed by the employees under their charge. Duties of the supervisor include:

- Ensuring that employees under their supervision including new hires) have received appropriate training, fit testing and the annual medical evaluation.
- Ensuring the availability of appropriate respirators and accessories.
- Being aware of tasks requiring the use of respiratory protection.
- Enforcing the proper use of respiratory protection when necessary.

- Ensuring that respirators are properly cleaned, maintained, and stored according to the respiratory protection plan.
- Ensuring that respirators fit well and do not cause discomfort.
- Continually monitoring work areas and operations to identify respiratory hazards.
- Coordinating with the Program Administrator (David Onerheim) on how to address respiratory hazards or other concerns regarding this program.

EMPLOYEES

Each employee has the responsibility to wear his or her respirator when and where required and in the manner in which they were trained. Employees must also:

- Care for and maintain their respirators as instructed, and store them in a clean and sanitary location.
- Inform their foreman and David Onerheim if the respirator no longer fits well, and request a new one that fits properly.
- Inform their foreman and David Onerheim of any respiratory hazards that they feel are adequately addressed in the workplace and of any other concerns that they have regarding the program.

4.0 PROGRAM ELEMENTS

The Program Administrator (David Onerheim) will select respirators and/or filter type to be used on site, based on the identified hazards to which workers are exposed and in accordance with all OSHA standards. He will conduct a hazard evaluation for each operation, process or work area where airborne contaminants may be present in routine operations or during an emergency. The hazard evaluation will include:

- Identification and development of a list of hazardous substances used on the job sites.

- Review work processes to determine where potential exposures to these hazardous substances may occur. This review shall be conducted by surveying the workplace and by talking with employees and foreman.

- Exposure monitoring to quantify potential hazardous exposures. Monitoring will be contracted out to Haztech Environmental Services when needed.

The results of the current hazard evaluation are as follows:

PREP POWER SANDING: Sanders with shrouds are available for use. Half face APRs with P100 filters and safety goggles are required for employees engaging in this kind of work.

PAINTING - EXTERIOR: In most cases non-toxic acrylic paints, epoxies and epoxy modified primers, urethanes, alkyd and oil based coatings and elastomeric coatings will not require a respirator in well ventilated areas.

PAINTING - INTERIOR: Whenever possible, non-toxic acrylic or water based paints will be used. If windows cannot be opened to allow air flow or in confined spaces with poor ventilation, respirator use will be required for oil base paints, alkyds, epoxies, urethanes, varnishes, stains and sealers.

EXTERIOR CHIPPING AND GRINDING CONCRETE: Because some concrete contains silica, respirator protection will be required when performing this work. Use dust shrouds on equipment when possible and vacuum cleaners to reduce the amount of dust generated.

LEAD PAINT REMOVAL: Employees are not allowed to disturb lead base paints until they have express approval and are trained and certificed to do so.

SWEEPING SHOP FLOORS AND JOB SITE: Whenever possible the surfaces should be wetted down before sweeping to reduce the dust generated. Because there is a chance of silica or other contamination of the dust on jobsites and in the shop, respirators with particulate filters will be required for sweeping these areas.

Updating the Hazard Assessment

The Program Administrator (David Onerheim) may revise and update the hazard assessment as needed (i.e. any time the work processes change may potentially affect exposure). If an employee feels that respiratory protection is needed during a particular activity where it is not otherwise called for, he/she is to contact David Onerheim, who will then evaluate the potential hazard and communicate the results to the all of the employees affected. If it is determined that respiratory protection is necessary, all other elements of this program will be in effect for those tasks and this program will be updated accordingly.

NIOSH Certification

All respirators must be certified by the National Institute for Occupational Safety and Health (NIOSH) and shall be used in accordance with the terms of that certification. Also, all filters, cartridges, and canisters must be labeled with the appropriate NIOSH approval label. The label must not be removed or defaced while it is in use.

MEDICAL EVALUATION

Employees who are either required to wear respirators, or who choose to wear an APR voluntarily, must pass a medical exam before being permitted to wear a respirator on the job. Employees are not permitted to wear respirators until a physician has determined that they are medically able to do so. Any employee refusing the medical evaluation will not be allowed to work in an area requiring

respirator use.

A licensed physician at The Medical Corner, Airport office, where our Company medical services are provided, will provide the medical evaluations. Medical evaluation procedures are as follows:

- The medical evaluation questionnaire form provided to us by Medical Corner will be given to the employee to fill out, along with a stamped and addressed envelope for mailing the questionnaire directly to the Company Physician at The Medical Corner. Employees will be allowed to fill out the questionnaire on Company time.

- The medical evaluation will be conducted by physicians at The Medical Corner as scheduled by the Company. This medical evaluation will be conducted at the time of hire for new employees and once per year for all employees.

- Follow up medical exams will be granted to employees as required by the standard, and/or as deemed necessary by The Medical Corner Physician.

- All employees will be granted the opportunity to speak with the physician about their medical evaluation, if they so request.

- The Program Administrator has provided the The Medical Corner with a copy of this program, a copy of the Respiratory Protection Standard, the list of hazardous substances we are likely to encounter in our operations, and for each employee requiring evaluation: his or her job title, proposed respirator type and weight, length of time required to wear respirator, expected physical work load, potential temperature and humidity extremes and any additional protective clothing required.

- Any employee required for medical reasons to a positive pressure air purifying respirator will be provided with a powered air purifying respirator.

- After an employee has received clearance and begun to wear his or her respirator, additional medical evaluations will be provided under the following circumstances:

  --- Employee reports signs or symptoms related to their ability to use a respirator, such as shortness of breath, dizziness, chest pains, or wheezing.

  --- The Medical Corner physician or supervisor informs the Color Dynamics Program Administrator that the employee needs to be re-evaluated.

--- Information from this program, including observations made during fit testing and program evaluation, indicates a need for re-evaluation.

--- A change occurs in the workplace conditions that may result in an increased physiological burden on the employee.

All Color Dynamics field employees are currently included for medical surveillance under this program.

All examinations and questionnaires are to remain confidential between the employee and the physician.

FIT TESTING

Fit testing is required for employees wearing half-face piece APRs for exposure to concrete demolition dust, paint fumes and overspray. The fit testing will be done:

- Prior to being allowed to wear any respirator with a tight fitting face piece
- Annually
- When there are changes in the employee's physical condition that could affect respiratory fit (e.g. obvious change in body weight, facial scarring, etc.)

Employees will be fit tested with the make, model and size of respirator that they will actually wear. Employees will be provided with several models and sizes of respirators so that they may find an optimal fit. Fit testing of APRs is to be conducted in the negative pressure mode.

Safety Systems will conduct the fit tests following the OSHA approved Bitrex Solution Aerosol QLFT Protocol in Appendix B (B$) of the Respiratory Protection standard.

General Use Procedures:

- Employees will use their respirators under conditions specified by this program, and in accordance with the training they receive on the use of each particular model. In addition, the respirator shall not be used in a manner for which it is not certified by NIOSH or by its manufacturer.

- All employees shall conduct user seal checks each time that they wear their respirator. Employees shall use either the positive or negative pressure check (depending on which test works best for them) specified in Appendix B-1 of the Respiratory Protection Standard.

- All employees shall be permitted to leave the work area to go to the locker room to maintain their respirator for the following reasons: to clean their respirator if the respirator is impeding their ability to work, change filters or cartridges, replace parts, or to inspect respirator if it stops functioning as intended. Employees should notify their supervisor before leaving the work area.

- Employees are not permitted to wear tight-fitting respirators if they have any condition such as facial scars, facial hair, or missing dentures that prevents them from achieving a good seal. Employees are not permitted to wear headphones, jewelry, or other articles that may interfere with the face piece-to-face seal.

Respirator Malfunction:

For any malfunction of an APR (e.g. such as breakthrough, face piece leakage, or improperly working valve), the respirator wearer should inform his or her supervisor that the respirator no longer functions as intended, and go to the designated area to maintain the respirator. The supervisor or foreman must ensure that the employee receives the needed parts to repair the respirator, or is provided with a new respirator as soon as possible. The employee may not continue to work on tasks requiring a respirator until such time as he/she has the respirator adequately repaired or until such time as the respirator has been replaced and fitted properly.

CLEANING, MAINTENANCE, CHANGE SCHEDULES AND STORAGE

Cleaning:

Respirators are to be regularly cleaned and disinfected regularly and as often as necessary.

The following procedure is to be used when cleaning and disinfecting respirators:

- Disassemble respirator, removing any filters, canisters, or cartridges.
- Wash the face piece and associated parts in a mild detergent with warm water. Do not use organic solvents.
- Rinse completely in clean warm water.
- Wipe the respirator with disinfectant wipes (70% isopropyl alcohol) to kill germs.
- Air-dry in a clean area.
- Reassemble the respirator and replace any defective parts.
- Place in a clean, dry plastic bag or other air-tight container.

Note: The Program Administrator will ensure an adequate supply of appropriate cleaning and disinfection material at the job sites with an alternate supply to be stored at the office/shop facility. If supplies are low, employees should contact David Onerheim, the Program Administrator or Charlene in the office to replace the stock.

Maintenance:

Respirators are to be properly maintained at all times in order to ensure that they function properly and adequately protect the employee. Maintenance involves a thorough visual inspection for cleanliness and defects. Worn or deteriorated parts will be replaced prior to use. No components will be replaced or repairs made beyond those recommended by the manufacturer. Repairs to regulators or alarms of atmosphere-supplying respirators will be conducted only by the manufacturer.

The following checklist will be used when inspecting respirators:

- Face piece: cracks, tears or holes; facemask distortion;
- Head straps: breaks or tears; broken buckles;
- Valves: residue or dirt; cracks or tears in valve material;
- Filters/Cartridges: check approval designation; gaskets; cracks or dents in housing; proper cartridge for the hazard;
- Air Supply Systems: breathing air quality/grade; condition of supply hoses; hose connections; settings on regulators and valves;

Employees are permitted to leave their work area to perform limited maintenance on their respirator in a designated area that is free of respiratory hazards. Situations when this is permitted include to wash their face and respirator face piece to prevent any eye or skin irritation, to replace the filter, cartridge or canister, and if they detect vapor or gas breakthrough or leakage in the face piece or if they detect any other damage to the respirator or its components.

Change Schedules:

Employees wearing APRs with dust filters for protection against dust and other particulates shall change the cartridges on their respirators when they first begin to experience difficulty breathing (i.e. resistance) while wearing their masks.

Storage:

Respirators must be stored in a clean, dry area, and in accordance with the manufacturer's recommendations. Each employee will clean and inspect their own air-purifying respirator in accordance with the provisions of this program and will store their respirator in a plastic bag. Each employee should place his/her name on the bag and the bag shall only be used for storage of that respirator.

All filters and replacement parts will be picked up directly from Safety Systems by the employees as needed. Employees should be sure that all replacement parts, filters etc. are in the original manufacturer's packaging.

Defective Respirators:

Respirators that are defective or have defective parts shall be taken out of service immediately. If, during an inspection, an employee discovers a defect in a respirator, he/she is to bring the defect to the attention of his Foreman or the program

Administrator, who will then direct the employee to take the respirator to Safety Systems where they will do one of the following:

- Temporarily take the respirator out of service until it can be repaired.
- Perform a simple fix on the spot such as replacing a head strap.
- Dispose of the respirator due to an irreparable problem or defect, and then issue a new one and fit test the employee.

TRAINING:

David Onerheim, Program Administrator, will provide or coordinate (through Safety Systems) the training to respirator users, and their supervisors on the contents of the Color Dynamics Respiratory Protection Program and their responsibilities under it, and on the OSHA Respiratory Protection Standard. Workers will be trained prior to using a respirator in the workplace. Supervisors will also be trained prior to using a respirator in the workplace or prior to supervising employees that must wear respirators.

The training course will cover the following topics:

- The Color Dynamics Respiratory Protection Program
- The OSHA Respiratory Protection Standard
- Respiratory hazards encountered at Color Dynamics shop facility and at the jobsites and their health effects
- Proper selection and use of respirators
- Limitations of respirators
- Respirator donning and user seal (fit) checks
- Fit Testing
- Emergency use procedures (if applicable)
- Maintenance and storage
- Medical signs and symptoms limiting the effective use of respirators

Employees will be re-trained annually or as needed (e.g. if they change the type of respirator). New hires will be trained before commencing any work which requires respirator wear. Employees must demonstrate their understanding of the topics covered in the training through hands-on exercises and a written test. Respirator training will be documented by Safety Systems (or the Program Administrator) and documentation will include type, model, and size of respirator for which each employee has been trained and fit tested.

5.0 PROGRAM EVALUATION

David Onerheim, the Program Administrator, will conduct periodic evaluation of the workplace to ensure that the provisions of this program are being implemented The evaluations will include regular consultations with employees who use respirators and their supervisors, site inspections, air monitoring (as required) and a review of records.

6.0 DOCUMENTATION AND RECORD KEEPING

A written copy of this program and the OSHA standard is kept in the company office and is available to all employees who wish to review it.

Also maintained in the company office are copies of training and fit test records received from Safety Systems. These records will be updated as new employees are trained, as existing employees receive refresher training, and as new fit tests are conducted.

The Program Administrator will also maintain copies of the medical records for all employees covered under the respirator program. The completed medical questionnaire and the physician's documented findings are confidential and will remain at Straub Clinic. The company will only retain the physician's written recommendation regarding each employee's ability to wear a respirator.

SAFE LIFTING PRACTICES

Revised October 2002

816 Gulick Avenue ~ Honolulu, HI 96819 ~ Tel: (808) 848-7000 ~ Fax: (808) 842-0800 ~ BC #11207

PURPOSE:

The purpose of Color Dynamics' Safe Lifting Practices handout is to prevent injuries when lifting or moving heavy or awkward objects, both on the job and at home.

SCOPE:

This instruction is designed to inform and help protect all employees who occasionally lift or move objects as part of their job duties. This will include all office employees as well as field employees.

PROGRAM: MOVING AND LIFTING THINGS SAFELY

- Wear steel-toe shoes when lifting heavy objects or working around things which could fall on your feet. Wearing leather gloves is also a good idea.
- Always ask for help in lifting heavy or awkward objects.
- Plan a route that is free from tripping and slipping hazards. Plan any rest stops you will need along the way. Be sure the weight of the object is as evenly distributed as possible.
- Lift with your legs!! As you rise up keep the load close in to your body and your back straight. Avoid twisting as you lift.
- When carrying an object, keep the load close to your body, don't allow your vision to be blocked, avoid twisting your body.
- When unloading an object, bend your knees and be careful not to pinch your fingers under the load when you set it down.
- Slide the load into tight spaces rather than lifting it in.
- Always be sure the load is secure and won't fall before taking your hands off of it.

Employee Safety and Health is the highest priority of Color Dynamics and the practice of safe lifting is required of all employees. If employees disregard instruction on safe lifting or repeatedly violate the policy, they may be dismissed. The total support of this important policy is a condition of employment.

CDI
COLOR DYNAMICS INC

SAFETY & HEALTH POLICY

HAZARD ANALYSIS & COMMUNICATION

Revised May 15, 2003

816 Gulick Avenue ~ Honolulu, HI 96819 ~ Tel: (808) 848-7000 ~ Fax: (808) 842-0800 ~ BC #11207

SAFETY & HEALTH POLICY STATEMENT

The safety and health of our employees continues to be the first priority and consideration in the operation of this business. To provide the safest possible workplace and healthy working environment is our Company goal and it is our policy to do everything possible to achieve it. The total support of this policy is every employee's responsibility, as well as a condition of employment.

To make this policy effective all employees must constantly be aware of conditions in each individual's work area that can produce injuries. No employee is required to work at a job he or she knows is unsafe or unhealthy. Your cooperation in detecting hazards, and in turn controlling them, is a condition of your employment. Inform your supervisor and the office immediately of any hazardous situation beyond your ability or authority to correct.

The personal safety and health of each employee of this company is of primary importance. To the greatest degree possible, management will provide or make available all mechanical and physical devices required for personal safety and health in keeping with the highest standards of the industry.

RESPONSIBILITIES OF ALL EMPLOYEES

Review the Material Safety Data Sheets (MSDS) for each product to be used on each job. MSDS sheets must be readily available to all employees on each jobsite and in the shop. If a new or different type of product is picked up from a material supplier or from the shop, it is the employee's responsibility to make sure that the appropriate MSDS sheet is also picked up and added to the jobsite MSDS booklet. If an employee is working on any product in the shop it is that employee's responsibility to first review the MSDS sheet for the product before opening or using the product. If the information is not clear, it is the employee's duty to address any question(s) to the Job Foreman or to the Safety Officer, David Onerheim.

- Prior to the commencement of work on any new project, or prior to starting work when transferred to an on-going project, employees must review all identified job site hazards with the Safety Officer and the Jobsite Foreman. After the initial hazards have been identified and communicated, work conditions must be continually monitored by every employee for possible new hazards.

- If any employee feels that the work conditions are unsafe or could be improved it is their responsibility to report and discuss this with David Onerheim, the Company Safety Officer. If any employee feels that he or she needs additional training prior to performing the assigned tasks then it is the employee's responsibility to report and discuss this concern with Brent Cullinan to find a satisfactory solution.

- Jobsite hazard briefing will be held on each site at least once per week. It is each employee's responsibility to attend these meetings and to bring up any concerns for the benefit of all employees.

- Any employee who refuses to follow the rules and safe work practices will be removed from the jobsite. Repeated carelessness or disregard for the safety of self or others will not be tolerated and will result in the termination of employment.

RESPONSIBILITIES OF SAFETY OFFICER

- Provide all new employees with general safety indoctrination, as well as a written copy of this policy prior to placement on jobsites. Be sure that new field employees receive a respirator-use medical evaluation and then a respirator fit test as well as a baseline hearing test if the employee is likely to be subjected to airborne hazards or loud noise on the jobsite.

- Confirm that all employees have been instructed as to job specific hazards prior to working on any new jobsites or being transferred to a job already in progress.

- Ensure that supervisors and foreman receive proper training.

- Ensure all record keeping requirements are being met.

- Ensure all accidents or near-accidents are recorded and reported on the day they occur.

- Review of OSHA form 200 periodically to determine if accident trends are occurring.

- Make periodic safety checks on Jobsites and discusses hazards with Job Foreman and employees.

- Answer questions about health and safety concerns.

- Be sure that there are adequate numbers of CPR and First Aid Trained individuals assigned to each jobsite. Be sure that there are adequate First Aid kits, Fire Extinguishers, etc. on each jobsite.

- For accidents, injuries, and diagnosed occupational illnesses that result in a fatality or lost work days, the Safety Officer will report immediately to the designated authority.

RESPONSIBILITIES OF JOBSITE FOREMAN

- Ensure that all program objectives are being met on the Jobsite. Report all accidents immediately to David Onerheim and the Office and verify that the accident is logged on the OSHA Form 200 posted in the office.

- Ensure that all employees new to the Jobsite know the potential safety hazards of the Project. Identify the location of MSDS booklet, fire extinguishers, first aid kits, etc. to each employee. Stress the requirement for reporting unforeseen hazards and for use of personal protective equipment such as ear muffs, respirators, eye protection, gloves, boots etc. as appropriate for the specific employee assignments. Inform the employees where the nearest emergency hospital room is and identify the

person (s) on the jobsite who is trained to administer CPR and First Aid.

- Be sure that all potential hazards identified by any employee which are not already controlled on the jobsite are forwarded to David Onerheim Do not allow any employee to work under conditions in question until the situation has been addressed by Safety Officer, David Onerheim and until all employees are satisfied and comfortable that the potential hazard has been mitigated.

MEDICAL & PHYSICAL REQUIREMENTS FOR ALL EMPLOYEES

- Each project site and each company owned vehicle must contain at least one full and complete first aid kit. If any product is removed from the first aid kits it should be reported and replaced as soon as possible.

- Each field employee is responsible for properly maintaining his/her company issued personal protective equipment. At a minimum, this would include eye protection glasses, hearing protection devices, half face negative pressure respirator with HEPA & Organic Vapor filters, hardhat and any issued fall protection equipment.

- Each field employee is responsible for wearing proper clothing in accordance with industry standards. This will include long pants and company issued short or long sleeve T-shirts. It is recommended that employees purchase steel toe shoes with a soft sole for the best grip. It is also recommended that each employee have a pair of leather gloves.

Each field employee must meet certain physical qualifications such as: 1. ability to correctly and comfortably lift a 5-gallon container of paint from the ground into the bed of a pickup: 2. ability to read and understand labels, signs, instructions and MSDS sheets: 3. ability to work in high places as well as places of confinement: 4. Ability to hear sounds and instructions clearly: 5. ability to comfortably breathe through a negative air respirator.

GENERAL INSTRUCTIONS

IN CASES OF EMERGENCY

- Dial 911 for Fire Department, Police, or Ambulance.

- If the emergency warrants, evacuate the immediate area and assemble at a pre-designated site, account for all employees, notify the foreman, David Onerheim and the Office and follow the instructions of the Fire Department or Police.

- First Aid Kits are located in the office, in the shop, in each Company Vehicle and there should always be a kit located on each jobsite. Be sure you know where it is.

- In all cases of emergency, contact David Onerheim and the Office Staff.

IN CASES OF ACCIDENT OR INJURY

- If accident or injury appears to be severe, dial 911 for Fire Department, Police, or Ambulance.
- Notify Supervisor/Foreman of incident immediately. Call David Onerheim and inform the Office staff also.
- For jobsite accidents or injuries, the job Foreman will be responsible for getting the incident recorded and reported. All employees should also describe the accident or near accident on the reverse side of their daily time sheet.

FIRE AND FIRE PROTECTION

Fire prevention is of the utmost importance. Therefore, here are some guidelines for fire prevention and suggestions of what to do in case of fire or if you smell smoke. Study and know the following:

- Smoking or open flames are not permitted within 50 feet of where flammables are stored or where equipment is being used, transferred or fueled is strictly prohibited.
- Be sure that at least one portable fire extinguisher, having a rating of no less than 20-B units is accessible in the shop and on each jobsite or in the Company vehicle assigned to that Jobsite. Each employee should be familiar with the operation of the fire extinguisher. Each fire extinguisher needs to be inspected and tagged once per year and must be re-filled and re-tagged after each use.
- Know the location of all fire exits and fire extinguishers for use in an emergency.
- Pour gasoline, kerosene, oil or other flammable liquids only into containers provided for that purpose and not in any sewer or drain. Maintain a minimum amount of fuel stored on site. Turn off machines before re-fueling and be sure no one is smoking in the area. If fuel is spilled on clothing, do not continue working and notify foreman at once.
- Stack equipment so that exits, fire-fighting equipment, first aid equipment, alarm boxes, or power panels and valves are not blocked.
- Keep access to all doors clear.
- Use extension cords only for temporary purposes, and put extension cords away after each use. Be sure that all extension cords are 3-prong and are double insulated. Use GFI devices when required.

STEPS TO BE TAKEN IN THE EVENT OF A FIRE:

- Notify fire department by activating fire alarm box. If an alarm point is not readily available, notify the Fire Department by phone and report the exact location of the fire. Then notify your manager.

- Utilize fire extinguishers if the fire is small enough to contain.
- If fire is too great to contain with extinguisher, evacuate the immediate area and assemble at a pre-designated site, account for all employees, notify the manager, and follow the instructions of the Fire Department or Police.

The electrical fixtures will automatically turn off. Do not waste time exiting the building as to endanger yourself.

USE OF POWER TOOLS

- Never remove factory installed safety devices or guards from power tools
- Use extension cords only for temporary use and as required. Be sure all extension cords are double insulated and grounded.
- Always use eye protection when using power tools.
- Never use electrical power tools in rainy or wet conditions.
- Never use high pressure washing or spray equipment around high voltage electrical lines or around the area where they enter the structure.
- Always shut down the sprayer or pressure washer before adjusting the tip. Always keep the spray gun or wand pointed in a safe direction.
- Try to minimize dust generated from power tools whenever possible. Wet down surfaces before and after grinding, chipping or blasting concrete if feasible.
- Never use power tools or even hand sanders on painted surfaces suspected of containing lead based paints.

IN THE EVENT OF SEVERE WEATHER

- Follow the instructions of the Foreman in securing the job-site.
- Make sure all equipment, gear, and material has been stored away in a secure area.
- Equipment, gear, or material too large to be stored indoors, will be secured outside in such a way as to not pose any danger to personnel or property during severe weather.
- When directed by the manager or local authorities, return to your places of dwelling and wait for the severe weather to pass.
- When the "all clear" is given by the local authorities, contact the Manager for further instructions.

SAFE ACCESS

- Safe access shall be provided to all work areas.
- Access-ways shall be kept clear of equipment, materials, trash, or debris that would obstruct passage or cause a tripping hazard.
- Immediately cleanup any liquid spills that could cause someone to slip.
- Do not carry items which obstruct your vision.

LADDERS

- The construction, installation, and use of ladders shall conform to the latest edition of the Safety Codes for Portable Wood Ladders, ANSI A14.1; Portable Metal Ladders, ANSI A14.2; Fixed Ladders, ANSI A14.3; and Job Made Ladders, ANSI A14.4.
- Portable ladders shall be used at such a pitch that the horizontal distance from the top support to the foot of the ladder will not be greater than one-fourth the vertical distance between these points.
- The supports on which a ladder rests, both top and bottom, shall be rigid and capable of supporting the loads to be imposed, that lateral displacement cannot occur.
- All portable ladders shall be of sufficient length and shall be placed so that workers will not have to stretch or assume a hazardous position.
- Portable metal ladders shall not be used for electrical work or where they may contact electrical conductors.
- Broken or damaged ladders shall be removed from service immediately and destroyed or tagged conspicuously "Do Not Use".
- The length of portable step ladders shall not exceed 20 feet.
- Employees should use extreme care when descending a ladder to make sure not to slip off or miss a rung. Be sure you feel the ground under your foot before shifting your weight off of the ladder.

WORK PLATFORMS AND SCAFFOLDS

- All platforms and scaffolds are to be inspected thoroughly for proper construction prior to any work being performed on the platform/scaffold.
- Platforms must be kept level and secure at all times when work is being performed.

- Safety railings are to be erected all around the platform, except for suspended scaffolding, where the side next to the wall will remain open to the wall (when the wall surface is within 12" of the scaffold frame).

- Fine mesh netting/fencing will encircle the work platform, except for suspended scaffolding, where the side next to the wall will remain open to the wall.

- Working levels of work platforms shall be fully decked or planked.

- Work platforms shall be securely fastened to the scaffold.

- For erected scaffolding, an access ladder or equivalent shall be securely fastened to the scaffold.

- Erected scaffolding will be tied securely to the structure at least every 25' vertically and every 30' horizontally.

- Rolling free-standing scaffolding will be moved carefully. Brakes will be secured immediately after moving. Personnel will not be allowed on the scaffold when it is being moved. Maximum height of free standing scaffold is 4 times the width of the scaffold (including outriggers, if so equipped).

- Where lifelines secured from the roof make contact with the edge of a parapet or other protrusion of a structure, measures will be taken to protect the rope from chafing. Lifelines may only be attached to a solid structure and not to roof vents, standpipes etc.

- Personal Protective Equipments for fall protection will consist of full body harnesses with lanyard and rope grab.

- When working with or moving any type of scaffolding, great care must be taken not to allow contact of cables or frame with high voltage electrical power lines. Scaffolding should not be placed near electrical lines until such time as the Utility Company has insulated them properly.

- Secure back-up cables will be attached to the primary suspension point of suspended scaffold platforms. Primary and back-up cables will be attached only to solid portion of the building and not to roof vents, standpipes or a/c equipment.

ELEVATING AND ROTATING WORK PLATFORMS

- Belting off to an adjacent pole, structure or equipment while working from the aerial lift is not permitted.

- Employees shall always stand firmly on the floor of the basket and shall not sit or climb on the edge of the basket or use planks, ladders, or other devices to achieve a work position.

- Only persons authorized by David Onerheim may operate an aerial lift.
- A body harness shall be worn and a lanyard attached to the basket when working from the aerial lift.
- Wheel chocks shall be installed prior to using an aerial lift on an incline or uneven ground.

Care must be taken not to work near high voltage electrical power lines

OVERHEAD HAZARDS

- When working on the ground or on scaffold platforms in a situation where something could fall from above, a hard hat must be worn.
- Any hand tools that are used in high places which could endanger someone below if accidentally dropped must be secured to the scaffold or to the structure by a lanyard. great care must be taken when removing debris from elevated areas of buildings. Debris nets and toe boards on the scaffold rig should be used whenever feasible.
- Employees should avoid passing under the buckets or booms of loaders or aerial lifts when in operation. Employees should avoid working directly under suspended scaffolding whenever possible.

CONSTRUCTION/JOBSITE BARRICADE

- Any and all fencing or barricades will be conspicuously marked with the appropriate warnings for the type of work being done and the type of materials being used.

MOVING AND LIFTING THINGS SAFELY

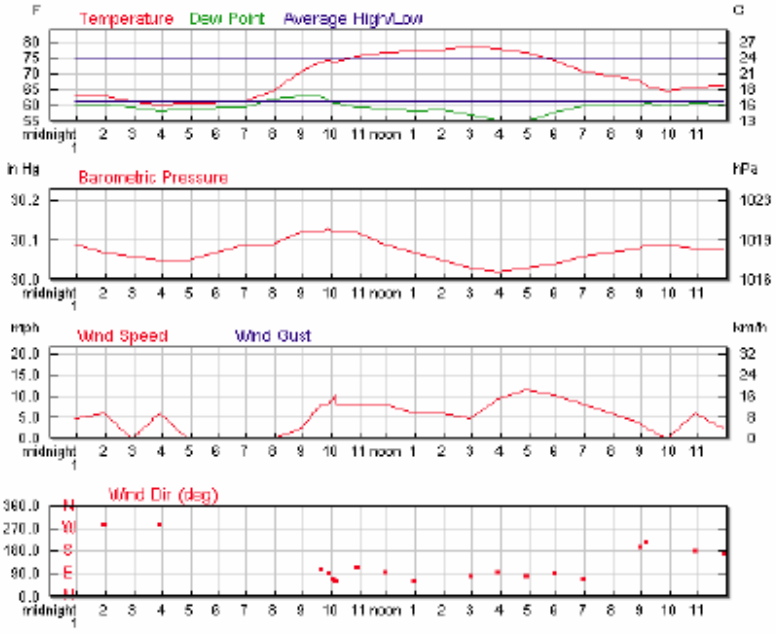
- Wear steel toed shoes when lifting heavy objects or working around things which could fall on your feet. Wearing leather gloves is also a good idea.
- Always ask for help in lifting heavy or awkward objects.
- Plan a route that is free from tripping and slipping hazards. Plan any rest stops you will need along the way. Be sure the weight of the object is as evenly distributed as possible.
- Lift with your legs!! As you rise up keep the load close in to your body and your back straight. Avoid twisting as you lift.
- When carrying an object, keep the load close to your body, don't allow your vision to be blocked, avoid twisting your body.

- When unloading an object, bend your knees and be careful not to pinch your fingers under the load when you set it down.
- Slide the load into tight spaces rather than lifting it in.
- Always be sure the load is secure and won't fall before taking your hands off of it.

THE ABOVE ARE ONLY GUIDELINES FOR YOUR SAFETY AND THE SAFETY OF THOSE AROUND YOU. COMMON SENSE AND CONSTANT SAFETY AWARENESS IS ALSO CRUCIAL TO THE SUCCESSFUL IMPLEMENTATION OF THIS POLICY.

Appendix 1D: Daily Quality Reports

Time (HST):	Temp.:	Dew Point:	Humidity:	Wind Dir:	Wind Speed:	Gust Speed:	Conditions:
12:55 AM	62.8 °F / 17.1 °C	60.1 °F / 15.6 °C	91%	WNW	4.6 mph / 7.4 km/h / 2.1 m/s	-	Clear
1:55 AM	62.8 °F / 17.1 °C	60.4 °F / 15.8 °C	92%	WNW	5.8 mph / 9.3 km/h / 2.6 m/s	-	Clear
2:55 AM	61.2 °F / 16.2 °C	59.2 °F / 15.1 °C	93%	Calm	Calm	-	Clear
3:55 AM	60.3 °F / 15.7 °C	58.1 °F / 14.5 °C	93%	WNW	5.8 mph / 9.3 km/h / 2.6 m/s	-	Clear
4:55 AM	60.8 °F / 16.0 °C	59.0 °F / 15.0 °C	94%	Calm	Calm	-	Clear
6:55 AM	61.2 °F / 16.2 °C	59.4 °F / 15.2 °C	94%	Calm	Calm	-	Clear
7:55 AM	64.2 °F / 17.9 °C	61.9 °F / 16.6 °C	92%	Calm	Calm	-	Clear
8:55 AM	70.5 °F / 21.4 °C	62.6 °F / 17.0 °C	76%	Variable	2.3 mph / 3.7 km/h / 1.0 m/s	-	Clear
9:55 AM	73.8 °F / 23.2 °C	61.3 °F / 16.3 °C	65%	East	8.1 mph / 13.0 km/h / 3.6 m/s	-	Mostly Cloudy
10:55 AM	75.2 °F / 24.0 °C	59.5 °F / 15.3 °C	58%	ESE	8.1 mph / 13.0 km/h / 3.6 m/s	-	Partly Cloudy
11:55 AM	76.6 °F / 24.8 °C	59.0 °F / 15.0 °C	54%	East	8.1 mph / 13.0 km/h / 3.6 m/s	-	Partly Cloudy
12:55 PM	76.8 °F / 24.9 °C	58.3 °F / 14.6 °C	53%	ENE	5.8 mph / 9.3 km/h / 2.6 m/s	-	Clear
1:55 PM	77.5 °F / 25.3 °C	58.6 °F / 14.8 °C	52%	Variable	5.8 mph / 9.3 km/h / 2.6 m/s	-	Clear
2:55 PM	78.4 °F / 25.8 °C	56.7 °F / 13.7 °C	47%	East	4.6 mph / 7.4 km/h / 2.1 m/s	-	Clear
3:55 PM	77.9 °F / 25.5 °C	55.4 °F / 13.0 °C	46%	East	9.2 mph / 14.8 km/h / 4.1 m/s	-	Clear
4:55 PM	76.5 °F / 24.7 °C	55.0 °F / 12.8 °C	47%	East	11.5 mph / 18.5 km/h / 5.1 m/s	-	Clear
5:55 PM	73.8 °F / 23.2 °C	57.9 °F / 14.4 °C	58%	East	10.4 mph / 16.7 km/h / 4.6 m/s	-	Clear
6:55 PM	70.7 °F / 21.5 °C	59.7 °F / 15.4 °C	68%	ENE	8.1 mph / 13.0 km/h / 3.6 m/s	-	Clear
8:55 PM	67.6 °F / 19.8 °C	59.9 °F / 15.5 °C	76%	SSW	3.5 mph / 5.6 km/h / 1.5 m/s	-	Scattered Clouds
9:55 PM	64.4 °F / 18.0 °C	59.9 °F / 15.5 °C	85%	Calm	Calm	-	Partly Cloudy
10:55 PM	65.8 °F / 18.8 °C	60.6 °F / 15.9 °C	83%	South	5.8 mph / 9.3 km/h / 2.6 m/s	-	Clear
11:55 PM	66.2 °F / 19.0 °C	60.4 °F / 15.8 °C	82%	South	2.3 mph / 3.7 km/h / 1.0 m/s	-	Clear



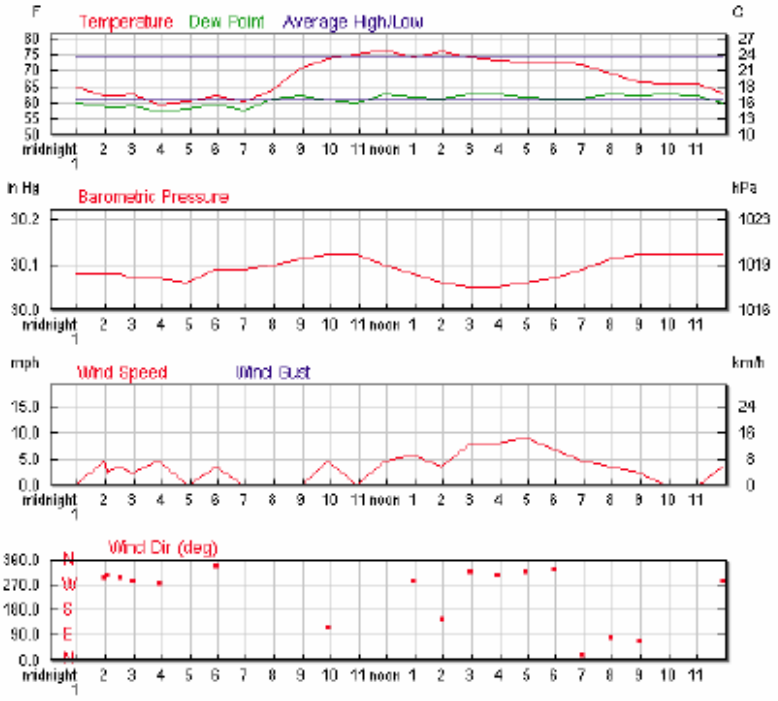
Data Source: Wheeler Army Airfield Weather Station - Airport Code (PHHI)

Notes

6 Mar 08 - Thurs – CDI cleaned all gutters to remove blockages that prevented water from the powder wash to drain (Figure XX).

WAAF Environmental Conditions
for 6 Mar 08

Time (HST):	Temp.:	Dew Point:	Humidity:	Wind Dir:	Wind Speed:	Gust Speed:	Conditions:
12:55 AM	65.1 °F / 18.4 °C	60.1 °F / 15.6 °C	84%	Calm	Calm	-	Partly Cloudy
1:55 AM	62.4 °F / 16.9 °C	59.5 °F / 15.3 °C	90%	WNW	4.6 mph / 7.4 km/h / 2.1 m/s	-	Scattered Clouds
2:55 AM	63.1 °F / 17.3 °C	59.2 °F / 15.1 °C	87%	WNW	2.3 mph / 3.7 km/h / 1.0 m/s	-	Partly Cloudy
3:55 AM	59.9 °F / 15.5 °C	57.4 °F / 14.1 °C	91%	West	4.6 mph / 7.4 km/h / 2.1 m/s	-	Clear
4:55 AM	60.8 °F / 16.0 °C	58.5 °F / 14.7 °C	92%	Calm	Calm	-	Clear
5:55 AM	62.6 °F / 17.0 °C	59.9 °F / 15.5 °C	91%	NNW	3.5 mph / 5.6 km/h / 1.5 m/s	-	Clear
6:55 AM	60.6 °F / 15.9 °C	58.1 °F / 14.5 °C	91%	Calm	Calm	-	Clear
7:55 AM	64.4 °F / 18.0 °C	61.7 °F / 16.5 °C	91%	Calm	Calm	-	Clear
8:55 AM	71.1 °F / 21.7 °C	62.4 °F / 16.9 °C	74%	Calm	Calm	-	Clear
9:55 AM	73.9 °F / 23.3 °C	61.2 °F / 16.2 °C	64%	ESE	4.6 mph / 7.4 km/h / 2.1 m/s	-	Clear
10:55 AM	75.2 °F / 24.0 °C	60.1 °F / 15.6 °C	59%	Calm	Calm	-	Partly Cloudy
11:55 AM	76.6 °F / 24.8 °C	62.8 °F / 17.1 °C	62%	Variable	4.6 mph / 7.4 km/h / 2.1 m/s	-	Overcast
12:55 PM	74.7 °F / 23.7 °C	62.1 °F / 16.7 °C	65%	WNW	5.8 mph / 9.3 km/h / 2.6 m/s	-	Overcast
1:55 PM	76.3 °F / 24.6 °C	61.5 °F / 16.4 °C	60%	SSE	3.5 mph / 5.6 km/h / 1.5 m/s	-	Overcast
2:55 PM	74.3 °F / 23.5 °C	62.8 °F / 17.1 °C	67%	NW	8.1 mph / 13.0 km/h / 3.6 m/s	-	Overcast
3:55 PM	73.4 °F / 23.0 °C	62.8 °F / 17.1 °C	69%	NW	8.1 mph / 13.0 km/h / 3.6 m/s	-	Mostly Cloudy
4:55 PM	73.0 °F / 22.8 °C	61.9 °F / 16.6 °C	68%	NW	9.2 mph / 14.8 km/h / 4.1 m/s	-	Overcast
5:55 PM	72.9 °F / 22.7 °C	61.5 °F / 16.4 °C	67%	NNW	6.9 mph / 11.1 km/h / 3.1 m/s	-	Overcast
6:55 PM	72.0 °F / 22.2 °C	61.7 °F / 16.5 °C	70%	NNE	4.6 mph / 7.4 km/h / 2.1 m/s	-	Overcast
7:55 PM	69.4 °F / 20.8 °C	62.8 °F / 17.1 °C	79%	East	3.5 mph / 5.6 km/h / 1.5 m/s	-	Partly Cloudy
8:55 PM	66.6 °F / 19.2 °C	62.4 °F / 16.9 °C	86%	ENE	2.3 mph / 3.7 km/h / 1.0 m/s	-	Scattered Clouds
9:55 PM	66.4 °F / 19.1 °C	62.8 °F / 17.1 °C	88%	Calm	Calm	-	Overcast
10:55 PM	66.2 °F / 19.0 °C	62.4 °F / 16.9 °C	88%	Calm	Calm	-	Mostly Cloudy
11:00 PM	66.2 °F / 19.0 °C	62.6 °F / 17.0 °C	88%	Calm	Calm	-	Scattered Clouds
11:55 PM	63.3 °F / 17.4 °C	60.3 °F / 15.7 °C	90%	WNW	3.5 mph / 5.6 km/h / 1.5 m/s	-	Clear



Data Source: Wheeler Army Airfield Weather Station - Airport Code (PHHI)

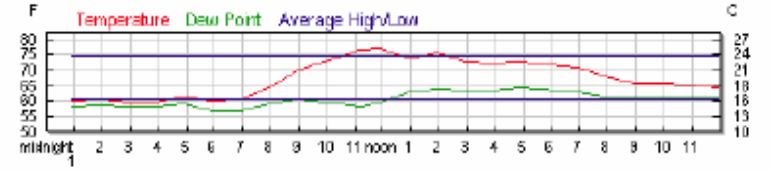
Notes

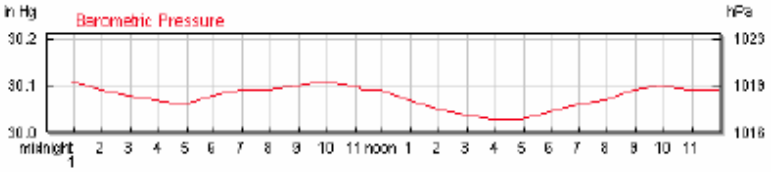
7 Mar 08 - Fri - CDI power washed roof, using water only unless mildew noted then JOMAX used as a mildewcide/remover.

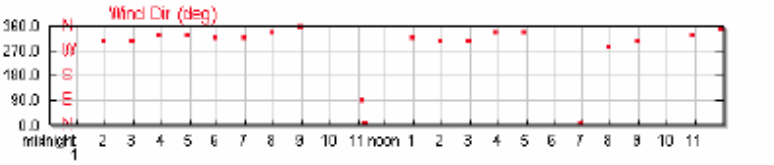
Required to notify base official 24 hours ahead for parking requirements. CDI notified SPC Schwartz – Barrack Mgr and Mr. Dean Kissinger DPW of requirements for blocking parking around the barracks for the remaining period of coating the roof.

WAAF Environmental Conditions
for 7 Mar 08

Time (HST):	Temp.:	Dew Point:	Humidity:	Wind Dir:	Wind Speed:	Gust Speed:	Conditions:
12:55 AM	60.6 °F / 15.9 °C	59.0 °F / 15.0 °C	94%	West	3.5 mph / 5.6 km/h / 1.5 m/s	-	Clear
1:55 AM	61.3 °F / 16.3 °C	59.2 °F / 15.1 °C	93%	NW	3.5 mph / 5.6 km/h / 1.5 m/s	-	Clear
2:55 AM	60.3 °F / 15.7 °C	58.6 °F / 14.8 °C	94%	NW	3.5 mph / 5.6 km/h / 1.5 m/s	-	Clear
3:55 AM	60.3 °F / 15.7 °C	58.6 °F / 14.8 °C	94%	NNW	2.3 mph / 3.7 km/h / 1.0 m/s	-	Clear
4:55 AM	62.1 °F / 16.7 °C	59.7 °F / 15.4 °C	92%	NNW	4.6 mph / 7.4 km/h / 2.1 m/s	-	Clear
5:55 AM	60.6 °F / 15.9 °C	57.6 °F / 14.2 °C	90%	NW	4.6 mph / 7.4 km/h / 2.1 m/s	-	Clear
6:55 AM	61.3 °F / 16.3 °C	57.6 °F / 14.2 °C	87%	NW	4.6 mph / 7.4 km/h / 2.1 m/s	-	Clear
7:55 AM	65.1 °F / 18.4 °C	59.9 °F / 15.5 °C	83%	NNW	2.3 mph / 3.7 km/h / 1.0 m/s	-	Clear
8:55 AM	70.7 °F / 21.5 °C	61.3 °F / 16.3 °C	72%	North	2.3 mph / 3.7 km/h / 1.0 m/s	-	Clear
9:55 AM	73.2 °F / 22.9 °C	60.4 °F / 15.8 °C	64%	Variable	2.3 mph / 3.7 km/h / 1.0 m/s	-	Clear
10:55 AM	76.3 °F / 24.6 °C	59.4 °F / 15.2 °C	56%	Variable	4.6 mph / 7.4 km/h / 2.1 m/s	-	Partly Cloudy
11:55 AM	77.5 °F / 25.3 °C	60.3 °F / 15.7 °C	55%	Calm	Calm	-	Mostly Cloudy
12:55 PM	74.3 °F / 23.5 °C	63.3 °F / 17.4 °C	68%	NW	11.5 mph / 18.5 km/h / 5.1 m/s	-	Overcast
1:55 PM	76.3 °F / 24.6 °C	64.6 °F / 18.1 °C	67%	NW	5.8 mph / 9.3 km/h / 2.6 m/s	-	Mostly Cloudy
2:55 PM	73.4 °F / 23.0 °C	64.0 °F / 17.8 °C	72%	NW	8.1 mph / 13.0 km/h / 3.6 m/s	-	Overcast
3:55 PM	72.7 °F / 22.6 °C	64.0 °F / 17.8 °C	74%	NNW	9.2 mph / 14.8 km/h / 4.1 m/s	-	Overcast
4:55 PM	73.2 °F / 22.9 °C	64.8 °F / 18.2 °C	75%	NNW	8.1 mph / 13.0 km/h / 3.6 m/s	-	Scattered Clouds
5:55 PM	71.6 °F / 22.0 °C	63.7 °F / 17.6 °C	76%	North	4.6 mph / 7.4 km/h / 2.1 m/s	-	Partly Cloudy
7:55 PM	68.7 °F / 20.4 °C	62.2 °F / 16.8 °C	80%	WNW	3.5 mph / 5.6 km/h / 1.5 m/s	-	Clear
8:55 PM	66.2 °F / 19.0 °C	62.2 °F / 16.8 °C	87%	NW	3.5 mph / 5.6 km/h / 1.5 m/s	-	Clear
9:55 PM	66.2 °F / 19.0 °C	62.1 °F / 16.7 °C	86%	Calm	Calm	-	Clear
10:55 PM	65.7 °F / 18.7 °C	62.1 °F / 16.7 °C	88%	NNW	3.5 mph / 5.6 km/h / 1.5 m/s	-	Clear
11:55 PM	64.8 °F / 18.2 °C	61.7 °F / 16.5 °C	90%	North	3.5 mph / 5.6 km/h / 1.5 m/s	-	Clear







Data Source: Wheeler Army Airfield Weather Station - Airport Code (PHHI)

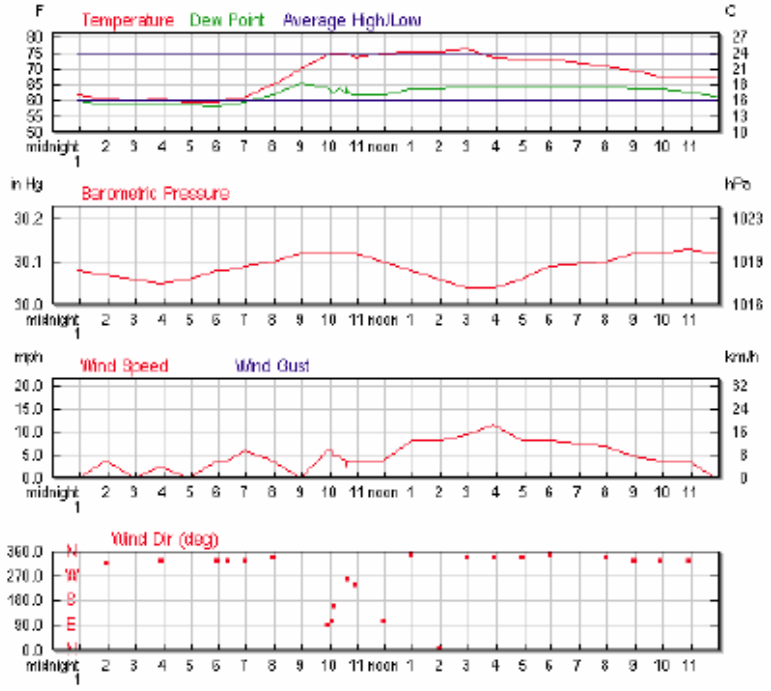
Notes

8 Mar 08 - Sat
Finished power washing, minimal sealing required

Made Test platform for Q-Panels and mounted panels with spacers beneath the screw heads for the Q-Panels to have stand off distance from the board to show edge wrap capabilities of the coating

WAAF Environmental Conditions
for 8 Mar 08

Time (HST):	Temp.:	Dew Point:	Humidity:	Wind Dir:	Wind Speed:	Gust Speed:	Conditions:
12:55 AM	62.2 °F / 16.8 °C	60.3 °F / 15.7 °C	93%	Calm	Calm	-	Clear
1:55 AM	60.4 °F / 15.8 °C	59.0 °F / 15.0 °C	95%	NW	3.5 mph / 5.6 km/h / 1.5 m/s	-	Clear
2:55 AM	60.3 °F / 15.7 °C	59.0 °F / 15.0 °C	96%	Calm	Calm	-	Clear
3:55 AM	60.6 °F / 15.9 °C	58.8 °F / 14.9 °C	94%	NNW	2.3 mph / 3.7 km/h / 1.0 m/s	-	Clear
4:55 AM	59.9 °F / 15.5 °C	58.6 °F / 14.8 °C	96%	Calm	Calm	-	Scattered Clouds
5:55 AM	59.7 °F / 15.4 °C	58.3 °F / 14.6 °C	95%	NNW	3.5 mph / 5.6 km/h / 1.5 m/s	-	Scattered Clouds
6:19 AM	60.8 °F / 16.0 °C	59.0 °F / 15.0 °C	94%	NNW	3.5 mph / 5.6 km/h / 1.5 m/s	-	Mostly Cloudy
6:55 AM	61.3 °F / 16.3 °C	59.7 °F / 15.4 °C	94%	NNW	5.8 mph / 9.3 km/h / 2.6 m/s	-	Mostly Cloudy
7:55 AM	65.3 °F / 18.5 °C	62.2 °F / 16.8 °C	90%	NNW	3.5 mph / 5.6 km/h / 1.5 m/s	-	Clear
8:55 AM	70.3 °F / 21.3 °C	65.5 °F / 18.6 °C	85%	Calm	Calm	-	Clear
9:55 AM	74.7 °F / 23.7 °C	64.4 °F / 18.0 °C	70%	East	5.8 mph / 9.3 km/h / 2.6 m/s	-	Scattered Clouds
10:04 AM	75.2 °F / 24.0 °C	62.6 °F / 17.0 °C	65%	ESE	5.8 mph / 9.3 km/h / 2.6 m/s	-	Mostly Cloudy
10:07 AM	75.2 °F / 24.0 °C	62.6 °F / 17.0 °C	65%	SSE	4.6 mph / 7.4 km/h / 2.1 m/s	-	Scattered Clouds
10:20 AM	75.2 °F / 24.0 °C	64.4 °F / 18.0 °C	69%	Variable	4.6 mph / 7.4 km/h / 2.1 m/s	-	Mostly Cloudy
10:33 AM	75.2 °F / 24.0 °C	62.6 °F / 17.0 °C	65%	Variable	3.5 mph / 5.6 km/h / 1.5 m/s	-	Mostly Cloudy
10:34 AM	75.2 °F / 24.0 °C	64.4 °F / 18.0 °C	69%	Variable	2.3 mph / 3.7 km/h / 1.0 m/s	-	Mostly Cloudy
10:38 AM	75.2 °F / 24.0 °C	62.6 °F / 17.0 °C	65%	West	3.5 mph / 5.6 km/h / 1.5 m/s	-	Mostly Cloudy
10:55 AM	73.9 °F / 23.3 °C	61.9 °F / 16.6 °C	66%	WSW	3.5 mph / 5.6 km/h / 1.5 m/s	-	Overcast
11:55 AM	75.2 °F / 24.0 °C	61.9 °F / 16.6 °C	63%	ESE	3.5 mph / 5.6 km/h / 1.5 m/s	-	Overcast
12:55 PM	75.7 °F / 24.3 °C	64.0 °F / 17.8 °C	67%	North	8.1 mph / 13.0 km/h / 3.6 m/s	-	Overcast
1:55 PM	75.7 °F / 24.3 °C	63.7 °F / 17.6 °C	66%	North	8.1 mph / 13.0 km/h / 3.6 m/s	-	Mostly Cloudy
2:55 PM	76.5 °F / 24.7 °C	64.9 °F / 18.3 °C	67%	NNW	9.2 mph / 14.8 km/h / 4.1 m/s	-	Mostly Cloudy
3:55 PM	74.1 °F / 23.4 °C	64.9 °F / 18.3 °C	73%	NNW	11.5 mph / 18.5 km/h / 5.1 m/s	-	Overcast
4:55 PM	73.6 °F / 23.1 °C	64.4 °F / 18.0 °C	73%	NNW	8.1 mph / 13.0 km/h / 3.6 m/s	-	Mostly Cloudy
5:55 PM	73.4 °F / 23.0 °C	64.4 °F / 18.0 °C	73%	North	8.1 mph / 13.0 km/h / 3.6 m/s	-	Overcast
7:55 PM	71.4 °F / 21.9 °C	64.6 °F / 18.1 °C	79%	NNW	6.9 mph / 11.1 km/h / 3.1 m/s	-	Mostly Cloudy
8:55 PM	70.0 °F / 21.1 °C	63.7 °F / 17.6 °C	80%	NNW	4.6 mph / 7.4 km/h / 2.1 m/s	-	Mostly Cloudy
9:55 PM	68.0 °F / 20.0 °C	63.7 °F / 17.6 °C	86%	NNW	3.5 mph / 5.6 km/h / 1.5 m/s	-	Scattered Clouds
10:55 PM	68.0 °F / 20.0 °C	63.0 °F / 17.2 °C	84%	NNW	3.5 mph / 5.6 km/h / 1.5 m/s	-	Overcast
11:55 PM	67.3 °F / 19.6 °C	61.5 °F / 16.4 °C	82%	Calm	Calm	-	Mostly Cloudy



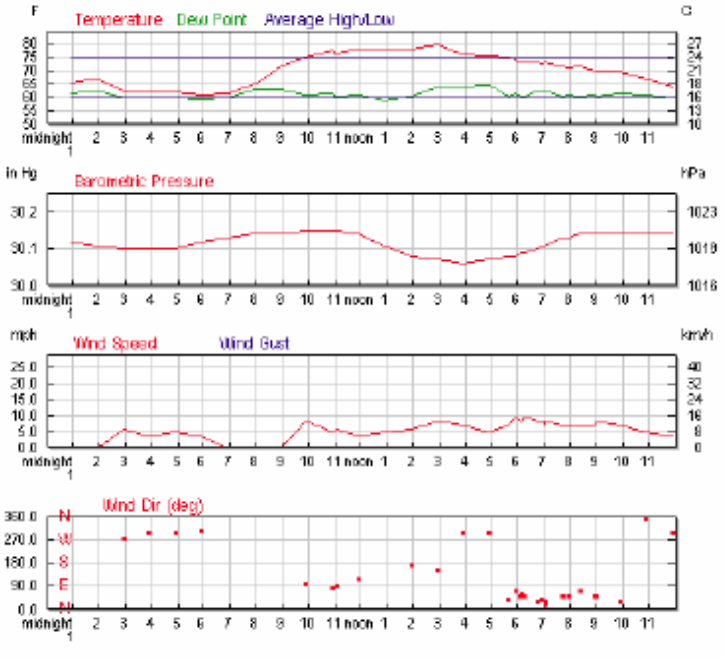
Data Source: Wheeler Army Airfield Weather Station - Airport Code (PHHI)

Notes

10 Mar 08 - Monday
0630
Parking not blocked by base personnel
CDI provided 9 covers for vehicles
The VFI™ consultant, Mr. Red Coleman provided the CDI applicators Gusmer/Probler spray equipment familiarization operations and mainte-nance training. He also provided the applicators with the VFI™ coating maintenance requirements .
Primer Application Started 1 person
1000 – cloudy, breezy – rain showers appeared imminent
Completed approx 1/3 of roof CDI personnel stopped at 1400

WAAF Environmental Conditions
for 10 Mar 08

Time (HST):	Temp.:	Dew Point:	Humidity:	Wind Dir:	Wind Speed:	Gust Speed:	Conditions:
12:55 AM	65.7 °F / 18.7 °C	61.5 °F / 16.4 °C	86%	Calm	Calm	-	Mostly Cloudy
1:55 AM	67.1 °F / 19.5 °C	62.8 °F / 17.1 °C	86%	Calm	Calm	-	Overcast
2:55 AM	63.0 °F / 17.2 °C	60.1 °F / 15.6 °C	90%	West	5.8 mph / 9.3 km/h / 2.6 m/s	-	Scattered Clouds
3:55 AM	62.4 °F / 16.9 °C	60.4 °F / 15.8 °C	93%	WNW	3.5 mph / 5.6 km/h / 1.5 m/s	-	Clear
4:55 AM	62.2 °F / 16.8 °C	60.3 °F / 15.7 °C	93%	WNW	4.6 mph / 7.4 km/h / 2.1 m/s	-	Clear
5:55 AM	61.0 °F / 16.1 °C	59.5 °F / 15.3 °C	95%	NW	3.5 mph / 5.6 km/h / 1.5 m/s	-	Clear
6:55 AM	61.7 °F / 16.5 °C	60.3 °F / 15.7 °C	95%	Calm	Calm	-	Clear
7:55 AM	65.5 °F / 18.6 °C	63.1 °F / 17.3 °C	92%	Calm	Calm	-	Clear
8:55 AM	71.8 °F / 22.1 °C	63.1 °F / 17.3 °C	74%	Calm	Calm	-	Clear
9:55 AM	75.6 °F / 24.2 °C	61.2 °F / 16.2 °C	61%	East	8.1 mph / 13.0 km/h / 3.6 m/s	-	Clear
10:55 AM	78.1 °F / 25.6 °C	61.5 °F / 16.4 °C	57%	East	4.6 mph / 7.4 km/h / 2.1 m/s	-	Mostly Cloudy
10:57 AM	77.0 °F / 25.0 °C	60.8 °F / 16.0 °C	57%	Variable	4.6 mph / 7.4 km/h / 2.1 m/s	-	Light Drizzle
11:06 AM	77.0 °F / 25.0 °C	60.8 °F / 16.0 °C	57%	East	5.8 mph / 9.3 km/h / 2.6 m/s	-	Mostly Cloudy
11:55 AM	78.4 °F / 25.8 °C	61.0 °F / 16.1 °C	55%	ESE	3.5 mph / 5.6 km/h / 1.5 m/s	-	Partly Cloudy
12:55 PM	78.3 °F / 25.7 °C	59.4 °F / 15.2 °C	52%	Variable	4.6 mph / 7.4 km/h / 2.1 m/s	-	Mostly Cloudy
1:55 PM	78.4 °F / 25.8 °C	60.8 °F / 16.0 °C	55%	South	5.8 mph / 9.3 km/h / 2.6 m/s	-	Mostly Cloudy
2:55 PM	79.7 °F / 26.5 °C	64.4 °F / 18.0 °C	59%	SSE	8.1 mph / 13.0 km/h / 3.6 m/s	18.4 mph / 29.6 km/h / 8.2 m/s	Mostly Cloudy
3:55 PM	76.5 °F / 24.7 °C	64.2 °F / 17.9 °C	66%	WNW	6.9 mph / 11.1 km/h / 3.1 m/s	-	Overcast
4:55 PM	75.9 °F / 24.4 °C	64.6 °F / 18.1 °C	68%	WNW	4.6 mph / 7.4 km/h / 2.1 m/s	-	Mostly Cloudy
5:38 PM	75.2 °F / 24.0 °C	60.8 °F / 16.0 °C	61%	NE	6.9 mph / 11.1 km/h / 3.1 m/s	-	Overcast
5:55 PM	74.5 °F / 23.6 °C	61.7 °F / 16.5 °C	64%	ENE	9.2 mph / 14.8 km/h / 4.1 m/s	-	Overcast
6:06 PM	73.4 °F / 23.0 °C	60.8 °F / 16.0 °C	65%	NE	8.1 mph / 13.0 km/h / 3.6 m/s	-	Mostly Cloudy
6:07 PM	73.4 °F / 23.0 °C	60.8 °F / 16.0 °C	65%	ENE	8.1 mph / 13.0 km/h / 3.6 m/s	-	Mostly Cloudy
6:16 PM	73.4 °F / 23.0 °C	60.8 °F / 16.0 °C	65%	NE	9.2 mph / 14.8 km/h / 4.1 m/s	-	Mostly Cloudy
6:46 PM	73.4 °F / 23.0 °C	62.6 °F / 17.0 °C	69%	NNE	8.1 mph / 13.0 km/h / 3.6 m/s	-	Mostly Cloudy
6:55 PM	73.0 °F / 22.8 °C	62.4 °F / 16.9 °C	69%	NE	8.1 mph / 13.0 km/h / 3.6 m/s	-	Mostly Cloudy
7:02 PM	73.4 °F / 23.0 °C	62.6 °F / 17.0 °C	69%	NNE	6.9 mph / 11.1 km/h / 3.1 m/s	-	Mostly Cloudy
7:03 PM	73.4 °F / 23.0 °C	62.6 °F / 17.0 °C	69%	NNE	8.1 mph / 13.0 km/h / 3.6 m/s	-	Mostly Cloudy
7:41 PM	71.6 °F / 22.0 °C	60.8 °F / 16.0 °C	69%	NE	6.9 mph / 11.1 km/h / 3.1 m/s	-	Scattered Clouds
7:55 PM	71.4 °F / 21.9 °C	61.0 °F / 16.1 °C	70%	NE	6.9 mph / 11.1 km/h / 3.1 m/s	-	Partly Cloudy
8:22 PM	71.6 °F / 22.0 °C	60.8 °F / 16.0 °C	69%	ENE	6.9 mph / 11.1 km/h / 3.1 m/s	-	Mostly Cloudy
8:55 PM	70.5 °F / 21.4 °C	61.3 °F / 16.3 °C	73%	NE	6.9 mph / 11.1 km/h / 3.1 m/s	-	Mostly Cloudy
8:59 PM	69.8 °F / 21.0 °C	60.8 °F / 16.0 °C	73%	NE	8.1 mph / 13.0 km/h / 3.6 m/s	-	Scattered Clouds
9:55 PM	69.6 °F / 20.9 °C	61.5 °F / 16.4 °C	75%	NNE	6.9 mph / 11.1 km/h / 3.1 m/s	-	Clear
10:55 PM	67.1 °F / 19.5 °C	61.0 °F / 16.1 °C	81%	North	4.6 mph / 7.4 km/h / 2.1 m/s	-	Clear
11:55 PM	64.4 °F / 18.0 °C	60.4 °F / 15.8 °C	87%	WNW	3.5 mph / 5.6 km/h / 1.5 m/s	-	Scattered Clouds



Data Source: Wheeler Army Airfield Weather Station - Airport Code (PHH)

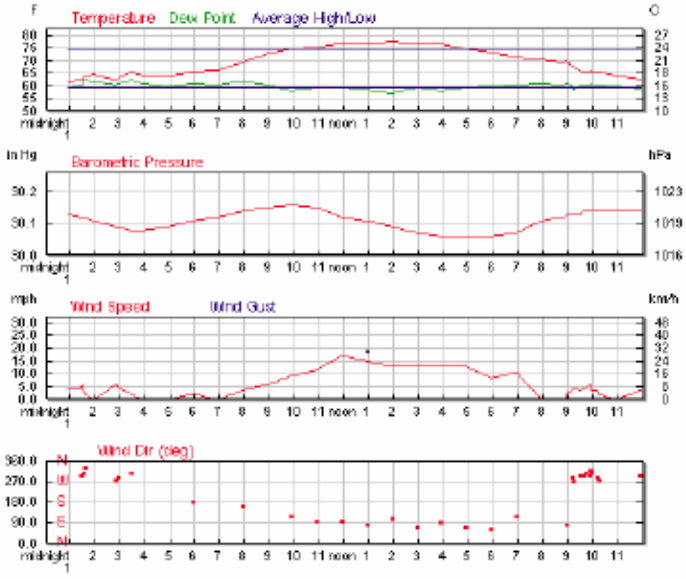
Notes

11 Mar 08 - Tuesday

Primer applied – although morning wind gusts were under the 15 mph blowing overspray was apparent. Light rain caused work stoppages at 1030, approx 1/6 roof completed.

WAAF Environmental Conditions
for 11 Mar 08

Time (HST):	Temp.:	Dew Point:	Humidity:	Wind Dir:	Wind Speed:	Gust Speed:	Conditions:
12:55 AM	62.1 °F / 16.7 °C	59.7 °F / 15.4 °C	92%	WNW	4.6 mph / 7.4 km/h / 2.1 m/s	-	Clear
1:25 AM	62.6 °F / 17.0 °C	60.8 °F / 16.0 °C	94%	WNW	4.6 mph / 7.4 km/h / 2.1 m/s	-	Light Drizzle
1:30 AM	62.6 °F / 17.0 °C	60.8 °F / 16.0 °C	94%	WNW	5.8 mph / 9.3 km/h / 2.6 m/s	-	Light Drizzle
1:34 AM	64.4 °F / 18.0 °C	62.6 °F / 17.0 °C	94%	NW	3.5 mph / 5.6 km/h / 1.5 m/s	-	Light Drizzle
1:35 AM	64.4 °F / 18.0 °C	62.6 °F / 17.0 °C	94%	NNW	2.3 mph / 3.7 km/h / 1.0 m/s	-	Mostly Cloudy
1:55 AM	65.1 °F / 18.4 °C	62.2 °F / 16.8 °C	90%	Calm	Calm	-	Overcast
2:51 AM	62.6 °F / 17.0 °C	60.8 °F / 16.0 °C	94%	West	5.8 mph / 9.3 km/h / 2.6 m/s	-	Mostly Cloudy
2:55 AM	63.7 °F / 17.6 °C	61.3 °F / 16.3 °C	92%	WNW	4.6 mph / 7.4 km/h / 2.1 m/s	-	Mostly Cloudy
3:27 AM	66.2 °F / 19.0 °C	62.6 °F / 17.0 °C	86%	NW	2.3 mph / 3.7 km/h / 1.0 m/s	-	Scattered Clouds
3:55 AM	64.6 °F / 18.1 °C	61.5 °F / 16.4 °C	90%	Calm	Calm	-	Mostly Cloudy
4:55 AM	64.2 °F / 17.9 °C	60.6 °F / 15.9 °C	86%	Calm	Calm	-	Scattered Clouds
5:55 AM	66.0 °F / 18.9 °C	61.3 °F / 16.3 °C	85%	South	2.3 mph / 3.7 km/h / 1.0 m/s	-	Mostly Cloudy
6:55 AM	66.6 °F / 19.2 °C	60.8 °F / 16.0 °C	82%	Calm	Calm	-	Partly Cloudy
7:55 AM	70.0 °F / 21.1 °C	62.1 °F / 16.7 °C	76%	SSE	3.5 mph / 5.6 km/h / 1.5 m/s	-	Clear
8:55 AM	73.4 °F / 23.0 °C	61.0 °F / 16.1 °C	65%	Variable	5.8 mph / 9.3 km/h / 2.6 m/s	-	Partly Cloudy
9:55 AM	75.2 °F / 24.0 °C	58.6 °F / 14.8 °C	56%	ESE	9.2 mph / 14.8 km/h / 4.1 m/s	-	Partly Cloudy
10:55 AM	75.7 °F / 24.3 °C	60.1 °F / 15.6 °C	58%	East	11.5 mph / 18.5 km/h / 5.1 m/s	-	Mostly Cloudy
11:55 AM	77.5 °F / 25.3 °C	60.1 °F / 15.6 °C	55%	East	17.3 mph / 27.8 km/h / 7.7 m/s	21.9 mph / 35.2 km/h / 9.8 m/s	Partly Cloudy
12:55 PM	77.2 °F / 25.1 °C	59.0 °F / 15.0 °C	53%	East	15.0 mph / 24.1 km/h / 6.7 m/s	18.4 mph / 29.6 km/h / 8.2 m/s	Scattered Clouds
1:55 PM	78.1 °F / 25.6 °C	57.6 °F / 14.2 °C	49%	ESE	12.7 mph / 20.4 km/h / 5.7 m/s	-	Partly Cloudy
2:55 PM	77.0 °F / 25.0 °C	60.1 °F / 15.6 °C	56%	ENE	12.7 mph / 20.4 km/h / 5.7 m/s	-	Mostly Cloudy
3:55 PM	77.0 °F / 25.0 °C	58.6 °F / 14.8 °C	53%	East	12.7 mph / 20.4 km/h / 5.7 m/s	-	Scattered Clouds
4:55 PM	75.4 °F / 24.1 °C	59.9 °F / 15.5 °C	58%	ENE	12.7 mph / 20.4 km/h / 5.7 m/s	-	Mostly Cloudy
5:55 PM	73.8 °F / 23.2 °C	60.6 °F / 15.9 °C	63%	ENE	8.1 mph / 13.0 km/h / 3.6 m/s	-	Mostly Cloudy
6:55 PM	72.0 °F / 22.2 °C	61.0 °F / 16.1 °C	66%	ESE	10.4 mph / 16.7 km/h / 4.6 m/s	-	Partly Cloudy
7:55 PM	70.7 °F / 21.5 °C	61.2 °F / 16.2 °C	72%	Calm	Calm	-	Scattered Clouds
8:44 PM	69.8 °F / 21.0 °C	60.8 °F / 16.0 °C	73%	Calm	Calm	-	Mostly Cloudy
8:49 PM	69.8 °F / 21.0 °C	60.8 °F / 16.0 °C	73%	Calm	Calm	-	Mostly Cloudy
8:55 PM	70.3 °F / 21.3 °C	61.3 °F / 16.3 °C	73%	East	2.3 mph / 3.7 km/h / 1.0 m/s	-	Mostly Cloudy
9:10 PM	68.0 °F / 20.0 °C	60.8 °F / 16.0 °C	78%	WNW	3.5 mph / 5.6 km/h / 1.5 m/s	-	Mostly Cloudy
9:13 PM	68.0 °F / 20.0 °C	59.0 °F / 15.0 °C	73%	West	4.6 mph / 7.4 km/h / 2.1 m/s	-	Mostly Cloudy
9:29 PM	66.2 °F / 19.0 °C	60.8 °F / 16.0 °C	83%	WNW	3.5 mph / 5.6 km/h / 1.5 m/s	-	Mostly Cloudy
9:37 PM	66.2 °F / 19.0 °C	60.8 °F / 16.0 °C	83%	WNW	4.6 mph / 7.4 km/h / 2.1 m/s	-	Overcast
9:44 PM	66.2 °F / 19.0 °C	60.8 °F / 16.0 °C	83%	NW	4.6 mph / 7.4 km/h / 2.1 m/s	-	Mostly Cloudy
9:53 PM	66.2 °F / 19.0 °C	60.8 °F / 16.0 °C	83%	WNW	5.8 mph / 9.3 km/h / 2.6 m/s	-	Mostly Cloudy
9:55 PM	66.4 °F / 19.1 °C	61.2 °F / 16.2 °C	83%	NW	4.6 mph / 7.4 km/h / 2.1 m/s	-	Mostly Cloudy
9:56 PM	66.2 °F / 19.0 °C	60.8 °F / 16.0 °C	83%	NW	3.5 mph / 5.6 km/h / 1.5 m/s	-	Mostly Cloudy
9:57 PM	66.2 °F / 19.0 °C	60.8 °F / 16.0 °C	83%	NW	3.5 mph / 5.6 km/h / 1.5 m/s	-	Mostly Cloudy
10:10 PM	66.2 °F / 19.0 °C	60.8 °F / 16.0 °C	83%	WNW	3.5 mph / 5.6 km/h / 1.5 m/s	-	Mostly Cloudy
10:15 PM	66.2 °F / 19.0 °C	60.8 °F / 16.0 °C	83%	West	2.3 mph / 3.7 km/h / 1.0 m/s	-	Overcast
10:55 PM	64.9 °F / 18.3 °C	60.6 °F / 15.9 °C	86%	Calm	Calm	-	Scattered Clouds
11:55 PM	63.5 °F / 17.5 °C	59.5 °F / 15.3 °C	87%	WNW	3.5 mph / 5.6 km/h / 1.5 m/s	-	Clear



WAAF Environmental Conditions
for 12 Mar 08

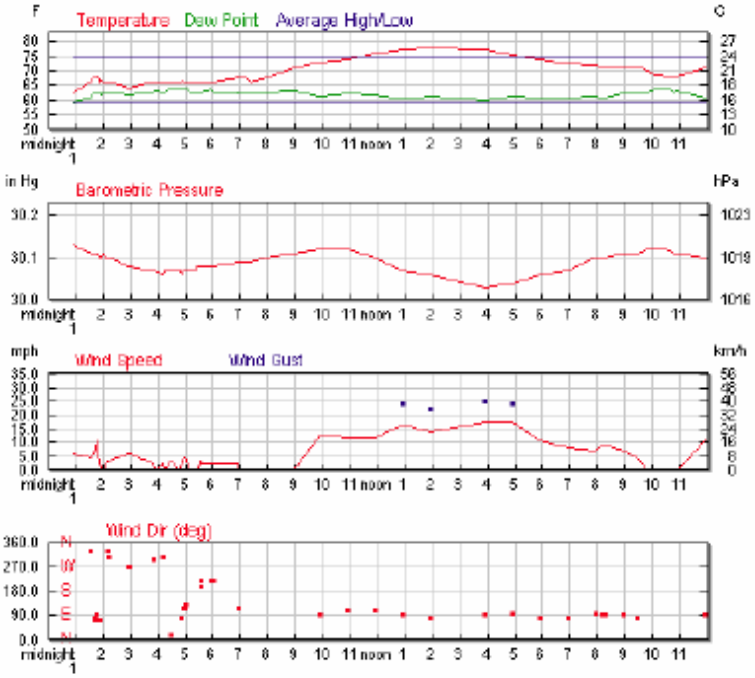
Data Source: Wheeler Army Airfield Weather Station - Airport Code (PHHI)

Notes

12 Mar 08 - Wed
0630 Start - Roof surface wet from early AM showers. Dried quickly

Priming ops completed in the afternoon

Time (HST):	Temp.:	Dew Point:	Humidity:	Wind Dir:	Wind Speed:	Gust Speed:	Conditions:
12:55 AM	62.6 °F / 17.0 °C	59.2 °F / 15.1 °C	89%	WNW	5.8 mph / 9.3 km/h / 2.6 m/s	-	Clear
1:55 AM	66.7 °F / 19.3 °C	61.9 °F / 16.6 °C	84%	Calm	Calm	-	Heavy Drizzle
2:55 AM	64.4 °F / 18.0 °C	61.7 °F / 16.5 °C	91%	West	5.8 mph / 9.3 km/h / 2.6 m/s	-	Mostly Cloudy
3:55 AM	65.8 °F / 18.8 °C	63.0 °F / 17.2 °C	90%	Calm	Calm	-	Overcast
4:11 AM	66.2 °F / 19.0 °C	62.6 °F / 17.0 °C	88%	NW	2.3 mph / 3.7 km/h / 1.0 m/s	-	Light Drizzle
4:55 AM	66.7 °F / 19.3 °C	63.9 °F / 17.7 °C	90%	ESE	3.5 mph / 5.6 km/h / 1.5 m/s	-	Light Drizzle
5:30 AM	66.2 °F / 19.0 °C	62.6 °F / 17.0 °C	88%	Variable	3.5 mph / 5.6 km/h / 1.5 m/s	-	Light Drizzle
5:55 AM	65.8 °F / 18.8 °C	63.5 °F / 17.5 °C	92%	SW	2.3 mph / 3.7 km/h / 1.0 m/s	-	Overcast
6:02 AM	66.2 °F / 19.0 °C	62.6 °F / 17.0 °C	88%	SW	2.3 mph / 3.7 km/h / 1.0 m/s	-	Overcast
6:55 AM	67.5 °F / 19.7 °C	62.2 °F / 16.8 °C	83%	ESE	2.3 mph / 3.7 km/h / 1.0 m/s	-	Mostly Cloudy
7:55 AM	67.5 °F / 19.7 °C	62.6 °F / 17.0 °C	84%	Calm	Calm	-	Scattered Clouds
8:55 AM	71.1 °F / 21.7 °C	63.3 °F / 17.4 °C	76%	Calm	Calm	-	Overcast
9:55 AM	73.0 °F / 22.8 °C	61.2 °F / 16.2 °C	66%	East	12.7 mph / 20.4 km/h / 5.7 m/s	-	Overcast
10:55 AM	73.8 °F / 23.2 °C	62.2 °F / 16.8 °C	67%	ESE	11.5 mph / 18.5 km/h / 5.1 m/s	-	Overcast
11:55 AM	75.6 °F / 24.2 °C	61.7 °F / 16.5 °C	62%	ESE	11.5 mph / 18.5 km/h / 5.1 m/s	km/h / 8.2 m/s	Mostly Cloudy
12:55 PM	77.0 °F / 25.0 °C	60.4 °F / 15.8 °C	56%	East	16.1 mph / 25.9 km/h / 7.2 m/s	km/h / 10.8 m/s	Partly Cloudy
1:55 PM	77.7 °F / 25.4 °C	61.3 °F / 16.3 °C	57%	East	13.8 mph / 22.2 km/h / 6.2 m/s	km/h / 9.8 m/s	Mostly Cloudy
3:55 PM	77.2 °F / 25.1 °C	59.9 °F / 15.5 °C	55%	East	17.3 mph / 27.8 km/h / 7.7 m/s	km/h / 11.3 m/s	Clear
4:55 PM	75.4 °F / 24.1 °C	61.3 °F / 16.3 °C	62%	East	17.3 mph / 27.8 km/h / 7.7 m/s	km/h / 10.8 m/s	Partly Cloudy
5:55 PM	73.6 °F / 23.1 °C	60.6 °F / 15.9 °C	64%	East	10.4 mph / 16.7 km/h / 4.6 m/s	-	Partly Cloudy
6:55 PM	72.3 °F / 22.4 °C	61.0 °F / 16.1 °C	67%	East	8.1 mph / 13.0 km/h / 3.6 m/s	-	Overcast
7:55 PM	72.1 °F / 22.3 °C	61.3 °F / 16.3 °C	69%	East	6.9 mph / 11.1 km/h / 3.1 m/s	-	Overcast
8:17 PM	71.6 °F / 22.0 °C	60.8 °F / 16.0 °C	69%	East	9.2 mph / 14.8 km/h / 4.1 m/s	-	Overcast
8:55 PM	70.9 °F / 21.6 °C	62.1 °F / 16.7 °C	74%	East	6.9 mph / 11.1 km/h / 3.1 m/s	-	Mostly Cloudy
9:55 PM	69.1 °F / 20.6 °C	63.1 °F / 17.3 °C	81%	Calm	Calm	-	Mostly Cloudy
10:32 PM	68.0 °F / 20.0 °C	64.4 °F / 18.0 °C	88%	Calm	Calm	-	Light Drizzle
10:55 PM	68.2 °F / 20.1 °C	63.3 °F / 17.4 °C	84%	Calm	Calm	-	Mostly Cloudy
11:55 PM	71.1 °F / 21.7 °C	60.6 °F / 15.9 °C	69%	East	10.4 mph / 16.7 km/h / 4.6 m/s	-	Overcast



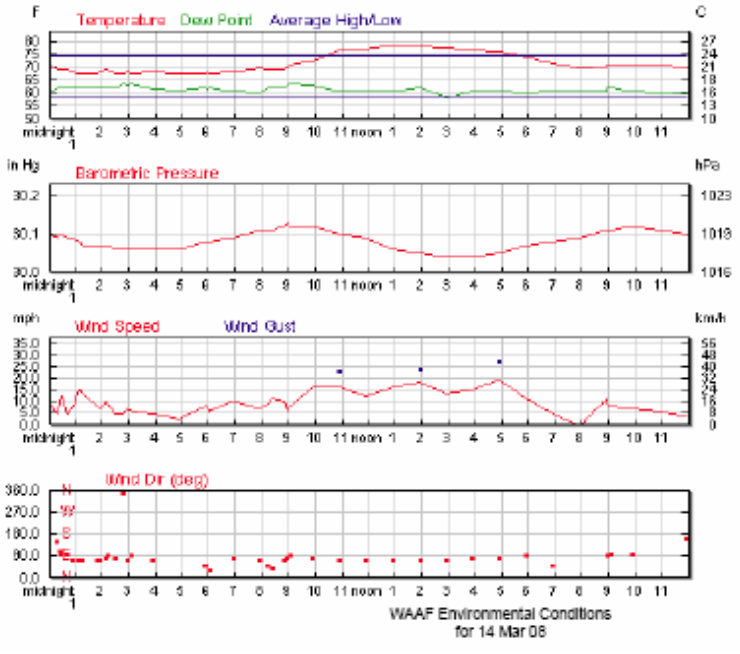
Data Source: Wheeler Army Airfield Weather Station - Airport Code (PHHI)

Notes

13 Mar 08 - Thursday
0630 Start - Early showers stopped Ops until roof dried
Changed spray tip to .02. Less back pressure, seem less material is pumped through and overspray seems to be reduced. Dropped pressure to 1200 psi at gun
Hose temp remains 150 degrees F
02 tip produces an oval pattern not round like the 01 tip - more appropriate for this spraying operation
Rental generator keeps shutting off – CDI took generator back to the rental agency for a change out. Had to shut down Ops until generator is back in place.
Started back 1100 hrs
1230 slight misting of rain – Ops continued – applicator said the hot roof dried the light mist on contact.
1250 wind gust increasing and heavy clouds approaching. Ops stopped for the day.

WAAF Environmental Conditions
for 13 Mar 08

Time (HST):	Temp.:	Dew Point:	Humidity:	Wind Dir:	Wind Speed:	Gust Speed:	Conditions:
12:00 AM	71.6 °F / 22.0 °C	60.8 °F / 16.0 °C	69%	East	9.2 mph / 14.8 km/h / 4.1 m/s	-	Light Drizzle
12:20 AM	69.8 °F / 21.0 °C	62.6 °F / 17.0 °C	78%	SSE	4.6 mph / 7.4 km/h / 2.1 m/s	-	Mostly Cloudy
12:26 AM	69.8 °F / 21.0 °C	62.6 °F / 17.0 °C	78%	ESE	9.2 mph / 14.8 km/h / 4.1 m/s	-	Light Drizzle
12:29 AM	69.8 °F / 21.0 °C	62.6 °F / 17.0 °C	78%	East	12.7 mph / 20.4 km/h / 5.7 m/s	-	Light Drizzle
12:42 AM	69.8 °F / 21.0 °C	62.6 °F / 17.0 °C	78%	East	4.6 mph / 7.4 km/h / 2.1 m/s	-	Scattered Clouds
12:55 AM	68.5 °F / 20.3 °C	63.0 °F / 17.2 °C	82%	ENE	8.1 mph / 13.0 km/h / 3.6 m/s	-	Partly Cloudy
1:08 AM	68.0 °F / 20.0 °C	62.6 °F / 17.0 °C	83%	ENE	15.0 mph / 24.1 km/h / 6.7 m/s	-	Light Drizzle
1:17 AM	68.0 °F / 20.0 °C	62.6 °F / 17.0 °C	83%	ENE	13.8 mph / 22.2 km/h / 6.2 m/s	-	Partly Cloudy
1:51 AM	68.0 °F / 20.0 °C	62.6 °F / 17.0 °C	83%	ENE	8.1 mph / 13.0 km/h / 3.6 m/s	-	Light Drizzle
1:55 AM	68.5 °F / 20.3 °C	63.0 °F / 17.2 °C	82%	ENE	6.9 mph / 11.1 km/h / 3.1 m/s	-	Light Drizzle
2:10 AM	69.8 °F / 21.0 °C	62.6 °F / 17.0 °C	78%	East	10.4 mph / 16.7 km/h / 4.6 m/s	-	Mostly Cloudy
2:12 AM	69.8 °F / 21.0 °C	62.6 °F / 17.0 °C	78%	East	9.2 mph / 14.8 km/h / 4.1 m/s	-	Light Drizzle
2:29 AM	68.0 °F / 20.0 °C	62.6 °F / 17.0 °C	83%	East	4.6 mph / 7.4 km/h / 2.1 m/s	-	Mostly Cloudy
2:46 AM	68.0 °F / 20.0 °C	64.4 °F / 18.0 °C	88%	North	4.6 mph / 7.4 km/h / 2.1 m/s	-	Light Drizzle
2:55 AM	68.4 °F / 20.2 °C	63.9 °F / 17.7 °C	85%	ENE	6.9 mph / 11.1 km/h / 3.1 m/s	-	Light Drizzle
3:08 AM	68.0 °F / 20.0 °C	64.4 °F / 18.0 °C	88%	East	5.8 mph / 9.3 km/h / 2.6 m/s	-	Overcast
3:55 AM	68.4 °F / 20.2 °C	62.4 °F / 16.9 °C	81%	ENE	4.6 mph / 7.4 km/h / 2.1 m/s	-	Overcast
4:55 AM	68.2 °F / 20.1 °C	61.5 °F / 16.4 °C	79%	Variable	2.3 mph / 3.7 km/h / 1.0 m/s	-	Mostly Cloudy
5:52 AM	68.0 °F / 20.0 °C	62.6 °F / 17.0 °C	83%	NE	8.1 mph / 13.0 km/h / 3.6 m/s	-	Mostly Cloudy
5:55 AM	68.4 °F / 20.2 °C	61.9 °F / 16.6 °C	80%	NE	8.1 mph / 13.0 km/h / 3.6 m/s	-	Mostly Cloudy
6:01 AM	68.0 °F / 20.0 °C	62.6 °F / 17.0 °C	83%	NNE	5.8 mph / 9.3 km/h / 2.6 m/s	-	Mostly Cloudy
6:55 AM	68.5 °F / 20.3 °C	61.2 °F / 16.2 °C	77%	East	10.4 mph / 16.7 km/h / 4.6 m/s	-	Overcast
7:55 AM	70.2 °F / 21.2 °C	60.6 °F / 15.9 °C	72%	ENE	6.9 mph / 11.1 km/h / 3.1 m/s	-	Mostly Cloudy
8:14 AM	69.8 °F / 21.0 °C	62.6 °F / 17.0 °C	78%	NE	9.2 mph / 14.8 km/h / 4.1 m/s	-	Light Drizzle
8:23 AM	69.8 °F / 21.0 °C	62.6 °F / 17.0 °C	78%	NE	11.5 mph / 18.5 km/h / 5.1 m/s	-	Scattered Clouds
8:50 AM	69.8 °F / 21.0 °C	62.6 °F / 17.0 °C	78%	ENE	10.4 mph / 16.7 km/h / 4.6 m/s	-	Mostly Cloudy
8:55 AM	70.3 °F / 21.3 °C	63.9 °F / 17.7 °C	80%	East	5.8 mph / 9.3 km/h / 2.6 m/s	-	Light Drizzle
9:04 AM	71.6 °F / 22.0 °C	64.4 °F / 18.0 °C	78%	East	8.1 mph / 13.0 km/h / 3.6 m/s	-	Mostly Cloudy
9:55 AM	73.2 °F / 22.9 °C	63.5 °F / 17.5 °C	71%	East	16.1 mph / 25.9 km/h / 7.2 m/s	km/h / 10.8 m/s	Mostly Cloudy
10:55 AM	77.0 °F / 25.0 °C	61.0 °F / 16.1 °C	58%	ENE	16.1 mph / 25.9 km/h / 7.2 m/s	23.0 mph / 37.0	Clear
11:55 AM	77.4 °F / 25.2 °C	61.5 °F / 16.4 °C	58%	ENE	12.7 mph / 20.4 km/h / 5.7 m/s	-	Partly Cloudy
12:55 PM	79.2 °F / 26.2 °C	61.0 °F / 16.1 °C	54%	ENE	16.1 mph / 25.9 km/h / 7.2 m/s	km/h / 10.8 m/s	Clear
1:55 PM	78.4 °F / 25.8 °C	62.8 °F / 17.1 °C	58%	ENE	18.4 mph / 29.6 km/h / 8.2 m/s	km/h / 10.8 m/s	Mostly Cloudy
2:55 PM	78.1 °F / 25.6 °C	58.6 °F / 14.8 °C	51%	ENE	13.8 mph / 22.2 km/h / 6.2 m/s	-	Overcast
3:55 PM	77.0 °F / 25.0 °C	61.3 °F / 16.3 °C	58%	East	15.0 mph / 24.1 km/h / 6.7 m/s	km/h / 11.3 m/s	Scattered Clouds
4:55 PM	76.5 °F / 24.7 °C	61.2 °F / 16.2 °C	59%	East	19.6 mph / 31.5 km/h / 8.7 m/s	km/h / 12.3 m/s	Partly Cloudy
5:55 PM	74.5 °F / 23.6 °C	60.8 °F / 16.0 °C	62%	East	11.5 mph / 18.5 km/h / 5.1 m/s	-	Partly Cloudy
6:55 PM	72.1 °F / 22.3 °C	61.2 °F / 16.2 °C	68%	NE	4.6 mph / 7.4 km/h / 2.1 m/s	-	Clear
7:55 PM	70.3 °F / 21.3 °C	61.2 °F / 16.2 °C	73%	Calm	Calm	-	Partly Cloudy
8:55 PM	70.7 °F / 21.5 °C	61.3 °F / 16.3 °C	72%	East	11.5 mph / 18.5 km/h / 5.1 m/s	-	Partly Cloudy
8:57 PM	71.6 °F / 22.0 °C	62.6 °F / 17.0 °C	73%	East	9.2 mph / 14.8 km/h / 4.1 m/s	-	Light Drizzle
9:06 PM	71.6 °F / 22.0 °C	62.6 °F / 17.0 °C	73%	East	8.1 mph / 13.0 km/h / 3.6 m/s	-	Partly Cloudy
9:55 PM	70.9 °F / 21.6 °C	61.2 °F / 16.2 °C	71%	East	6.9 mph / 11.1 km/h / 3.1 m/s	-	Scattered Clouds
10:55 PM	71.1 °F / 21.7 °C	60.6 °F / 15.9 °C	69%	Variable	5.8 mph / 9.3 km/h / 2.6 m/s	-	Mostly Cloudy
11:55 PM	70.5 °F / 21.4 °C	60.4 °F / 15.8 °C	70%	SSE	3.5 mph / 5.6 km/h / 1.5 m/s	-	Mostly Cloudy



WAAF Environmental Conditions
for 14 Mar 08

Data Source: Wheeler Army Airfield Weather Station - Airport Code (PHHI)

Notes

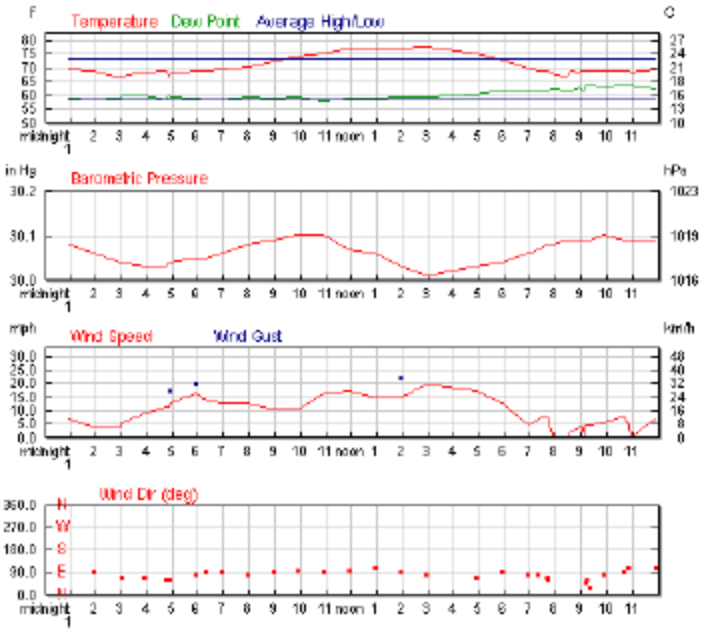
14 Mar 08 - Friday
0700 Very light shower – applicators continued spraying said the heat from the roof immediately dried the any rain

Met Jeff Awana – Sale rep Bonded Materials Co.- local distributor of silicone coating
Solventless Silicone Coating S2000 White
One component moisture cure
$295/5gl pail, with thickness coverage averages out to $.69 sq ft

Note primer is past three days overcoat window. Consultant Red Coleman Cell (206) 618-6594 Office (509) 997-3660 stated the overcoat window listed on data sheet really doesn't apply as long as the surface is clean and dry. Will this affect the warranty??

CDI worked through lunch, stopped at 1320 due to pending bad weather.

Time (HST):	Temp.:	Dew Point:	Humidity:	Wind Dir:	Wind Speed:	Gust Speed:	Conditions:
12:55 AM	70.0 °F / 21.1 °C	59.9 °F / 15.5 °C	70%	East	6.9 mph / 11.1 km/h / 3.1 m/s	-	Mostly Cloudy
1:55 AM	69.8 °F / 21.0 °C	59.4 °F / 15.2 °C	69%	East	3.5 mph / 5.6 km/h / 1.5 m/s	-	Scattered Clouds
2:55 AM	67.3 °F / 19.6 °C	59.5 °F / 15.3 °C	76%	Variable	3.5 mph / 5.6 km/h / 1.5 m/s	-	Light Drizzle
3:01 AM	68.0 °F / 20.0 °C	60.8 °F / 16.0 °C	78%	ENE	5.8 mph / 9.3 km/h / 2.6 m/s	-	Mostly Cloudy
3:55 AM	69.3 °F / 20.7 °C	60.4 °F / 15.8 °C	73%	ENE	9.2 mph / 14.8 km/h / 4.1 m/s	-	Mostly Cloudy
4:43 AM	69.8 °F / 21.0 °C	59.0 °F / 15.0 °C	68%	ENE	11.5 mph / 18.5 km/h / 5.1 m/s	-	Drizzle
4:52 AM	68.0 °F / 20.0 °C	60.8 °F / 16.0 °C	78%	ENE	11.5 mph / 18.5 km/h / 5.1 m/s	km/h / 7.7 m/s	Mostly Cloudy
4:55 AM	68.7 °F / 20.4 °C	60.3 °F / 15.7 °C	74%	ENE	12.7 mph / 20.4 km/h / 5.7 m/s	km/h / 7.7 m/s	Mostly Cloudy
5:55 AM	69.8 °F / 21.0 °C	59.7 °F / 15.4 °C	70%	East	16.1 mph / 25.9 km/h / 7.2 m/s	km/h / 8.7 m/s	Mostly Cloudy
6:18 AM	69.8 °F / 21.0 °C	59.0 °F / 15.0 °C	68%	East	13.8 mph / 22.2 km/h / 6.2 m/s	-	Overcast
6:55 AM	70.3 °F / 21.3 °C	59.2 °F / 15.1 °C	68%	East	12.7 mph / 20.4 km/h / 5.7 m/s	-	Mostly Cloudy
7:55 AM	71.1 °F / 21.7 °C	60.3 °F / 15.7 °C	69%	East	12.7 mph / 20.4 km/h / 5.7 m/s	-	Scattered Clouds
8:55 AM	72.9 °F / 22.7 °C	59.9 °F / 15.5 °C	64%	East	10.4 mph / 16.7 km/h / 4.6 m/s	-	Partly Cloudy
9:55 AM	74.8 °F / 23.8 °C	60.3 °F / 15.7 °C	60%	East	10.4 mph / 16.7 km/h / 4.6 m/s	-	Clear
10:55 AM	75.9 °F / 24.4 °C	58.8 °F / 14.9 °C	55%	East	16.1 mph / 25.9 km/h / 7.2 m/s	-	Partly Cloudy
11:55 AM	77.9 °F / 25.5 °C	59.5 °F / 15.3 °C	53%	East	17.3 mph / 27.8 km/h / 7.7 m/s	-	Clear
12:55 PM	77.9 °F / 25.5 °C	59.9 °F / 15.5 °C	54%	ESE	15.0 mph / 24.1 km/h / 6.7 m/s	km/h / 10.3 m/s	Partly Cloudy
1:55 PM	78.1 °F / 25.6 °C	60.1 °F / 15.6 °C	54%	East	15.0 mph / 24.1 km/h / 6.7 m/s	km/h / 9.8 m/s	Clear
2:55 PM	78.4 °F / 25.8 °C	60.3 °F / 15.7 °C	53%	East	19.6 mph / 31.5 km/h / 8.7 m/s	-	Clear
4:55 PM	76.1 °F / 24.5 °C	61.3 °F / 16.3 °C	60%	ENE	17.3 mph / 27.8 km/h / 7.7 m/s	-	Mostly Cloudy
5:55 PM	73.4 °F / 23.0 °C	62.4 °F / 16.9 °C	68%	East	12.7 mph / 20.4 km/h / 5.7 m/s	-	Scattered Clouds
6:55 PM	70.7 °F / 21.5 °C	61.9 °F / 16.6 °C	74%	East	4.6 mph / 7.4 km/h / 2.1 m/s	-	Partly Cloudy
7:19 PM	69.8 °F / 21.0 °C	62.6 °F / 17.0 °C	78%	East	6.9 mph / 11.1 km/h / 3.1 m/s	-	Scattered Clouds
7:40 PM	69.8 °F / 21.0 °C	62.6 °F / 17.0 °C	78%	ENE	8.1 mph / 13.0 km/h / 3.6 m/s	-	Mostly Cloudy
7:41 PM	69.8 °F / 21.0 °C	62.6 °F / 17.0 °C	78%	ENE	6.9 mph / 11.1 km/h / 3.1 m/s	-	Mostly Cloudy
7:43 PM	69.8 °F / 21.0 °C	62.6 °F / 17.0 °C	78%	ENE	5.8 mph / 9.3 km/h / 2.6 m/s	-	Scattered Clouds
7:55 PM	68.5 °F / 20.3 °C	63.0 °F / 17.2 °C	82%	Calm	Calm	-	Scattered Clouds
8:25 PM	68.0 °F / 20.0 °C	62.6 °F / 17.0 °C	83%	Calm	Calm	-	Mostly Cloudy
8:35 PM	69.8 °F / 21.0 °C	62.6 °F / 17.0 °C	78%	Variable	2.3 mph / 3.7 km/h / 1.0 m/s	-	Scattered Clouds
8:55 PM	69.4 °F / 20.8 °C	63.5 °F / 17.5 °C	81%	Variable	3.5 mph / 5.6 km/h / 1.5 m/s	-	Scattered Clouds
9:04 PM	69.8 °F / 21.0 °C	62.6 °F / 17.0 °C	78%	Variable	3.5 mph / 5.6 km/h / 1.5 m/s	-	Mostly Cloudy
9:06 PM	69.8 °F / 21.0 °C	62.6 °F / 17.0 °C	78%	Calm	Calm	-	Light Drizzle
9:11 PM	69.8 °F / 21.0 °C	64.4 °F / 18.0 °C	83%	NE	4.6 mph / 7.4 km/h / 2.1 m/s	-	Light Drizzle
9:15 PM	69.8 °F / 21.0 °C	64.4 °F / 18.0 °C	83%	ENE	4.6 mph / 7.4 km/h / 2.1 m/s	-	Mostly Cloudy
9:20 PM	69.8 °F / 21.0 °C	64.4 °F / 18.0 °C	83%	NNE	4.6 mph / 7.4 km/h / 2.1 m/s	-	Mostly Cloudy
9:55 PM	69.6 °F / 20.9 °C	63.9 °F / 17.7 °C	82%	East	5.8 mph / 9.3 km/h / 2.6 m/s	-	Overcast
10:42 PM	69.8 °F / 21.0 °C	64.4 °F / 18.0 °C	83%	East	8.1 mph / 13.0 km/h / 3.6 m/s	-	Overcast
10:50 PM	69.8 °F / 21.0 °C	64.4 °F / 18.0 °C	83%	ESE	4.6 mph / 7.4 km/h / 2.1 m/s	-	Overcast
10:55 PM	69.1 °F / 20.6 °C	64.4 °F / 18.0 °C	85%	Calm	Calm	-	Overcast
11:55 PM	70.0 °F / 21.1 °C	63.0 °F / 17.2 °C	78%	ESE	6.9 mph / 11.1 km/h / 3.1 m/s	-	Overcast



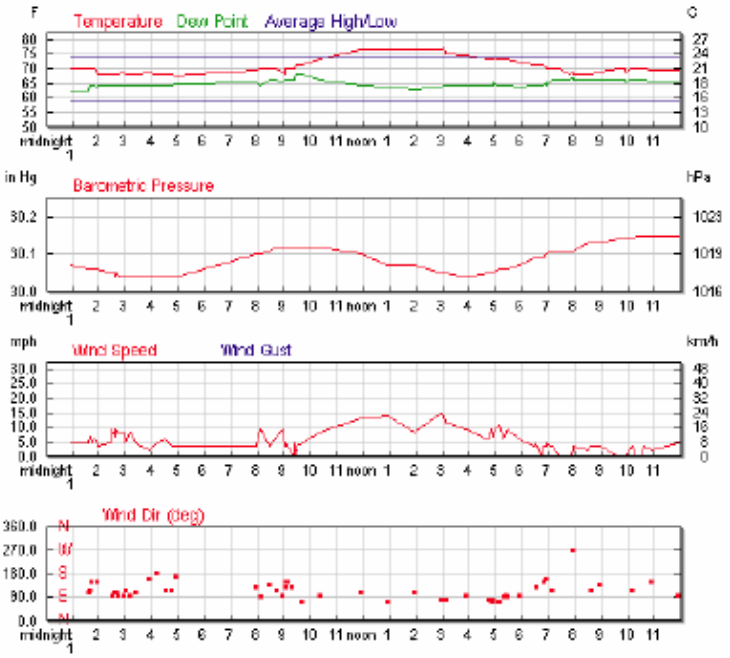
Data Source: Wheeler Army Airfield Weather Station - Airport Code (PHHI)

Notes

0630 - Roof surfaces too wet and would not dry off. Very windy. Forecast for scattered rain showers. Coating ops called off for the entire day

WAAF Environmental Conditions
for 16 Mar 08

Time (HST):	Temp.:	Dew Point:	Humidity:	Wind Dir:	Wind Speed:	Gust Speed:	Conditions:
12:55 AM	70.2 °F / 21.2 °C	62.6 °F / 17.0 °C	77%	Variable	4.6 mph / 7.4 km/h / 2.1 m/s	-	Overcast
1:55 AM	68.4 °F / 20.2 °C	63.9 °F / 17.7 °C	85%	Variable	4.6 mph / 7.4 km/h / 2.1 m/s	-	Light Drizzle
2:37 AM	68.0 °F / 20.0 °C	64.4 °F / 18.0 °C	88%	ESE	8.1 mph / 13.0 km/h / 3.6 m/s	-	Light Drizzle
2:55 AM	68.5 °F / 20.3 °C	64.2 °F / 17.9 °C	86%	East	8.1 mph / 13.0 km/h / 3.6 m/s	-	Scattered Clouds
3:11 AM	68.0 °F / 20.0 °C	64.4 °F / 18.0 °C	88%	East	8.1 mph / 13.0 km/h / 3.6 m/s	-	Light Drizzle
3:55 AM	68.4 °F / 20.2 °C	64.2 °F / 17.9 °C	87%	SSE	2.3 mph / 3.7 km/h / 1.0 m/s	-	Scattered Clouds
4:32 AM	68.0 °F / 20.0 °C	64.4 °F / 18.0 °C	88%	ESE	5.8 mph / 9.3 km/h / 2.6 m/s	-	Light Rain
4:55 AM	67.5 °F / 19.7 °C	64.8 °F / 18.2 °C	91%	South	3.5 mph / 5.6 km/h / 1.5 m/s	-	Mostly Cloudy
8:06 AM	69.8 °F / 21.0 °C	64.4 °F / 18.0 °C	83%	East	9.2 mph / 14.8 km/h / 4.1 m/s	-	Light Drizzle
8:55 AM	68.9 °F / 20.5 °C	65.3 °F / 18.5 °C	88%	East	9.2 mph / 14.8 km/h / 4.1 m/s	-	Light Rain
9:28 AM	71.6 °F / 22.0 °C	68.0 °F / 20.0 °C	88%	Calm	Calm	-	Light Drizzle
10:21 AM	73.4 °F / 23.0 °C	66.2 °F / 19.0 °C	78%	East	8.1 mph / 13.0 km/h / 3.6 m/s	-	Mostly Cloudy
11:55 AM	76.5 °F / 24.7 °C	64.2 °F / 17.9 °C	66%	ESE	12.7 mph / 20.4 km/h / 5.7 m/s	21.9 mph / 35.2 km/h / 9.8 m/s	Partly Cloudy
12:55 PM	76.5 °F / 24.7 °C	63.9 °F / 17.7 °C	65%	ENE	13.8 mph / 22.2 km/h / 6.2 m/s	-	Scattered Clouds
1:55 PM	76.6 °F / 24.8 °C	62.8 °F / 17.1 °C	62%	ESE	8.1 mph / 13.0 km/h / 3.6 m/s	-	Mostly Cloudy
2:55 PM	76.6 °F / 24.8 °C	64.0 °F / 17.8 °C	65%	East	15.0 mph / 24.1 km/h / 6.7 m/s	18.4 mph / 29.6 km/h / 8.2 m/s	Unknown
3:55 PM	74.5 °F / 23.6 °C	64.2 °F / 17.9 °C	70%	East	9.2 mph / 14.8 km/h / 4.1 m/s	16.1 mph / 25.9 km/h / 7.2 m/s	Scattered Clouds
4:51 PM	73.4 °F / 23.0 °C	64.4 °F / 18.0 °C	73%	ENE	9.2 mph / 14.8 km/h / 4.1 m/s	-	Light Drizzle
4:55 PM	73.9 °F / 23.3 °C	65.1 °F / 18.4 °C	74%	ENE	8.1 mph / 13.0 km/h / 3.6 m/s	-	Overcast
5:24 PM	73.4 °F / 23.0 °C	64.4 °F / 18.0 °C	73%	East	8.1 mph / 13.0 km/h / 3.6 m/s	-	Light Drizzle
5:55 PM	72.5 °F / 22.5 °C	63.9 °F / 17.7 °C	74%	East	5.8 mph / 9.3 km/h / 2.6 m/s	-	Mostly Cloudy
6:55 PM	70.5 °F / 21.4 °C	65.3 °F / 18.5 °C	83%	SSE	3.5 mph / 5.6 km/h / 1.5 m/s	-	Light Rain
7:55 PM	68.7 °F / 20.4 °C	66.6 °F / 19.2 °C	93%	West	2.3 mph / 3.7 km/h / 1.0 m/s	-	Overcast
8:55 PM	69.1 °F / 20.6 °C	66.4 °F / 19.1 °C	91%	SE	3.5 mph / 5.6 km/h / 1.5 m/s	-	Mostly Cloudy
9:55 PM	68.9 °F / 20.5 °C	65.8 °F / 18.8 °C	90%	Calm	Calm	-	Overcast
10:55 PM	69.4 °F / 20.8 °C	65.5 °F / 18.6 °C	87%	SSE	2.3 mph / 3.7 km/h / 1.0 m/s	-	Overcast
11:55 PM	69.3 °F / 20.7 °C	65.3 °F / 18.5 °C	87%	East	4.6 mph / 7.4 km/h / 2.1 m/s	-	Mostly Cloudy



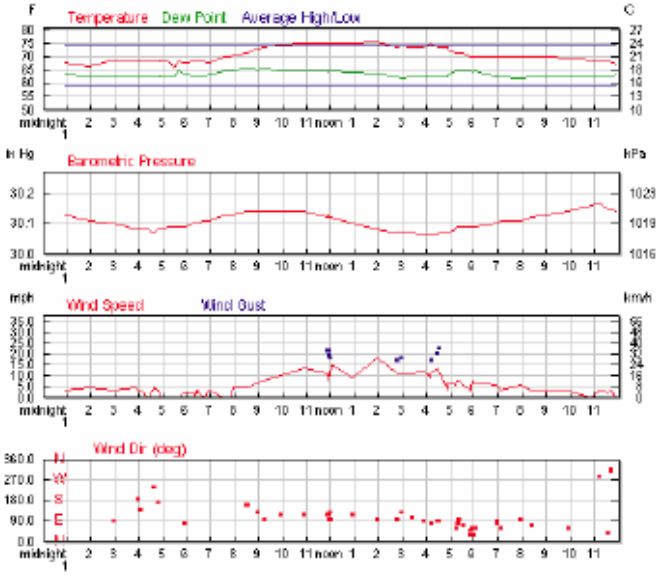
Data Source: Wheeler Army Airfield Weather Station - Airport Code (PHHI)

Notes

0630 - Roof surfaces too wet. Rain and wind forecasted to continue - Painting ops called off for the entire day.

WAAF Environmental Conditions
for 17 Mar 08

Time (HST):	Temp.:	Dew Point:	Humidity:	Wind Dir:	Wind Speed:	Gust Speed:		Conditions:
12:55 AM	67.6 °F / 19.8 °C	63.1 °F / 17.3 °C	85%	Variable	3.5 mph / 5.6 km/h / 1.5 m/s	-		Partly Cloudy
1:55 AM	66.6 °F / 19.2 °C	63.0 °F / 17.2 °C	88%	Variable	4.6 mph / 7.4 km/h / 2.1 m/s	-		Partly Cloudy
2:55 AM	68.7 °F / 20.4 °C	62.8 °F / 17.1 °C	81%	East	3.5 mph / 5.6 km/h / 1.5 m/s	-		Partly Cloudy
3:55 AM	68.0 °F / 20.0 °C	62.2 °F / 16.8 °C	82%	Variable	4.6 mph / 7.4 km/h / 2.1 m/s	-		Mostly Cloudy
4:55 AM	68.7 °F / 20.4 °C	62.8 °F / 17.1 °C	81%	Calm	Calm	-		Overcast
5:55 AM	67.6 °F / 19.8 °C	63.5 °F / 17.5 °C	87%	East	2.3 mph / 3.7 km/h / 1.0 m/s	-		Mostly Cloudy
6:55 AM	67.8 °F / 19.9 °C	63.1 °F / 17.3 °C	85%	Variable	3.5 mph / 5.6 km/h / 1.5 m/s	-		Mostly Cloudy
7:55 AM	70.3 °F / 21.3 °C	64.8 °F / 18.2 °C	82%	Variable	4.6 mph / 7.4 km/h / 2.1 m/s	-		Scattered Clouds
8:55 AM	73.0 °F / 22.8 °C	65.1 °F / 18.4 °C	76%	SE	6.9 mph / 11.1 km/h / 3.1 m/s	17.3 mph / 27.8 km/h / 7.7 m/s		Partly Cloudy
10:55 AM	74.8 °F / 23.8 °C	64.8 °F / 18.2 °C	71%	ESE	13.8 mph / 22.2 km/h / 6.2 m/s	21.9 mph / 35.2 km/h / 9.8 m/s		Mostly Cloudy
11:55 AM	75.2 °F / 24.0 °C	64.2 °F / 17.9 °C	69%	East	10.4 mph / 16.7 km/h / 4.6 m/s	19.6 mph / 31.5 km/h / 8.7 m/s		Overcast
12:55 PM	75.0 °F / 23.9 °C	64.0 °F / 17.8 °C	69%	ESE	9.2 mph / 14.8 km/h / 4.1 m/s	-		Overcast
1:55 PM	75.6 °F / 24.2 °C	63.7 °F / 17.6 °C	66%	East	18.4 mph / 29.6 km/h / 8.2 m/s	27.6 mph / 44.4 km/h / 12.3 m/s		Mostly Cloudy
2:55 PM	74.1 °F / 23.4 °C	62.1 °F / 16.7 °C	66%	SE	11.5 mph / 18.5 km/h / 5.1 m/s	18.4 mph / 29.6 km/h / 8.2 m/s		Mostly Cloudy
3:55 PM	73.6 °F / 23.1 °C	62.8 °F / 17.1 °C	69%	East	12.7 mph / 20.4 km/h / 5.7 m/s	-		Mostly Cloudy
4:55 PM	72.9 °F / 22.7 °C	63.3 °F / 17.4 °C	72%	Variable	6.9 mph / 11.1 km/h / 3.1 m/s	-		Light Drizzle
5:17 PM	71.6 °F / 22.0 °C	64.4 °F / 18.0 °C	78%	East	8.1 mph / 13.0 km/h / 3.6 m/s	-		Light Drizzle
5:21 PM	71.6 °F / 22.0 °C	64.4 °F / 18.0 °C	78%	East	8.1 mph / 13.0 km/h / 3.6 m/s	-		Light Drizzle
5:30 PM	71.6 °F / 22.0 °C	64.4 °F / 18.0 °C	78%	ENE	5.8 mph / 9.3 km/h / 2.6 m/s	-		Light Drizzle
5:49 PM	69.8 °F / 21.0 °C	64.4 °F / 18.0 °C	83%	NE	3.5 mph / 5.6 km/h / 1.5 m/s	-		Light Drizzle
5:57 PM	69.8 °F / 21.0 °C	64.4 °F / 18.0 °C	83%	NNE	6.9 mph / 11.1 km/h / 3.1 m/s	-		Light Drizzle
6:55 PM	70.2 °F / 21.2 °C	62.8 °F / 17.1 °C	77%	East	5.8 mph / 9.3 km/h / 2.6 m/s	-		Light Drizzle
7:55 PM	70.0 °F / 21.1 °C	62.1 °F / 16.7 °C	76%	East	5.8 mph / 9.3 km/h / 2.6 m/s	-		Mostly Cloudy
8:55 PM	70.0 °F / 21.1 °C	62.2 °F / 16.8 °C	76%	Variable	3.5 mph / 5.6 km/h / 1.5 m/s	-		Mostly Cloudy
9:55 PM	69.4 °F / 20.8 °C	62.6 °F / 17.0 °C	79%	ENE	3.5 mph / 5.6 km/h / 1.5 m/s	-		Overcast
10:55 PM	68.5 °F / 20.3 °C	62.6 °F / 17.0 °C	81%	Calm	Calm	-		Overcast
11:36 PM	68.0 °F / 20.0 °C	62.6 °F / 17.0 °C	83%	NE	2.3 mph / 3.7 km/h / 1.0 m/s	-		Light Rain
11:55 PM	67.3 °F / 19.6 °C	63.3 °F / 17.4 °C	87%	Calm	Calm	-		Overcast

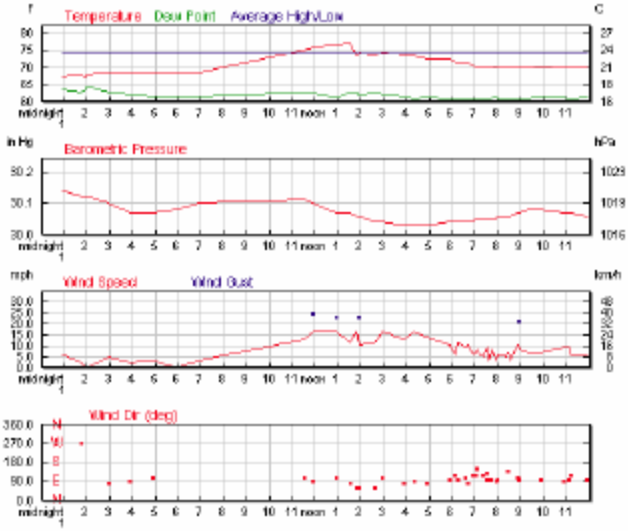


Data Source: Wheeler Army Airfield Weather Station - Airport Code (PHH)

Notes

0630 - Equipment setup - intermittent wind gusts - stopped ops until winds reduced - full day coating.

Time (HST):	Temp.:	Dew Point:	Humidity:	Wind Dir:	Wind Speed:	Gust Speed:	Conditions:
12:55 AM	67.3 °F / 19.6 °C	63.3 °F / 17.4 °C	87%	West	5.8 mph / 9.3 km/h / 2.6 m/s	-	Overcast
1:46 AM	68.0 °F / 20.0 °C	62.6 °F / 17.0 °C	83%	West	2.3 mph / 3.7 km/h / 1.0 m/s	-	Light Drizzle
1:55 AM	66.9 °F / 19.4 °C	63.3 °F / 17.4 °C	88%	Calm	Calm	-	Overcast
2:00 AM	68.0 °F / 20.0 °C	64.4 °F / 18.0 °C	88%	Calm	Calm	-	Light Drizzle
2:55 AM	68.5 °F / 20.3 °C	62.6 °F / 17.0 °C	81%	East	4.6 mph / 7.4 km/h / 2.1 m/s	-	Overcast
3:55 AM	68.5 °F / 20.3 °C	62.2 °F / 16.8 °C	80%	East	2.3 mph / 3.7 km/h / 1.0 m/s	-	Overcast
4:55 AM	68.5 °F / 20.3 °C	61.5 °F / 16.4 °C	78%	ESE	3.5 mph / 5.6 km/h / 1.5 m/s	-	Mostly Cloudy
5:55 AM	68.5 °F / 20.3 °C	61.3 °F / 16.3 °C	78%	Calm	Calm	-	Overcast
6:55 AM	68.5 °F / 20.3 °C	61.5 °F / 16.4 °C	78%	Variable	3.5 mph / 5.6 km/h / 1.5 m/s	-	Mostly Cloudy
11:31 AM	75.2 °F / 24.0 °C	62.6 °F / 17.0 °C	66%	ESE	12.7 mph / 20.4 km/h / 5.7 m/s	21.9 mph / 35.2 km/h / 9.8 m/s	Mostly Cloudy
11:55 AM	75.6 °F / 24.2 °C	62.4 °F / 16.9 °C	64%	East	16.1 mph / 25.9 km/h / 7.2 m/s	24.2 mph / 38.9 km/h / 10.8 m/s	Mostly Cloudy
12:55 PM	76.8 °F / 24.9 °C	61.2 °F / 16.2 °C	58%	ESE	16.1 mph / 25.9 km/h / 7.2 m/s	23.0 mph / 37.0 km/h / 10.3 m/s	Mostly Cloudy
1:33 PM	77.0 °F / 25.0 °C	62.6 °F / 17.0 °C	61%	East	11.5 mph / 18.5 km/h / 5.1 m/s	-	Mostly Cloudy
1:51 PM	73.4 °F / 23.0 °C	62.6 °F / 17.0 °C	69%	ENE	16.1 mph / 25.9 km/h / 7.2 m/s	23.0 mph / 37.0 km/h / 10.3 m/s	Overcast
1:55 PM	74.3 °F / 23.5 °C	61.9 °F / 16.6 °C	65%	ENE	10.4 mph / 16.7 km/h / 4.6 m/s	23.0 mph / 37.0 km/h / 10.3 m/s	Mostly Cloudy
2:38 PM	73.4 °F / 23.0 °C	62.6 °F / 17.0 °C	69%	ENE	11.5 mph / 18.5 km/h / 5.1 m/s	-	Overcast
2:55 PM	74.5 °F / 23.6 °C	62.2 °F / 16.8 °C	66%	ESE	16.1 mph / 25.9 km/h / 7.2 m/s	21.9 mph / 35.2 km/h / 9.8 m/s	Overcast
3:55 PM	73.9 °F / 23.3 °C	61.5 °F / 16.4 °C	65%	East	12.7 mph / 20.4 km/h / 5.7 m/s	-	Mostly Cloudy
4:20 PM	73.4 °F / 23.0 °C	60.8 °F / 16.0 °C	65%	East	16.1 mph / 25.9 km/h / 7.2 m/s	21.9 mph / 35.2 km/h / 9.8 m/s	Overcast
4:55 PM	72.5 °F / 22.5 °C	61.0 °F / 16.1 °C	67%	East	13.8 mph / 22.2 km/h / 6.2 m/s	-	Scattered Clouds
5:55 PM	72.3 °F / 22.4 °C	60.8 °F / 16.0 °C	67%	East	10.4 mph / 16.7 km/h / 4.6 m/s	-	Scattered Clouds
6:08 PM	71.6 °F / 22.0 °C	60.8 °F / 16.0 °C	69%	ESE	5.8 mph / 9.3 km/h / 2.6 m/s	-	Mostly Cloudy
6:14 PM	71.6 °F / 22.0 °C	60.8 °F / 16.0 °C	69%	East	11.5 mph / 18.5 km/h / 5.1 m/s	-	Scattered Clouds
6:36 PM	71.6 °F / 22.0 °C	60.8 °F / 16.0 °C	69%	ESE	9.2 mph / 14.8 km/h / 4.1 m/s	-	Mostly Cloudy
6:41 PM	71.6 °F / 22.0 °C	60.8 °F / 16.0 °C	69%	East	10.4 mph / 16.7 km/h / 4.6 m/s	-	Scattered Clouds
6:55 PM	70.5 °F / 21.4 °C	60.8 °F / 16.0 °C	71%	ESE	5.8 mph / 9.3 km/h / 2.6 m/s	-	Scattered Clouds
7:03 PM	69.8 °F / 21.0 °C	60.8 °F / 16.0 °C	73%	ESE	6.9 mph / 11.1 km/h / 3.1 m/s	-	Mostly Cloudy
7:06 PM	69.8 °F / 21.0 °C	60.8 °F / 16.0 °C	73%	SSE	8.1 mph / 13.0 km/h / 3.6 m/s	-	Scattered Clouds
7:12 PM	69.8 °F / 21.0 °C	60.8 °F / 16.0 °C	73%	Variable	5.8 mph / 9.3 km/h / 2.6 m/s	-	Mostly Cloudy
7:21 PM	69.8 °F / 21.0 °C	60.8 °F / 16.0 °C	73%	ESE	4.6 mph / 7.4 km/h / 2.1 m/s	-	Scattered Clouds
7:32 PM	69.8 °F / 21.0 °C	60.8 °F / 16.0 °C	73%	East	9.2 mph / 14.8 km/h / 4.1 m/s	-	Mostly Cloudy
7:34 PM	69.8 °F / 21.0 °C	60.8 °F / 16.0 °C	73%	SE	4.6 mph / 7.4 km/h / 2.1 m/s	-	Scattered Clouds
7:35 PM	69.8 °F / 21.0 °C	60.8 °F / 16.0 °C	73%	Variable	3.5 mph / 5.6 km/h / 1.5 m/s	-	Mostly Cloudy
7:41 PM	69.8 °F / 21.0 °C	60.8 °F / 16.0 °C	73%	East	6.9 mph / 11.1 km/h / 3.1 m/s	-	Scattered Clouds
7:43 PM	69.8 °F / 21.0 °C	60.8 °F / 16.0 °C	73%	East	8.1 mph / 13.0 km/h / 3.6 m/s	-	Mostly Cloudy
7:55 PM	70.2 °F / 21.2 °C	61.3 °F / 16.3 °C	74%	East	3.5 mph / 5.6 km/h / 1.5 m/s	-	Mostly Cloudy
8:00 PM	69.8 °F / 21.0 °C	60.8 °F / 16.0 °C	73%	East	5.8 mph / 9.3 km/h / 2.6 m/s	-	Scattered Clouds
8:24 PM	69.8 °F / 21.0 °C	60.8 °F / 16.0 °C	73%	Variable	4.6 mph / 7.4 km/h / 2.1 m/s	-	Mostly Cloudy
8:28 PM	69.8 °F / 21.0 °C	60.8 °F / 16.0 °C	73%	SE	6.9 mph / 11.1 km/h / 3.1 m/s	-	Scattered Clouds
8:32 PM	69.8 °F / 21.0 °C	60.8 °F / 16.0 °C	73%	Variable	3.5 mph / 5.6 km/h / 1.5 m/s	-	Mostly Cloudy
8:52 PM	69.8 °F / 21.0 °C	60.8 °F / 16.0 °C	73%	ESE	10.4 mph / 16.7 km/h / 4.6 m/s	20.7 mph / 33.3 km/h / 9.3 m/s	Scattered Clouds
8:55 PM	70.0 °F / 21.1 °C	60.8 °F / 16.0 °C	73%	East	8.1 mph / 13.0 km/h / 3.6 m/s	20.7 mph / 33.3 km/h / 9.3 m/s	Scattered Clouds
9:20 PM	69.8 °F / 21.0 °C	60.8 °F / 16.0 °C	73%	Variable	6.9 mph / 11.1 km/h / 3.1 m/s	-	Mostly Cloudy
9:55 PM	70.2 °F / 21.2 °C	61.3 °F / 16.3 °C	74%	East	6.9 mph / 11.1 km/h / 3.1 m/s	-	Mostly Cloudy
10:55 PM	70.0 °F / 21.1 °C	61.0 °F / 16.1 °C	73%	East	9.2 mph / 14.8 km/h / 4.1 m/s	-	Mostly Cloudy
11:08 PM	69.8 °F / 21.0 °C	60.8 °F / 16.0 °C	73%	East	9.2 mph / 14.8 km/h / 4.1 m/s	-	Scattered Clouds
11:10 PM	69.8 °F / 21.0 °C	60.8 °F / 16.0 °C	73%	ESE	5.8 mph / 9.3 km/h / 2.6 m/s	-	Mostly Cloudy
11:55 PM	69.8 °F / 21.0 °C	61.0 °F / 16.1 °C	73%	East	5.8 mph / 9.3 km/h / 2.6 m/s	-	Mostly Cloudy



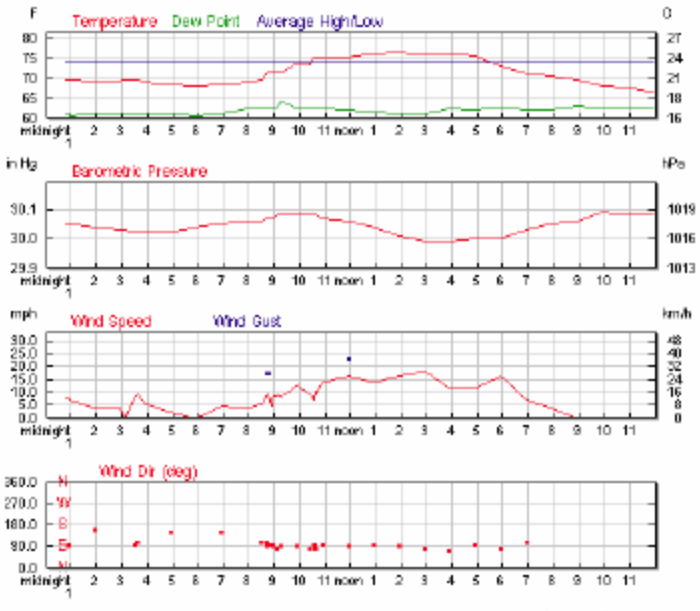
Data Source: Wheeler Army Airfield Weather Station - Airport Code (PHWH)

Notes

0630: Roof surfaces too wet and would not dry off. Rain and high winds forecasted intermittent all day - coating ops called off

WAAF Environmental Conditions for 19 Mar 08

Time (HST):	Temp.:	Dew Point:	Humidity:	Wind Dir:	Wind Speed:	Gust Speed:	Conditions:
12:45 AM	69.8 °F / 21.0 °C	60.8 °F / 16.0 °C	73%	East	8.1 mph / 13.0 km/h / 3.6 m/s	-	Scattered Clouds
12:52 AM	69.8 °F / 21.0 °C	60.8 °F / 16.0 °C	73%	East	8.1 mph / 13.0 km/h / 3.6 m/s	-	Mostly Cloudy
12:55 AM	69.6 °F / 20.9 °C	60.4 °F / 15.8 °C	73%	East	6.9 mph / 11.1 km/h / 3.1 m/s	-	Mostly Cloudy
1:55 AM	69.4 °F / 20.8 °C	61.0 °F / 16.1 °C	74%	ESE	3.5 mph / 5.6 km/h / 1.5 m/s	-	Overcast
2:55 AM	69.3 °F / 20.7 °C	61.2 °F / 16.2 °C	75%	Variable	3.5 mph / 5.6 km/h / 1.5 m/s	-	Mostly Cloudy
2:59 AM	69.8 °F / 21.0 °C	60.8 °F / 16.0 °C	73%	Variable	2.3 mph / 3.7 km/h / 1.0 m/s	-	Light Drizzle
3:08 AM	69.8 °F / 21.0 °C	60.8 °F / 16.0 °C	73%	Calm	Calm	-	Overcast
3:29 AM	69.8 °F / 21.0 °C	60.8 °F / 16.0 °C	73%	East	8.1 mph / 13.0 km/h / 3.6 m/s	-	Mostly Cloudy
3:37 AM	69.8 °F / 21.0 °C	60.8 °F / 16.0 °C	73%	ESE	9.2 mph / 14.8 km/h / 4.1 m/s	-	Mostly Cloudy
3:55 AM	68.9 °F / 20.5 °C	60.8 °F / 16.0 °C	75%	Variable	5.8 mph / 9.3 km/h / 2.6 m/s	-	Mostly Cloudy
4:55 AM	68.5 °F / 20.3 °C	61.2 °F / 16.2 °C	77%	SSE	2.3 mph / 3.7 km/h / 1.0 m/s	-	Overcast
5:55 AM	68.0 °F / 20.0 °C	60.6 °F / 15.9 °C	77%	Calm	Calm	-	Mostly Cloudy
6:55 AM	68.5 °F / 20.3 °C	61.2 °F / 16.2 °C	77%	SSE	4.6 mph / 7.4 km/h / 2.1 m/s	-	Overcast
7:55 AM	69.1 °F / 20.6 °C	62.4 °F / 16.9 °C	79%	Variable	3.5 mph / 5.6 km/h / 1.5 m/s	-	Mostly Cloudy
8:30 AM	69.8 °F / 21.0 °C	62.6 °F / 17.0 °C	78%	ESE	5.8 mph / 9.3 km/h / 2.6 m/s	-	Mostly Cloudy
8:42 AM	71.6 °F / 22.0 °C	62.6 °F / 17.0 °C	73%	ESE	9.2 mph / 14.8 km/h / 4.1 m/s	17.3 mph / 27.8 km/h / 7.7 m/s	Mostly Cloudy
8:44 AM	71.6 °F / 22.0 °C	62.6 °F / 17.0 °C	73%	East	9.2 mph / 14.8 km/h / 4.1 m/s	17.3 mph / 27.8 km/h / 7.7 m/s	Mostly Cloudy
8:45 AM	71.6 °F / 22.0 °C	62.6 °F / 17.0 °C	73%	East	9.2 mph / 14.8 km/h / 4.1 m/s	17.3 mph / 27.8 km/h / 7.7 m/s	Mostly Cloudy
8:54 AM	71.6 °F / 22.0 °C	62.6 °F / 17.0 °C	73%	East	4.6 mph / 7.4 km/h / 2.1 m/s	-	Mostly Cloudy
8:55 AM	71.4 °F / 21.9 °C	62.8 °F / 17.1 °C	74%	East	4.6 mph / 7.4 km/h / 2.1 m/s	-	Mostly Cloudy
8:57 AM	71.6 °F / 22.0 °C	62.6 °F / 17.0 °C	73%	East	8.1 mph / 13.0 km/h / 3.6 m/s	-	Scattered Clouds
9:08 AM	71.6 °F / 22.0 °C	62.6 °F / 17.0 °C	73%	East	9.2 mph / 14.8 km/h / 4.1 m/s	-	Light Rain
9:18 AM	71.6 °F / 22.0 °C	64.4 °F / 18.0 °C	78%	East	8.1 mph / 13.0 km/h / 3.6 m/s	-	Scattered Clouds
9:55 AM	73.9 °F / 23.3 °C	62.4 °F / 16.9 °C	67%	East	12.7 mph / 20.4 km/h / 5.7 m/s	-	Scattered Clouds
10:23 AM	73.4 °F / 23.0 °C	62.6 °F / 17.0 °C	69%	East	9.2 mph / 14.8 km/h / 4.1 m/s	-	Mostly Cloudy
10:35 AM	75.2 °F / 24.0 °C	62.6 °F / 17.0 °C	65%	East	6.9 mph / 11.1 km/h / 3.1 m/s	-	Mostly Cloudy
10:37 AM	75.2 °F / 24.0 °C	62.6 °F / 17.0 °C	65%	East	10.4 mph / 16.7 km/h / 4.6 m/s	-	Mostly Cloudy
10:38 AM	75.2 °F / 24.0 °C	62.6 °F / 17.0 °C	65%	East	9.2 mph / 14.8 km/h / 4.1 m/s	-	Scattered Clouds
10:55 AM	75.4 °F / 24.1 °C	62.4 °F / 16.9 °C	64%	East	13.8 mph / 22.2 km/h / 6.2 m/s	19.6 mph / 31.5 km/h / 8.7 m/s	Partly Cloudy
11:55 AM	75.2 °F / 24.0 °C	62.2 °F / 16.8 °C	64%	East	16.1 mph / 25.9 km/h / 7.2 m/s	23.0 mph / 37.0 km/h / 10.3 m/s	Mostly Cloudy
12:55 PM	76.3 °F / 24.6 °C	61.5 °F / 16.4 °C	60%	East	13.8 mph / 22.2 km/h / 6.2 m/s	-	Scattered Clouds
1:55 PM	76.5 °F / 24.7 °C	61.0 °F / 16.1 °C	59%	East	16.1 mph / 25.9 km/h / 7.2 m/s	-	Scattered Clouds
2:55 PM	76.1 °F / 24.5 °C	61.0 °F / 16.1 °C	59%	East	18.4 mph / 29.6 km/h / 8.2 m/s	-	Clear
3:55 PM	76.3 °F / 24.6 °C	62.4 °F / 16.9 °C	62%	ENE	11.5 mph / 18.5 km/h / 5.1 m/s	-	Clear
4:55 PM	75.7 °F / 24.3 °C	62.1 °F / 16.7 °C	62%	East	11.5 mph / 18.5 km/h / 5.1 m/s	20.7 mph / 33.3 km/h / 9.3 m/s	Partly Cloudy
5:55 PM	73.0 °F / 22.8 °C	62.8 °F / 17.1 °C	70%	East	16.1 mph / 25.9 km/h / 7.2 m/s	-	Clear
6:55 PM	71.2 °F / 21.8 °C	61.9 °F / 16.6 °C	72%	ESE	6.9 mph / 11.1 km/h / 3.1 m/s	-	Overcast
7:55 PM	70.7 °F / 21.5 °C	62.2 °F / 16.8 °C	75%	Variable	3.5 mph / 5.6 km/h / 1.5 m/s	-	Scattered Clouds
8:55 PM	69.6 °F / 20.9 °C	63.1 °F / 17.3 °C	80%	Calm	Calm	-	Partly Cloudy
9:55 PM	68.2 °F / 20.1 °C	62.4 °F / 16.9 °C	82%	Calm	Calm	-	Clear
10:55 PM	67.8 °F / 19.9 °C	62.6 °F / 17.0 °C	83%	Calm	Calm	-	Clear
11:55 PM	66.4 °F / 19.1 °C	62.4 °F / 16.9 °C	87%	Calm	Calm	-	Scattered Clouds



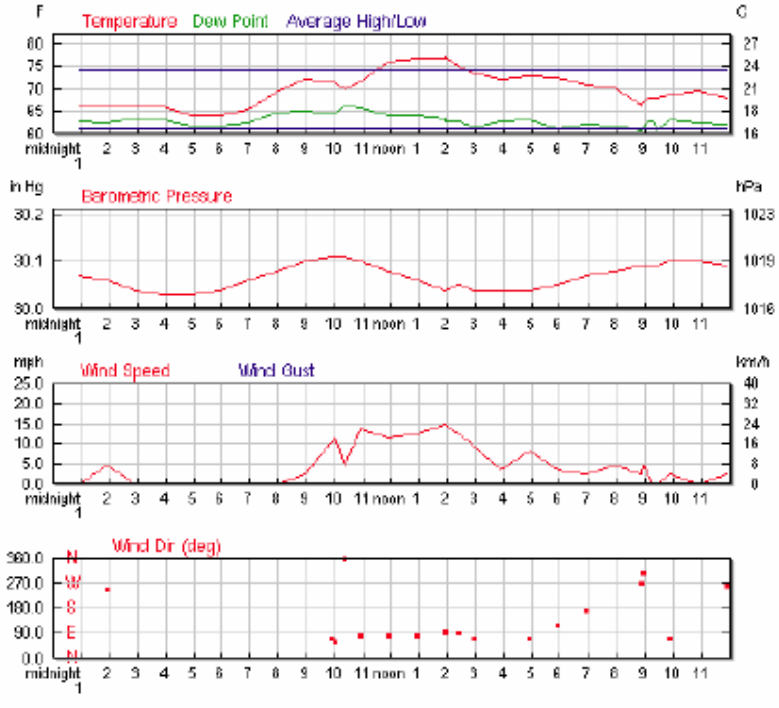
Data Source: Wheeler Army Airfield Weather Station - Airport Code (PHHI)

Notes

0630 - Roof wet but dried off. Light drizzle noted mid morning - coating ops stopped until the rain quit and surfaces were dry. Continued coating for the remainder of the work shift

-WAAF Environmental Conditions for 20 Mar 08

Time (HST):	Temp.:	Dew Point:	Humidity:	Wind Dir:	Wind Speed:	Gust Speed:	Conditions:
12:55 AM	66.4 °F / 19.1 °C	62.6 °F / 17.0 °C	88%	Calm	Calm	-	Partly Cloudy
1:55 AM	66.0 °F / 18.9 °C	62.4 °F / 16.9 °C	88%	WSW	4.6 mph / 7.4 km/h / 2.1 m/s	-	Partly Cloudy
2:55 AM	66.4 °F / 19.1 °C	63.3 °F / 17.4 °C	90%	Calm	Calm	-	Overcast
3:55 AM	66.0 °F / 18.9 °C	63.1 °F / 17.3 °C	90%	Calm	Calm	-	Mostly Cloudy
4:55 AM	64.2 °F / 17.9 °C	61.9 °F / 16.6 °C	92%	Calm	Calm	-	Clear
5:55 AM	64.2 °F / 17.9 °C	61.9 °F / 16.6 °C	92%	Calm	Calm	-	Mostly Cloudy
6:55 AM	65.5 °F / 18.6 °C	62.4 °F / 16.9 °C	90%	Calm	Calm	-	Mostly Cloudy
7:55 AM	69.1 °F / 20.6 °C	64.6 °F / 18.1 °C	86%	Calm	Calm	-	Mostly Cloudy
8:55 AM	72.1 °F / 22.3 °C	64.9 °F / 18.3 °C	78%	Variable	2.3 mph / 3.7 km/h / 1.0 m/s	-	Mostly Cloudy
9:55 AM	71.4 °F / 21.9 °C	64.4 °F / 18.0 °C	78%	ENE	10.4 mph / 16.7 km/h / 4.6 m/s	-	Overcast
10:00 AM	71.6 °F / 22.0 °C	64.4 °F / 18.0 °C	78%	ENE	11.5 mph / 18.5 km/h / 5.1 m/s	-	Light Drizzle
10:22 AM	69.8 °F / 21.0 °C	66.2 °F / 19.0 °C	88%	North	4.6 mph / 7.4 km/h / 2.1 m/s	-	Scattered Clouds
10:55 AM	71.6 °F / 22.0 °C	65.7 °F / 18.7 °C	81%	East	13.8 mph / 22.2 km/h / 6.2 m/s	-	Mostly Cloudy
11:55 AM	75.9 °F / 24.4 °C	64.2 °F / 17.9 °C	67%	East	11.5 mph / 18.5 km/h / 5.1 m/s	-	Mostly Cloudy
12:55 PM	76.6 °F / 24.8 °C	64.2 °F / 17.9 °C	65%	East	12.7 mph / 20.4 km/h / 5.7 m/s	-	Mostly Cloudy
1:55 PM	76.6 °F / 24.8 °C	63.3 °F / 17.4 °C	63%	East	15.0 mph / 24.1 km/h / 6.7 m/s	-	Mostly Cloudy
1:56 PM	77.0 °F / 25.0 °C	62.6 °F / 17.0 °C	61%	East	15.0 mph / 24.1 km/h / 6.7 m/s	-	Mostly Cloudy
2:24 PM	75.2 °F / 24.0 °C	62.6 °F / 17.0 °C	65%	East	12.7 mph / 20.4 km/h / 5.7 m/s	-	Overcast
2:55 PM	73.4 °F / 23.0 °C	61.5 °F / 16.4 °C	66%	ENE	9.2 mph / 14.8 km/h / 4.1 m/s	-	Overcast
3:55 PM	72.1 °F / 22.3 °C	62.8 °F / 17.1 °C	72%	Variable	3.5 mph / 5.6 km/h / 1.5 m/s	-	Overcast
4:55 PM	72.7 °F / 22.6 °C	63.0 °F / 17.2 °C	71%	ENE	8.1 mph / 13.0 km/h / 3.6 m/s	-	Overcast
5:55 PM	72.3 °F / 22.4 °C	61.2 °F / 16.2 °C	68%	ESE	3.5 mph / 5.6 km/h / 1.5 m/s	-	Overcast
6:55 PM	70.9 °F / 21.6 °C	62.1 °F / 16.7 °C	74%	South	2.3 mph / 3.7 km/h / 1.0 m/s	-	Overcast
7:55 PM	70.3 °F / 21.3 °C	61.7 °F / 16.5 °C	74%	Variable	4.6 mph / 7.4 km/h / 2.1 m/s	-	Clear
8:52 PM	66.2 °F / 19.0 °C	60.8 °F / 16.0 °C	83%	West	2.3 mph / 3.7 km/h / 1.0 m/s	-	Mostly Cloudy
8:54 PM	66.2 °F / 19.0 °C	60.8 °F / 16.0 °C	83%	Variable	2.3 mph / 3.7 km/h / 1.0 m/s	-	Scattered Clouds
8:55 PM	66.9 °F / 19.4 °C	61.3 °F / 16.3 °C	82%	NW	4.6 mph / 7.4 km/h / 2.1 m/s	-	Scattered Clouds
9:07 PM	68.0 °F / 20.0 °C	62.6 °F / 17.0 °C	83%	Variable	2.3 mph / 3.7 km/h / 1.0 m/s	-	Mostly Cloudy
9:18 PM	68.0 °F / 20.0 °C	62.6 °F / 17.0 °C	83%	Calm	Calm	-	Scattered Clouds
9:26 PM	68.0 °F / 20.0 °C	60.8 °F / 16.0 °C	78%	Calm	Calm	-	Mostly Cloudy
9:55 PM	68.5 °F / 20.3 °C	63.1 °F / 17.3 °C	83%	ENE	2.3 mph / 3.7 km/h / 1.0 m/s	-	Mostly Cloudy
10:55 PM	69.4 °F / 20.8 °C	62.4 °F / 16.9 °C	78%	Calm	Calm	-	Mostly Cloudy
11:55 PM	67.8 °F / 19.9 °C	62.1 °F / 16.7 °C	82%	West	2.3 mph / 3.7 km/h / 1.0 m/s	-	Mostly Cloudy



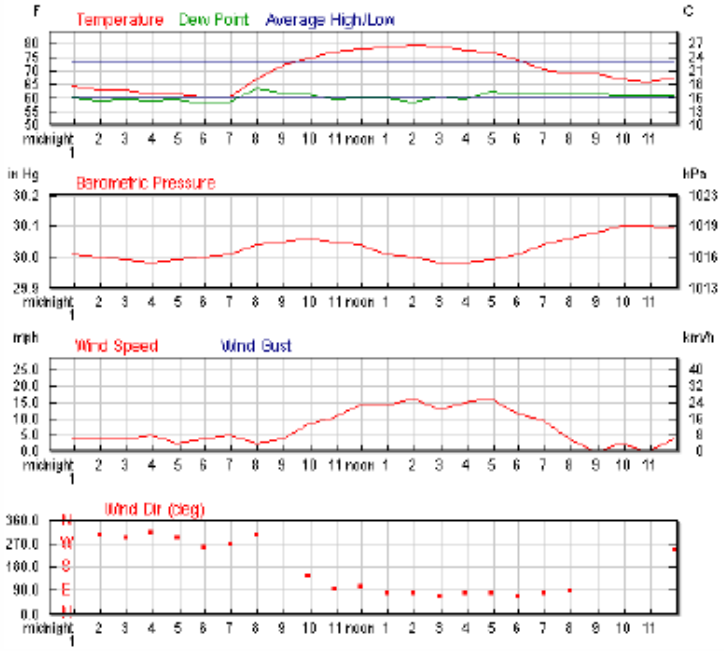
WAAF Environmental Conditions
for 21 Mar 08

Data Source: Wheeler Army Airfield Weather Station - Airport Code (PHHI)

Notes

0630 - Coating ops began in the AM. Wind and rain forced shutdown midday.

Time (HST):	Temp.:	Dew Point:	Humidity:	Wind Dir:	Wind Speed:	Gust Speed:	Conditions:
12:55 AM	65.3 °F / 18.5 °C	60.3 °F / 15.7 °C	84%	West	3.5 mph / 5.6 km/h / 1.5 m/s	-	Clear
1:55 AM	63.5 °F / 17.5 °C	59.7 °F / 15.4 °C	87%	NW	3.5 mph / 5.6 km/h / 1.5 m/s	-	Partly Cloudy
2:55 AM	63.5 °F / 17.5 °C	59.9 °F / 15.5 °C	88%	WNW	3.5 mph / 5.6 km/h / 1.5 m/s	-	Scattered Clouds
3:55 AM	62.2 °F / 16.8 °C	59.5 °F / 15.3 °C	91%	NW	4.6 mph / 7.4 km/h / 2.1 m/s	-	Partly Cloudy
4:55 AM	62.2 °F / 16.8 °C	59.9 °F / 15.5 °C	92%	WNW	2.3 mph / 3.7 km/h / 1.0 m/s	-	Scattered Clouds
5:55 AM	60.8 °F / 16.0 °C	58.6 °F / 14.8 °C	93%	West	3.5 mph / 5.6 km/h / 1.5 m/s	-	Clear
6:55 AM	61.0 °F / 16.1 °C	59.0 °F / 15.0 °C	93%	West	4.6 mph / 7.4 km/h / 2.1 m/s	-	Partly Cloudy
7:55 AM	67.5 °F / 19.7 °C	64.0 °F / 17.8 °C	89%	NW	2.3 mph / 3.7 km/h / 1.0 m/s	-	Clear
8:55 AM	72.7 °F / 22.6 °C	62.6 °F / 17.0 °C	71%	Variable	3.5 mph / 5.6 km/h / 1.5 m/s	-	Clear
9:55 AM	75.0 °F / 23.9 °C	62.2 °F / 16.8 °C	64%	SSE	8.1 mph / 13.0 km/h / 3.6 m/s	-	Scattered Clouds
10:55 AM	77.5 °F / 25.3 °C	59.9 °F / 15.5 °C	54%	East	10.4 mph / 16.7 km/h / 4.6 m/s	-	Scattered Clouds
11:55 AM	78.8 °F / 26.0 °C	60.4 °F / 15.8 °C	53%	ESE	13.8 mph / 22.2 km/h / 6.2 m/s	18.4 mph / 29.6 km/h / 8.2 m/s	Partly Cloudy
12:55 PM	79.2 °F / 26.2 °C	60.6 °F / 15.9 °C	53%	East	13.8 mph / 22.2 km/h / 6.2 m/s	-	Clear
1:55 PM	80.1 °F / 26.7 °C	59.0 °F / 15.0 °C	48%	East	16.1 mph / 25.9 km/h / 7.2 m/s	-	Clear
2:55 PM	79.9 °F / 26.6 °C	61.2 °F / 16.2 °C	53%	ENE	12.7 mph / 20.4 km/h / 5.7 m/s	-	Clear
3:55 PM	78.4 °F / 25.8 °C	60.1 °F / 15.6 °C	53%	East	15.0 mph / 24.1 km/h / 6.7 m/s	-	Clear
4:55 PM	77.5 °F / 25.3 °C	62.8 °F / 17.1 °C	60%	East	16.1 mph / 25.9 km/h / 7.2 m/s	-	Clear
5:55 PM	74.7 °F / 23.7 °C	62.1 °F / 16.7 °C	65%	ENE	11.5 mph / 18.5 km/h / 5.1 m/s	-	Scattered Clouds
6:55 PM	71.4 °F / 21.9 °C	62.1 °F / 16.7 °C	72%	East	9.2 mph / 14.8 km/h / 4.1 m/s	-	Clear
7:55 PM	69.8 °F / 21.0 °C	62.2 °F / 16.8 °C	77%	East	3.5 mph / 5.6 km/h / 1.5 m/s	-	Clear
8:55 PM	69.4 °F / 20.8 °C	61.9 °F / 16.6 °C	77%	Calm	Calm	-	Clear
9:55 PM	67.8 °F / 19.9 °C	61.7 °F / 16.5 °C	81%	Variable	2.3 mph / 3.7 km/h / 1.0 m/s	-	Clear
10:55 PM	66.7 °F / 19.3 °C	61.5 °F / 16.4 °C	83%	Calm	Calm	-	Partly Cloudy
11:55 PM	66.0 °F / 20.0 °C	61.3 °F / 16.3 °C	79%	WSW	3.5 mph / 5.6 km/h / 1.5 m/s	-	Clear



Data Source: Wheeler Army Airfield Weather Station - Airport Code (PHHI)

Notes

0630 - Coating ops began in the AM. Wind forced intermittent stoppages completed roof coating ops.

Appendix 1E: Material Information – JOMAX Mildewcide

ZINSSER
QUALITY SINCE 1849

Technical Data Bulletin

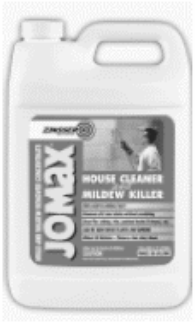
ZINSSER Co., Inc.
173 Belmont Drive, Somerset NJ 08875
An RPM Company

4/04

JOMAX®

House Cleaner and Mildew Killer

A high performance outdoor cleaner or pre-paint mildew remover uniquely formulated to kill mold and mildew fast and remove dirt and stains on most exterior painted or non-porous surfaces; without the need for scrubbing. **Jomax®** is an EPA approved, patented concentrate containing a mildewcide, ChloRelease® bleach activator and detergents. When used as directed **Jomax®** will not damage painted surfaces and may be applied near plants and shrubs.



Selection Data

Generic Type – Mildewcidal liquid house washing concentrate.

EPA Data – Jomax® House Cleaner and Mildew Killer is registered with the U.S. Environmental Protection Agency. EPA Reg. No. 71240-1. EPA Est. No. 71240-NJ-001. NOTE: IT IS A VIOLATION OF FEDERAL LAW TO USE THIS PRODUCT IN A MANNER INCONSISTENT WITH ITS LABELING.

Performance Characteristics

- Kills mold & mildew fast
- Removes dirt and stains without scrubbing
- Can be used near plants and shrubs
- Easy application with a garden sprayer
- One gallon of **Jomax®** makes 20 gallons of solution

Recommended Uses – Recommended for cleaning vinyl and aluminum siding and trim; painted or stained wood siding, trim, decks, and fences, and painted or stained stucco, concrete and other painted or non-porous surfaces.

Coverage – One quart of **Jomax®** makes 5 gallons (18.9 liters) of solution, sufficient to clean and treat approximately 1,000 sq. feet (92.5 sq. meters). One gallon of **Jomax®** makes 20 gallons (75.7 liters) of solution, sufficient to clean approximately 4,000 sq. feet (371.6 sq. meters) Actual coverage will depend upon quantity applied and porosity of the surface.

Application Data

Mixing Instructions - Shake well before using. Mix in the proper proportions with bleach and water (80% water, 15% bleach, and 5% **Jomax®**) according to label directions.

To ensure that components are properly mixed, follow mixing chart to produce the desired quantity of cleaning solution.

Water	+ Bleach	+ JOMAX	= Cleaning Solution
3 1/4 quarts	2 1/4 cups	3/4 cups	1 gallon
6 1/2 quarts	4 1/2 cups	1 1/2 cups	2 gallons
4 gallons	3 quarts	1 quart	5 gallons

1. Pour water into a tank-type garden sprayer or plastic pail.
2. Add EPA registered household bleach, like Clorox®.
3. Shake **Jomax®** concentrate thoroughly.
4. Add **Jomax®** then stir solution thoroughly.

IMPORTANT: Always follow manufacturer's precautions when using bleach. Use immediately after mixing - prepared **Jomax®** solution remains effective for 3 hours after mixing. Do not allow solution to contact fabrics. Mixture may be applied in areas adjacent to plants, shrubs and trees.

Application - Test a small area before using. Apply with a tank-type garden sprayer or airless or chemical sprayer. Spray surfaces liberally and wait 5 minutes and rinse well. Heavy mildew stains may require a second application. Textured surfaces may require light scrubbing. For best results rinse surfaces with a pressure washer (follow manufacturer's instructions for tip size and pressure setting). As a precaution spray sensitive plants with water before and after **Jomax®** application.

Clean up - Clean sprayer with water and baking soda or a non-ammonia cleaner. Rinse well.

Limitations

Jomax® is not recommended for indoor application. For porous surfaces such as bare concrete and masonry, unfinished wood, asphalt roof shingles, etc. may require scrubbing and multiple applications. It is in violation of Federal law to use this product in a manner inconsistent with its labeling.

PRECAUTIONARY STATEMENTS:

HAZARDS TO HUMANS AND DOMESTIC ANIMALS. **CAUTION. Harmful if swallowed.** Avoid contact with skin, eyes, or clothing. Avoid breathing vapors or spray mist. Protective goggles and gloves or equivalent should be worn. Do not use in confined areas without proper ventilation. Avoid applications during windy conditions.

FIRST AID

If swallowed:

- Call a poison control center immediately for treatment advice.
- Have a person sip a glass of water if able to swallow.
- Do not induce vomiting unless told to do so by the poison control center or doctor.
- Do not give anything by mouth to an unconscious person.

If on skin or clothing:

- Take off contaminated clothing.
- Rinse skin immediately with plenty of water for 15-20 minutes.
- Call a poison control center for treatment advice.

If in eyes:

- Hold eye open and rinse slowly and gently with water for 15-20 minutes.
- Remove contact lenses, if present, after the first 5 minutes, then continue rinsing eye.
- Call a poison control center or doctor for treatment advice.

In case of emergency, call CHEMTREC at 1-800-424-9300. Have the product container or label with you when calling a Poison Control Center or doctor, or going for treatment.

ENVIRONMENTAL HAZARDS: This product is toxic to fish. Do not apply directly to water. Do not contaminate water when disposing of equipment wash waters. For guidance, contact your state water board or EPA regional office.

STORAGE AND DISPOSAL- Product may discolor during storage. Color changes do not affect product performance. Dispose by securely wrapping original container in several layers of newspaper and discard in trash. Do not reuse container.

Shelf Life	60 months @ 75°F (24°C)
Storage/Handling	Store indoors 40°F – 80°F (4°C – 27°C) Freeze/thaw stable

Warranty

This product will perform as claimed if directions are followed. Directions are as complete as possible but cannot encompass all conditions, applications, techniques, and/or surfaces which are beyond our control. If you have a question, check with your dealer or contact ZINSSER Co., Inc. Somerset, NJ. Warranty is limited to replacement or refunded value of product actually used if such product proves defective within two years of manufacture. No other warranty or guarantee is expressed or implied.

Packaging and Shipping Information

Unit Size	Code	Product UPC	Carton Code	Case Pack	Case Wt. Lbs.	Dimensions	Case Vol. Inches	Pallet Pack	Pallet Size
1 gallon	60101	0 47719 60101 2	4 00 47719 60101 0	4	38	14⅞" x 9⅜" x 12"	1,673	40	42 x 42
1 quart	60104	0 47719 60104 3	5 00 47719 60104 8	12	29	14" x 10¾" x 8½"	1279	60	42 x 42

ZINSSER Co., Inc. 173 Belmont Drive Somerset, NJ 08875 (732) 469-8100 www.zinsser.com

Material Safety Data Sheet

Section 1 General Information

Manufacturer:
Zinsser Company, Inc.
173 Belmont Drive
Somerset, NJ 08875
(732) 469-8100

Emergency Telephone: Chemtrec (800) 424-9300 **Date: November 9, 2007**

Product Name: Jomax

Codes: 60101 60102 60103 60104 60105 60112 60121 60122 60136 60148 60151 60155 60157

Section 2 Hazardous Ingredients

Hazardous Component	CAS#	OSHA PEL	ACGIH TLV
Acetic Acid	64-19-7	10 ppm	10 ppm

Section 3 Hazard Identification

Emergency Overview: This material is a milky white liquid with a flash point greater than 200° F. This material is used as a mildew remover and is an EPA registered pesticide.

Primary Routes of Exposure:
Inhalation
Skin Contact
Eye Contact

Potential Acute Health Effects:

Eye: May cause eye irritation.

Skin: May cause skin irritation.

Ingestion: Not determined.

Inhalation: May cause respiratory tract irritation.

Final Use Product (diluted): In addition to the above information, warnings and handling precautions provided by the producer of household bleach used to prepare the final use product should also be read and followed to minimize the risk of injury.

Potential Chronic Health Effects: This product contains Sodium O-Phenylphenate. Some substituted phenols have been shown to cause depigmentation (white patches on skin), even at diluted concentrations. O-Phenlphenol (OPP) has an important structural difference from the substituted phenol associated with depigmentation. OPP has been reported to produce depigmentation in experimental animals when given orally, but not by skin contact, and in humans only at concentrations that are also significantly irritating to the skin. OPP has not been found to cause depigmentation when present at concentrations used in disinfectant formulations.

Section 4 First Aid Measures

Eye contact: Immediately flush eyes with plenty of water for 30 minutes. Call a physician immediately. Lift the upper and lower eyelid occasionally. Get immediate medical attention.

Skin contact: Immediately flush skin with plenty of running water for 30 minutes. Remove contaminated clothing and shoes. If needed, seek medical attention.

Ingestion: Do not induce vomiting. If conscious give plenty of water or milk. Get immediate medical attention. Do not give anything by mouth to an unconscious or convulsing person.

Inhalation: Remove to fresh air. Give artificial respiration if person is not breathing. Get medical attention if symptoms persist.

Exposure to Final Product (diluted): In addition to the above, follow emergency and first aid procedures for exposures to bleach.

Section 5 Fire Fighting Measures

Flash Point (method): N/D (est. >200° F).

Extinguishing Media: Use appropriate extinguishing media for surrounding fire.

Unusual Fire and Explosion Hazards: None known.

Section 6 Accidental Release Measures

Personal Precautions: Wear acid resistant equipment including eye protection.

Clean Up Methods: For small spills, wipe up and dispose in DOT approved waste containers. For large spills, contain by diking with soil or other absorbent material and carefully neutralize with soda ash or lime. If soda ash is used, provide adequate ventilation to dissipate gases produced. Transfer all waste material to an appropriate container.

(See also Section 8 for information on Exposure Controls and Personal Protective Equipment)

Section 7 Handling and Storage

Handling: Keep away from heat or flame. Keep from freezing. Avoid all contact with eyes. Avoid contact with skin or clothing. Wash areas immediately after contact. Remove and launder clothing.

Storage: Keep out of reach of children. Store in a cool dry place away from incompatible materials. Keep container tightly closed when not in use.

Section 8 Exposure Controls / Personal Protection

Engineering Controls: Use local mechanical ventilation capable of maintaining emissions at the point of use below applicable occupational exposure limits.

Personal Protective Equipment (PPE):

Eye Protection: Chemical splash goggles or full-face shield

Skin Protection: Rubber gloves

Respiratory Protection: Avoid breathing in vapors or spray mists. Do not use in confined areas without proper ventilation. A respirator designed to protect against airborne mists can significantly reduce exposure in situations with the potential to generate mist in the air.

Protective Clothing: Impervious aprons boots or other equipment needed to protect the skin.

General Hygiene Practices: Always wash before performing any other function (such as eating or applying cosmetics). Launder any contaminated clothing.

Section 9 Physical Data

Appearance:	milky white liquid	**Odor:**	vinegar odor
Physical State:	Liquid	**pH:**	3.0-3.5 as supplied (9.1-9.4 mixed with bleach)
Boiling Point:	N/D (est. ~212° F.)	**Melting Point:**	N/A
Evaporation Rate:	Slower than ether.	**Density:**	8.38 pounds/gallon

Section 10 Stability and Reactivity

Stability: Stable **Hazardous Polymerization:** Will not occur

Hazardous Decomposition Products: May liberate carbon monoxide, carbon dioxide and unidentified compounds in black smoke.

N/A: Not Applicable N/D: Not Determined N/E: Not Established N/R: Not Required Est.: Estimated

Conditions to Avoid: Heat and Open Flame

Incompatibility: Strong alkalis, oxidizing or reducing materials, cyanides, sulfides, combustible materials, chromic acid, nitric acid, hydrogen peroxide, active metals, amines, oxides, and carbonates.

Section 11 Toxicological Information

Carcinocenicity: Sodium O-Phenylphenate has been identified by IARC as an animal carcinogen. Rats developed an increased incidence of bladder tumors in lifetime feeding experiments. IARC currently classifies Sodium O-Phenylphenate as a possible human carcinogen (Group 2B).

Jomax has not been tested for potential toxicity. The information contained in this MSDS is based on toxicological information provided by the manufacturers of the components and the final concentration of each of the components.

(See also Section 15 for related information)

Section 12 Ecological Information

Environmental Precautions: This product is toxic to fish. Do not apply directly to water. Do not contaminate water when disposing of equipment wash waters.

Section 13 Disposal Considerations

Recommended Waste Disposal Method: Dispose of contaminated product and materials used to clean up spills in a manner consistent with Federal, State, and local regulatory agencies. Dispose of all empty containers as directed on the label.

Section 14 Transportation Information

Regulated by the US DOT: No

DOT Proper Shipping Name: Cleaning Compound

UN / NA Number: N/A

Section 15 Regulatory Information

CERCLA:
The Comprehensive Environmental Response Compensation and Liability Act of 1980 (CERCLA) requires notification to the National Response Center for releases of quantities of Hazardous Substances equal to or greater than the reportable quantities (RQs) in 40 CFR 302.4 (for CERCLA 102).

Components present in this product at a level which could require reporting under the statute are:

Chemical Name	CAS#	Maximum Concentration (Wt. %)
None	N/A	N/A

SARA Title III, section 311/312:
The Superfund Amendments and Reauthorization Act of 1986 (SARA) Title III requires emergency planning based on Threshold Planning Quantities (TPQs) and release reporting based on Reportable Quantities (RQs) in 40 CFR 355 (used for SARA 302, 304, 311 and 312).

Components present in this product at a level which could require reporting under the statute are:

Chemical Name	CAS#	Maximum Concentration (Wt. %)
None	N/A	N/A

SARA Title III, section 313:
The Superfund Amendments and Reauthorization Act of 1986 (SARA) Title III requires submission of annual reports of release of toxic chemicals that appear in 40 CFR 372 (for SARA 313).

Components present in this product at a level which could require reporting under the statute are:

Chemical Name	CAS#	Maximum Concentration (Wt. %)
None	N/A	N/A

TSCA:

The components of this mixture are listed in the Toxic Substance Control Act Inventory of Chemical Substances.

Section 16 Other Information

Legend: **N/A**: Not Applicable
N/D: Not Determined
N/E: Not Established
N/R: Not Required
STEL: Short Term Exposure Limit
C: OSHA Ceiling Value
cps: Centipoise
mg/m^3: milligrams per cubic meter
mppcf: million particles per cubic foot of air.
PPM: Parts Per Million
PPB: Parts Per Billion
PEL: Permissible Exposure Limit
TLV: Threshold Limit Value
TWA: Time Weighted Average
ACGIH: American Conference of Governmental Industrial Hygienists
CPSC: Consumer Product Safety Commission
DOT: US Department of Transportation
FHSA: Federal Hazardous Substance Act
OSHA: Occupational Safety and Health Administration (US Dept. of Labor)
RCRA: Resource Conservation and Recovery Act
SARA: Superfund Amendment and Reauthorization Act
Skin: This substance has the potential to be absorbed systemically through the skin.
TSCA: Toxic Substance Control Act

Prepared By: Zinsser Regulatory Compliance Dept.
173 Belmont Drive Somerset, NJ 08875 (732) 469-8100

Appendix 1F: Coating Thickness Report

SPCC

Industrial, Petrochemical and Marine Coating Consulting
NACE Certified Coating Inspector

Monday, April 14, 2008

Mr. Brent Cullinan
Color Dynamics

Subject: Wheeler Army Airfield Building 118 Roof Coating Evaluation

Dear Sir,

SPCC and Consulting provided a cursory site visit and subsequent evaluation of the applied coating system on the exterior of the building 118 roof. The building roof had an existing waterproofing elastomeric acrylic membrane had been previously applied to the aluminum roof. The existing roof coating was not evaluated for adhesion to the base substrate prior to the site visit and the existing dry film thickness ware not measured. According to Color Dynamics, no leaking was evident at the time of the coating project and the roof coating was in satisfactory condition. No environmental readings were conducted by SPCC and Consulting.

The evaluation was conducted on March 27, 2008 by Joe Olvey, a NACE Certified Coatings Inspector. The on-site Color Dynamics employee, Mark *Able*, was the foreman of the project. The time of the evaluation was 0900 hours, the weather was clear and the ambient temperature was 80 around degrees Fahrenheit. The modified specification, provided by Mandaree SOW 07T0097 required an application of *VFI – 535 Copper* applied at a minimum dry film thickness of 40.0 mils on all flat surfaces and 80.0 mils on all seams, fasteners and penetrations. The specified coating is 97% solids polyurea hybrid manufactured by VOLITILE FREE INC..

Specific non destructive thickness readings could not be performed to determine the new coating film thickness since the total film thickness of the

previously applied coating and the newly applied coating would both be measured; however destructive dry film testing can be performed using a Tooke Gage. No destructive testing was performed since the testing would require touchup.

The polyurea coating appeared to be smooth, glossy and monolithic.
Total dry film thickness readings were taken at five locations, three readings per location using a Positector 6000 FN (ferrous and non ferrous capabilities) dry film thickness gage with thickness ranges from 0 to 250 mils. The total dry film thickness of the complete coating system on the building roof ranged from 42.0 to greater than > 250.0 mils. Typical film thickness for an existing elastomeric roof coating on this type of roof can be as little as 5.0 to 50.0 mils total film thickness. Prior to the application of the polyurea no dry film thicknesses were determined.

The specification requires encapsulation of all seam fasteners and penetrations and evidence of good hiding and uniform. It is the opinion of the writer that the system exhibits good hiding and has a glossy finish.

Should you have any question, please feel free to call me to discuss the assessment evaluation. My cellular phone number is 808-285-3526.

Sincerely,
Joe Olvey
SPCC and Consulting
NACE Certified Coatings Inspector
Senior Corrosion Specialist

Appendix 1G: Coating and Labor Warranties

ELASTOMERIC COATING SYSTEM
FIFTEEN YEAR MATERIAL WARRANTY

Subject to the conditions below and if applied according to Volatile Free, Inc.'s product specifications and application procedures, Volatile Free, Inc. warrants that the Volatile Free, Inc. Elastomeric Coating System supplied for use at:

Structure: Bldg. 118, Wheeler AAF

Address: 851 Wright Avenue
Schofield, HI 96857

Owner: US Army

Specification: 535MR32

Area Sq. Footage:14,400

Date of Completion of Application: 3/31/08

File # 033108C

is free of defects in material at time of sale and to meet published physical properties when applied, cured and tested in accordance with Volatile Free, Inc.'s. standard procedures for Quality Control. Volatile Free, Inc.'s sole liability is limited to replacement of any product shown to be otherwise than as warranted within a fifteen (15) year period from the date of application. This warranty is dependent on the following conditions.

1. This warranty does not apply to damage to the coating by physical abuse, failure of the structure or substrate, vandalism, modifications to the roof, windstorm, lightning, hail, plant life, animal life or other casualty.
2. All Volatile Free, Inc. products must be applied in accordance with standard Volatile Free, Inc.'s product specifications and application procedures.
3. This warranty does not extend to labor costs for inspection, testing or repair of the Volatile Free, Inc. Elastomeric Coating System or any other labor costs.
4. This warranty does not cover color changes or oxidation of the coating as a result of normal weathering or atmosphere conditions.
5. This warranty does not apply to damage to the Elastomeric Coating System by settlement, cracking, warping, expansion, contraction, deflection or other movement of the building greater than 1/16 of an inch at its widest point.
6. Volatile Free, Inc. will not be liable for consequential or incidental damages of any kind including but not limited to damages to the structure or its contents resulting from defects in the roof covering or Volatile Free, Inc. Elastomeric Coating System. The obligation assumed under this warranty is expressly limited to providing such materials, as provided herein, required to repair any defects covered herein.
7. Liability ceases if any alterations, additions, or repairs (excluding emergency repairs) are made except in accordance with specific written instructions from Volatile Free, Inc.
8. Any notice of claimed defect in Volatile Free, Inc.'s materials shall be sent in writing to Volatile Free, Inc. at the address below, including a statement of scope, pictures of claimed defect and evidence suggesting Volatile Free, Inc.'s liability. Failure to notify Volatile Free, Inc. in writing, as provided herein, of any such claimed defects within 7 days of discovery shall void this warranty.
9. This warranty becomes effective only upon payment in full to Volatile Free, Inc., for all outstanding charges relating to this project.
10. EXCEPT AS PROVIDED FOR HEREIN, VOLATILE FREE, INC. MAKES NO REPRESENTATION OR WARRANTY OF ANY KIND, EXPRESSED OR IMPLIED, INCLUDING BUT NOT LIMITED TO ALL IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR USE OR A PACTICULAR PURPOSE, OR ANY OTHER MATTER WITH RESPECT TO THE VOLATILE FREE, INC. ELASTOMERIC COATING SYSTEM.

APPLICATOR
Color Dynamics
816 Gulich Avenue
Honolulu, HI96857
By: _____
Corporate Officer Brent Cullinan
Title: Vice Pres
Date: 4-28-8

MANUFACTURER
VOLATILE FREE, INC.
P.O. Box 344
Brookfield, WI 53008
By: _____
Corporate Officer Nancy Hochmuth
Title: President
Date: 5-2-08

CDI
COLOR DYNAMICS INC

WARRANTY FOR LABOR

Color Dynamics, Inc. a Hawaii contractor, hereby warrants to the Owner of this project that the work put in place shall be free of defects caused by faulty workmanship for a period of fifteen (15) years from the time of substantial completion of work on the project, Wheeler Army Airfield Building 118 – Schofield, Hawaii – Rehabilitation of Metal Roof (No Materials), dated March 31, 2008.

This warranty is limited to the repair of any part of the painting work that fails due to defective workmanship. If a defect in work placed by Color Dynamics should occur, and is deemed to be caused by anything except defective workmanship, Color Dynamics will not be held responsible.

Any claim for breach of warranty shall be deemed waived unless Color Dynamics has received written notice within (30) days from the earliest date the Owner of the Project could have discovered the alleged breach. Color Dynamics will then conduct an inspection to determine the cause of the defect. If the defect is determined to be due to faulty workmanship from the original application, then Color Dynamics will promptly make repair. If the defect is deemed to be from some other cause, then the Owner will be notified of this determination. Owner shall have (30) thirty days from receipt of such notice to contest such determination, by issuing a written notice to Color Dynamics. In such a case, if the parties cannot resolve the dispute within a reasonable time, the matter shall be resolved by binding arbitration in the State of Hawaii.

In no event shall Color Dynamics be held responsible for any consequential damages to building or structure, it's contents, personal property, loss of profit, or for bodily injury or death of any person arising from or attributed to any defects in the workmanship or products installed.

This warranty is issued in lieu of all other guarantees or warranties express or implied. The warranty is non-transferable and effective only with the original owner. Owner must not make or permit, without Color Dynamics' prior written consent, changes in the use, function or purpose of the structure, or the warranty is void. Warranty is contingent upon complete and final payment for all labor and services per contract.

Wheeler Army Airfield Building 118 – Schofield, Hawaii
Rehabilitation of Metal Roof (No Materials)

Owner or Authorized Representative **Date**

Brent Cullinan **Brent Cullinan for Color Dynamics, Inc.** 5-13-08 **Date**

Annex 2: Supplementary Information and Data for Roof Re-covering System

Appendix 2A: Hi-Tec Roofing MRS 200 Project Details

FABRICATION AND INSTALLATION

DRAWINGS

JULY 2008

Project:
Wheeler AFB, Bldg. #835
Task Order: W9132T-HIT-001-02

Contractor:
Hi Tec Roofing, Inc.
5 Sand Island Road
Unit 157
Honolulu, HI 96819

CONTENTS

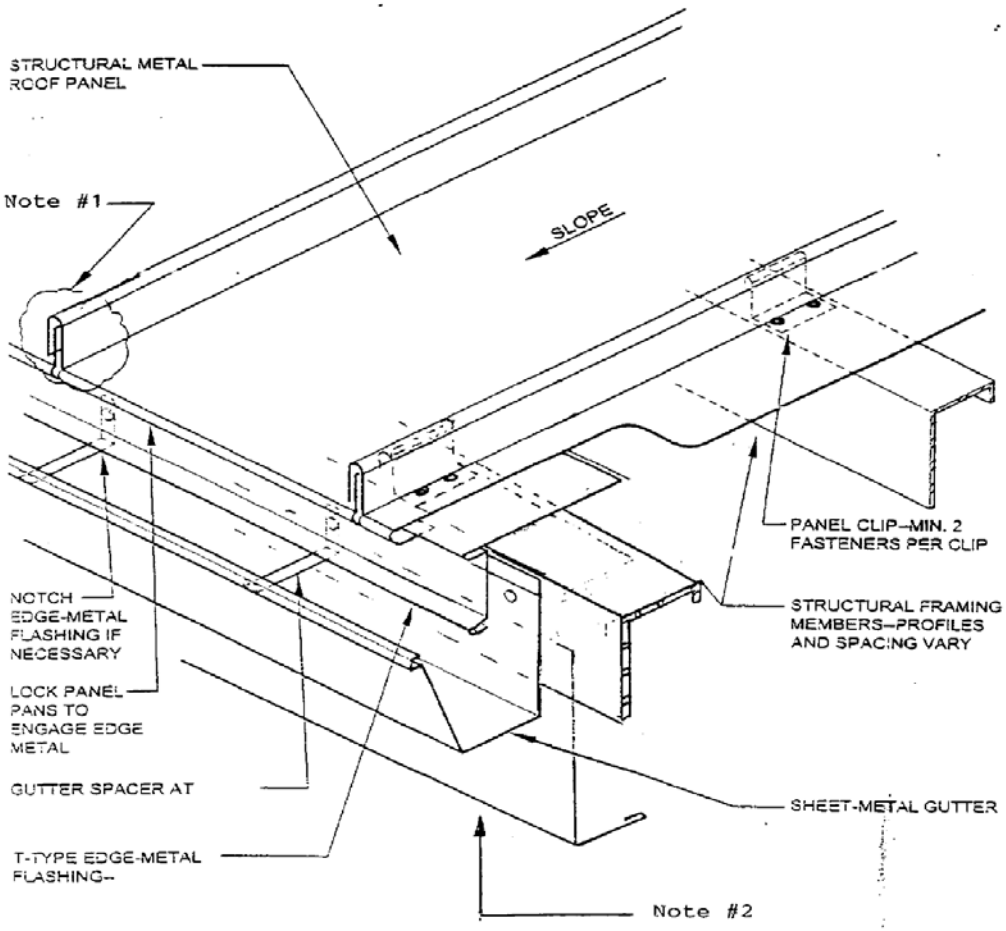
- **KEYNOTES TO DRAWINGS**

Note #	Description
1.	Standing seam (180° seam not shown for clarity)
2.	New 22 guage facia

General Notes

1. Roof panels and all exposed flashing components, ridge caps, rake edges, facia are 22 guage 2 mil prefinished galvalumn
2. Structural framing members are existing or "Roof Huggers"
3. Soffits and siding are not part of scope of work and are not shown for clarity
4. Clips, fasteners and sealants are as tested in the ATM 1592 test dated April 8, 2008
5. Existing roof not shown for clarity
6. Not to Scale

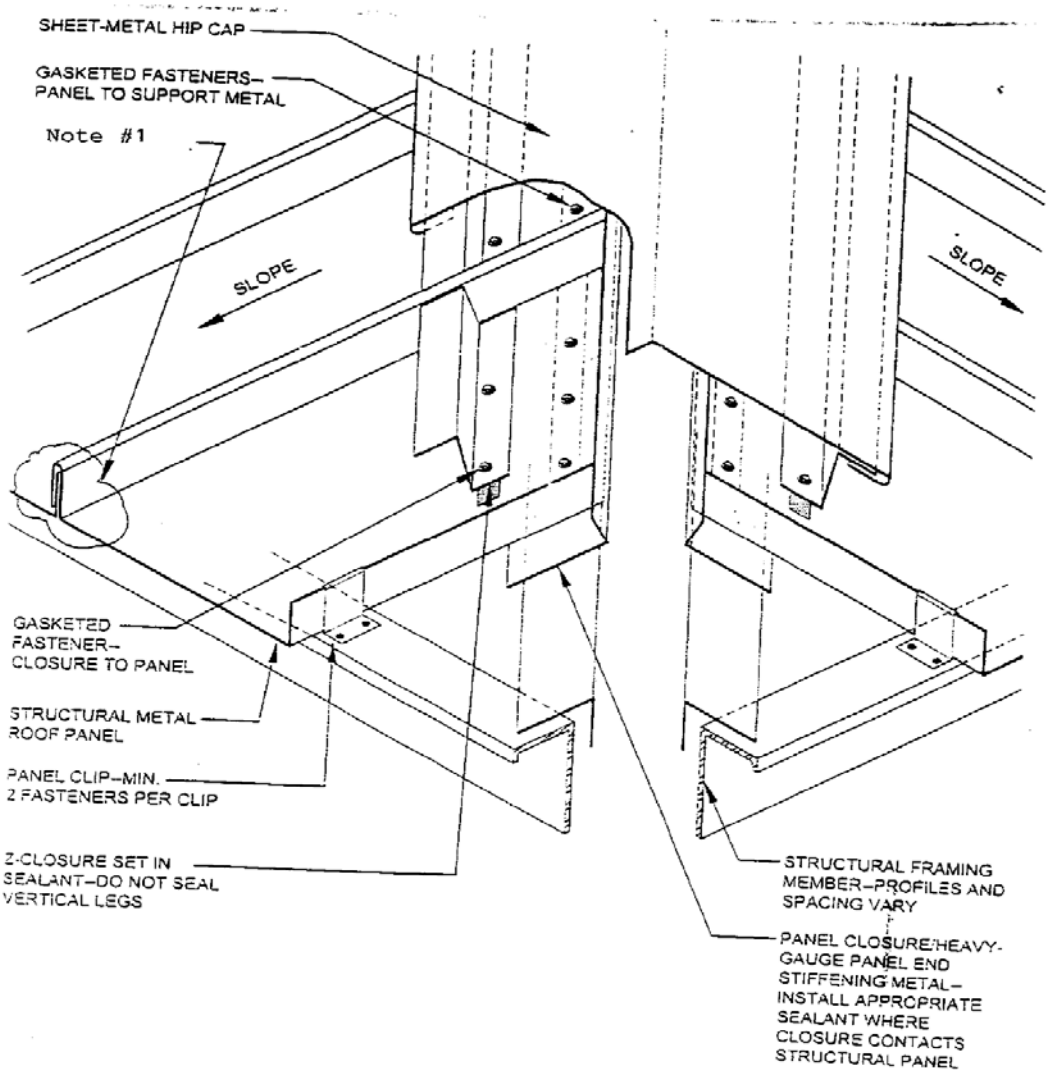
SVM-2A Eave Flashing with Gutter



Project:
Wheeler AFB, Bldg. #835
Task Order: W9132T-HIT-001-02

Contractor:
Hi Tec Roofing, Inc.
5 Sand Island Road
Unit 157
Honolulu, HI 96819

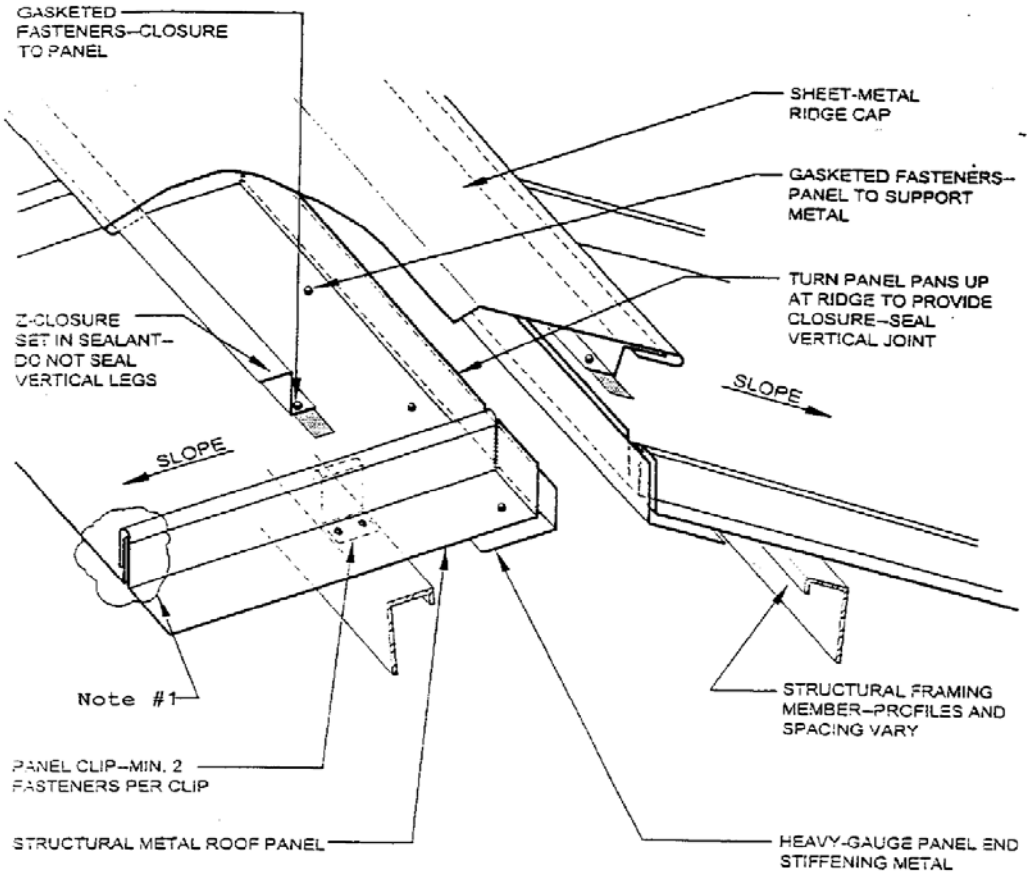
SVM-9A Hip Cap Flashing



Project:
Wheeler AFB, Bldg. #835
Task Order: W9132T-HIT-001-02

Contractor:
Hi Tec Roofing, Inc.
5 Sand Island Road
Unit 157
Honolulu, HI 96819

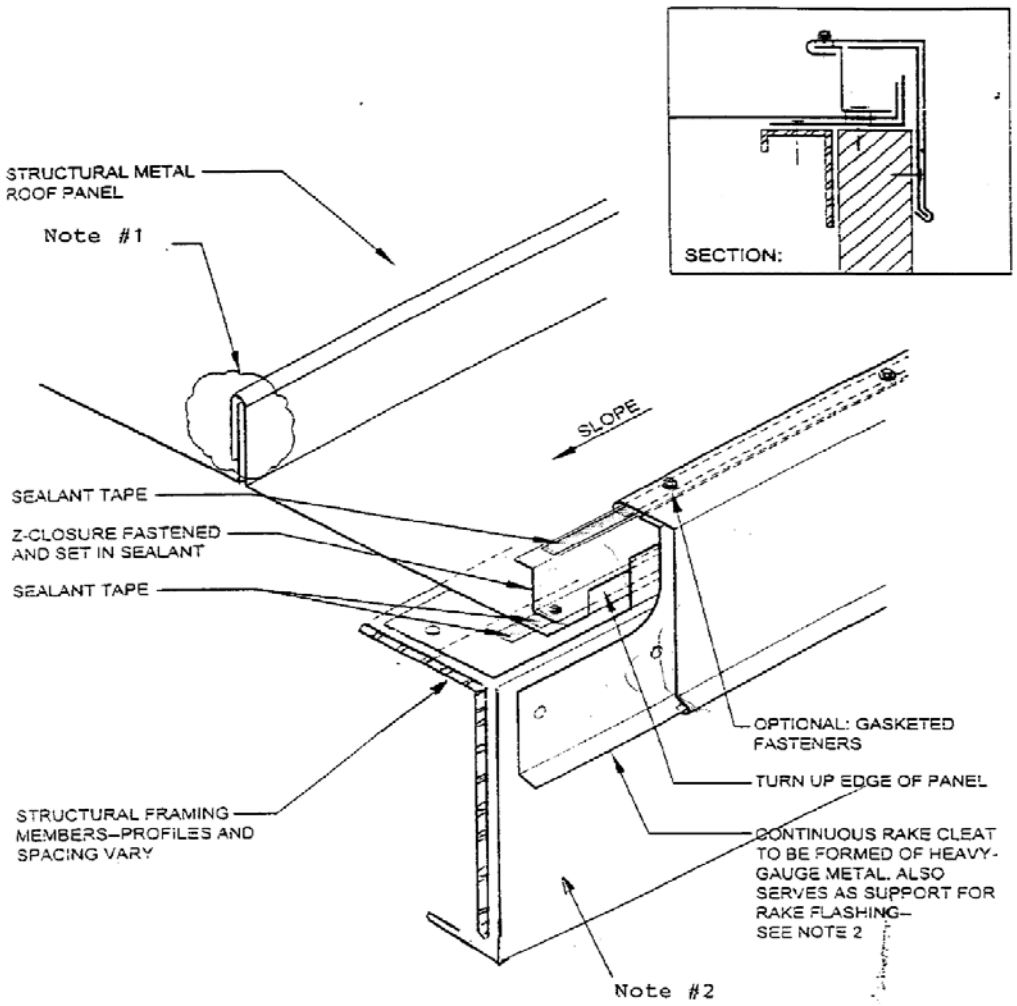
SVM-5A Ridge Cap Flashing



Project:
Wheeler AFB, Bldg. #835
Task Order: W9132T-HIT-001-02

Contractor:
Hi Tec Roofing, Inc.
5 Sand Island Road
Unit 157
Honolulu, HI 96819

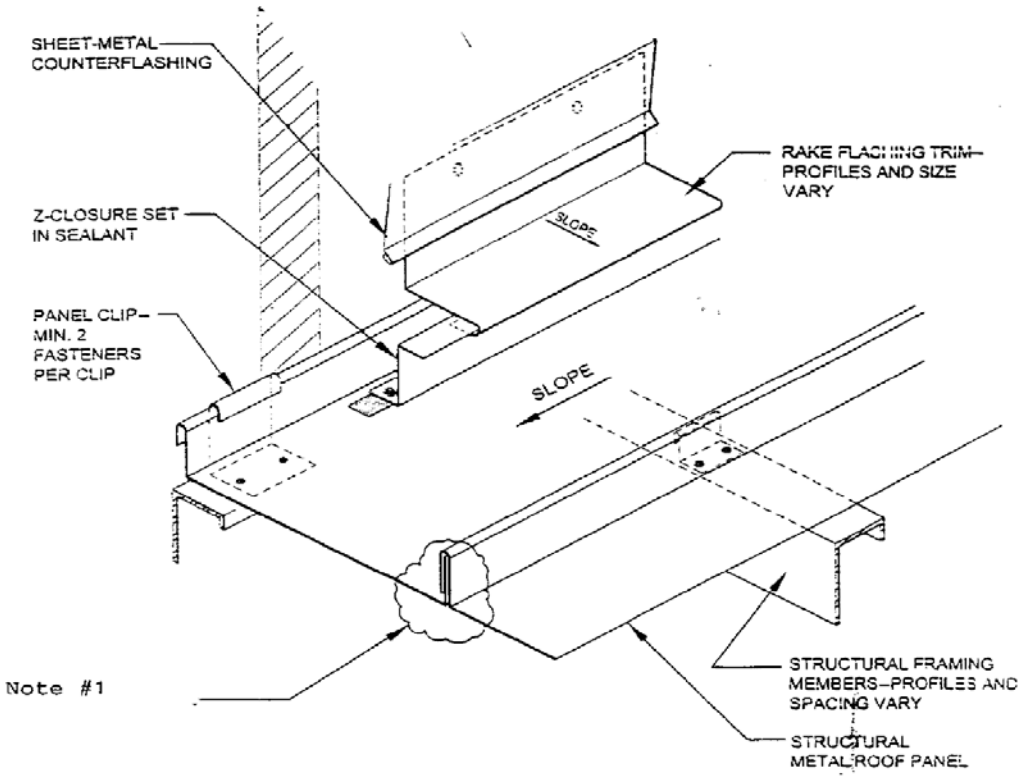
SVM-4 Rake Edge Flashing--End Panel



Project:
Wheeler AFB, Bldg. #835
Task Order: W9132T-HIT-001-02

Contractor:
Hi Tec Roofing, Inc.
5 Sand Island Road
Unit 157
Honolulu, HI 96819

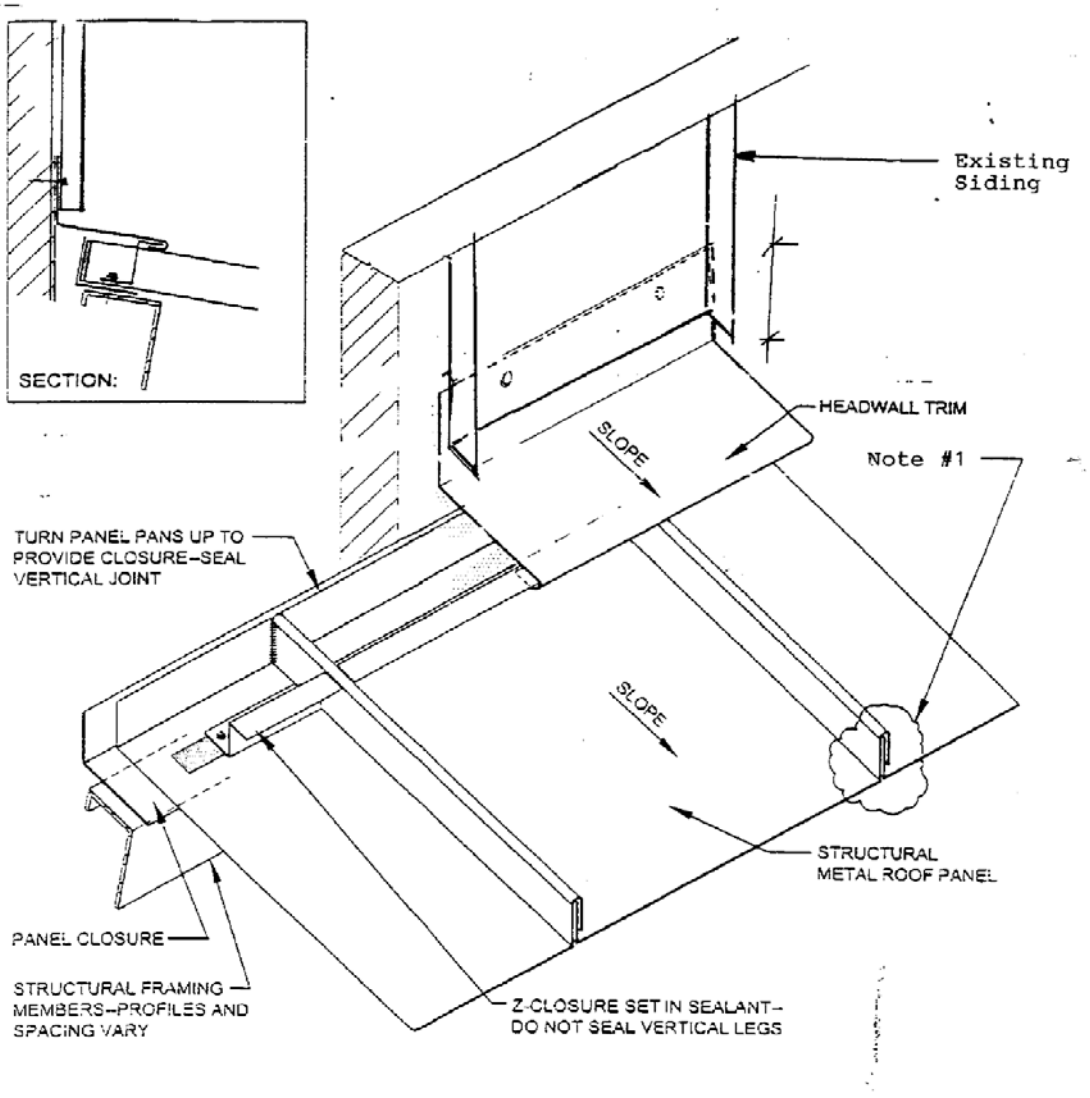
SMV-13B Roof-to-Wall (sidewall) Transition--Starter Panel



Project:
Wheeler AFB, Bldg. #835
Task Order: W9132T-HIT-001-02

Contractor:
Hi Tec Roofing, Inc.
5 Sand Island Road
Unit 157
Honolulu, HI 96819

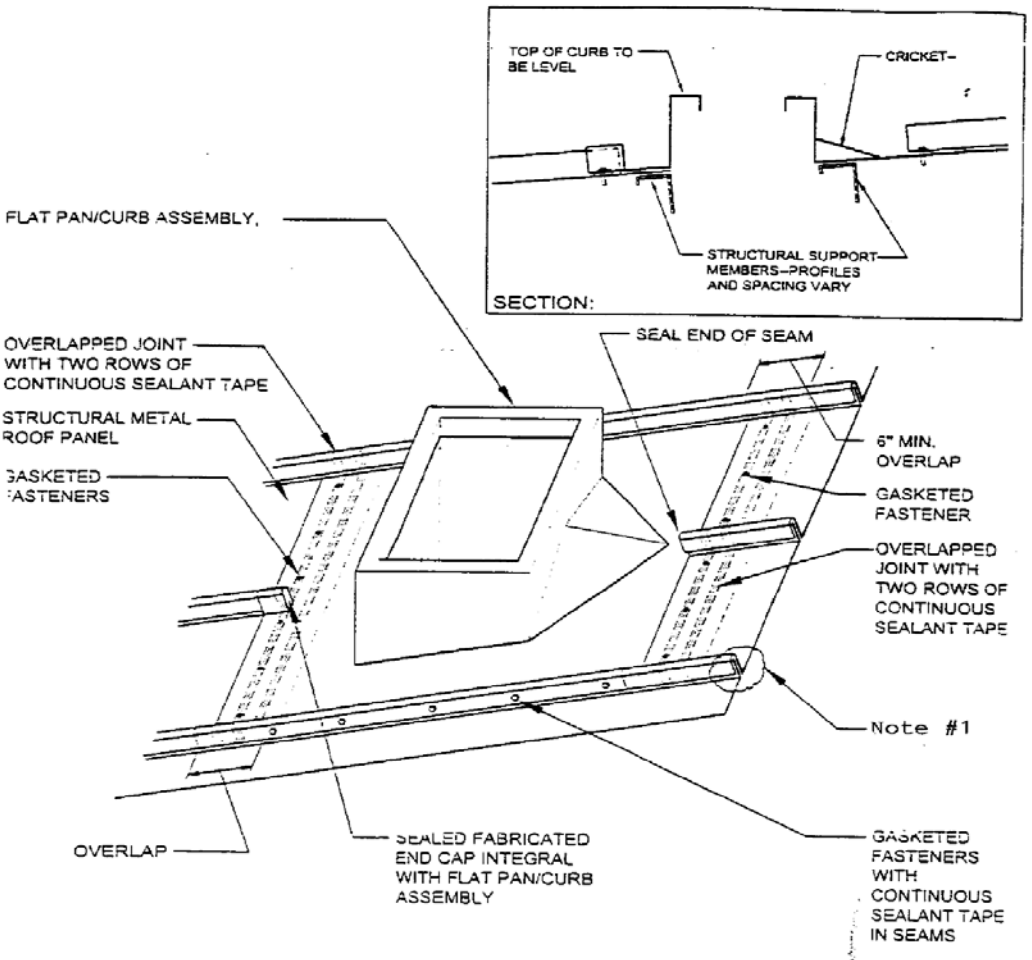
SVM-11A Roof-To-Wall (headwall) Transition



Project:
Wheeler AFB, Bldg. #835
Task Order: W9132T-HIT-001-02

Contractor:
Hi Tec Roofing, Inc.
5 Sand Island Road
Unit 157

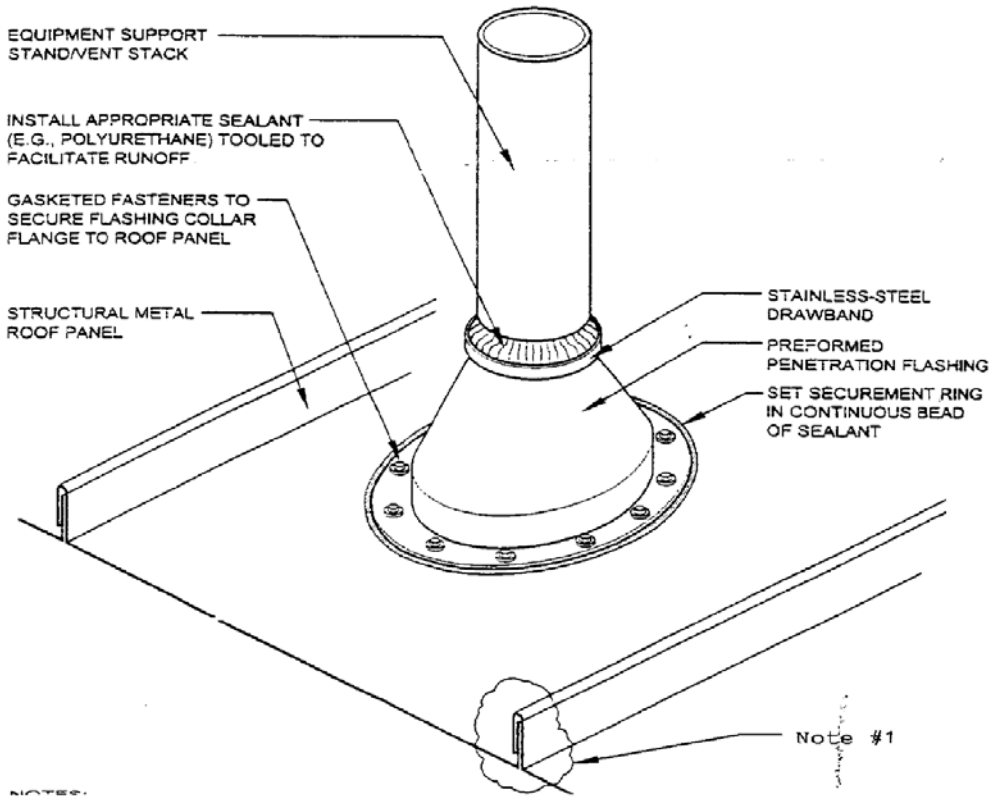
SMV-19 Raised Curb for Rooftop Equipment



Project:
Wheeler AFB, Bldg. #835
Task Order: W9132T-HIT-001-02

Contractor:
Hi Tec Roofing, Inc.
5 Sand Island Road
Unit 157
Honolulu, HI 96819

SVM-17 Equipment Support Stand/Vent Stack Flashing



Project:
Wheeler AFB, Bldg. #835
Task Order: W9132T-HIT-001-02

Contractor:
Hi Tec Roofing, Inc.
5 Sand Island Road
Unit 157
Honolulu, HI 96819

Appendix 2B: Contractor Health, Accident Prevention, and Safety Documents

Metal Roof at Wheeler AFB

Building 835 Bowling Alley

CONTRACT NO. W9132T-HIT-001

Site Specific Safety and Health Plan

Including Activity Hazard Analyses

License # BC17593

June 2008

1. SIGNATURE SHEET

A. Plan preparer:

1. Title: Superintendent' QC manager

2. Signature:

_____

Alan Meier

3. Telephone Number: 808-841-7663

4. Qualifications: Alan Meier has 30 years construction experience and has previously served as quality control manager and project superintendent for several Department of Defense construction projects.

B. Plan Approver:

1. Title: Project Manager/Company Safety Officer

2. Signature:

_ _____

Name: Robert Meier

3. Telephone Number: 841-7663

C. Plan Concurrence:

1. Title: Quality Control Representative

2. Signature:

_____

Name: Robert Meier

3. Telephone Number: 841-7663

2. BACKGROUND INFORMATION

A. Contractor: Hi-Tec Roofing, Inc.

B. Solicitation Number: W9132T-HIT-001

C. Project Name: **Metal Roof at Wheeler AFB Building 835-Bowling Alley**

D. Contract Description:

Reroof of Building 835 including the replacement of the gutter and downspouts as well as the fascia and soffits.

E. Contractor Accident Experience:

Hi-Tec Roofing, Inc. has a very low incidence of accidents. Hi-Tec Roofing, Inc. Experience Modification Ratings are as follows:

Year	EMR
2005	.80
2004	.78
2003	.74
2002	.78
2001	.76

F. Listing of Phases of Work and Hazardous Activities Requiring Activity Hazards Analysis

Job Site Mobilization

Division 07— Thermal and Moisture Protection

Metal Roofing, Gutters, Downspouts

Please see Activity Hazard Analyses at the end of this document.

3. STATEMENT OF HEALTH AND SAFETY POLICY

Hi-Tec Roofing, Inc. understands that construction work presents many risks to health and safety. However, health and safety may be protected with proper health and safety management.

As an employer in the building industry, it is our responsibility to provide a working environment where employees are protected from recognized health and safety hazards. Hi-Tec Roofing, Inc. is committed to preserving the health and safety of our employees and shall employ a comprehensive health and safety management program for this task order. This program shall incorporate compliance with the following:

- Hi-Tec Roofing, Inc. Site Specific Safety and Health Plan, including Activity Hazard Analyses

- EM 385-1-1, "Safety and Health Requirements Manual," Department of the Army, Corps of Engineers

- Hawaii Occupational Safety and Health (FIIOSH) Construction Standards

Note that in situations where applicable regulations overlap, the more stringent shall be recognized.

Health and safety in the work environment requires not only proper health and safety management, but also a commitment to health and safety from all personnel. Hi-Tec Roofing, Inc. shall encourage an attitude of health and safety awareness among all employees. Toward this end, Hi-Tec Roofing, Inc. Personnel shall be required to comply with all applicable health and safety regulations. Additionally, personnel are encouraged through the following:

- New employee indoctrination

- Weekly safety meetings for all personnel

- Site display of safety information

- Site safety reference materials

4. RESPONSIBILITIES AND LINES OF AUTHORITY

A. Identification and accountability of personnel responsible for safety:

- Project Manager/Corporate Safety Officer:

• Site Safety Representative:

B. Lines of Authority:

• Project Manager/Corporate Safety Officer (ultimate safety authority)

• Site Safety Representative (accountable to Project Manager/Company Safety Officer)

C. Qualifications:

Please see resumes and certificates for Corporate Safety Officer Alan Meier and Site Safety Representative Robert Meier on the following page

KEY PERSONNEL

Qualifications, Experience, and Recent Project Information.

Name: Alan Meier	
Proposed Assignment to this Project: Safety Officer and President of Hi-Tec Roofing, Inc.	Safety Officer and President of Hi-Tec Roofing, Inc.
Name of Firm, Position held, Dates of Employment:	Hi-Tec Roofing, Inc. President. 1992 till present. Member of Roof Consulting Institute and National Roofing Contractors Association (Director- 1985 – 1988). Currently holds State of Hawaii Contractor license for B-General, C-42 Roofing, C-44 Sheet Metal, C-19 Abatement, C-55 Waterproofing.
Number of Years w/other Firms, Position held, dates of employment:	35 years experience with all types of construction experience including but not limited to carpentry, roofing, sheet metal, and waterproofing, thermal insulation and solar. Owner operator of another mainland company for 30 years. Over past 15 years managed several projects on various bases. Wheeler AFB, Schofield Barracks, Pearl Harbor, Ft. Shafter and Kaneohe Marine Corp Base.
Educational Background: (Year, Degree, Specialization, Name of U.S. Accredited University)	High School Diploma
Professional Registration (if any): (Year, State, Discipline)	Contractor's License BC17593, State of Hawaii,

Name: Robert Meier	
Proposed Assignment to this Project:	Project Manager, Quality Control Officer and employee of AEI, Hi-Tec's sister company on the mainland.

Name of Firm, Position held, Dates of employment.	Hi-Tec Roofing, Inc. Project Manager, Quality Control Officer and employee of AEI, Hi-Tec's sister company on the mainland. 23 years experience.
Number of Years w/other Firms, Position held, dates of employment:	Has served as a Construction consultant as well as been employed by Hi-Tec Roofing, Inc. over the past 8 years.
Educational Background: (Year, Degree, Specialization, Name of U.S. Accredited University)	High School Diploma

Training Courses Completed: (COE (Corps of Engineers)
Construction quality management, safety Etc.)

Recent Project Involvement (Position, Project Name, Project Number, Value):
Information on additional projects available upon request.

Alan Meier – Safety Officer and President of Hi-Tec Roofing, Inc., 1992 – present. 35 years experience with all types of construction. Experience includes but not limited to carpentry, roofing, sheet metal, waterproofing, thermal insulation, solar. Owner operator of another mainland company for 30years. Member of Roof Consultant Institute and National Roofing Contractors Association (Director 1985 – 1988). Currently holds State of Hawaii Contractor License for B- General Contractor, C-42 Roofing, C-44 Sheet Metal, C-55 Waterproofing and C-19 Abatement. Over past 15 years managed multiple projects on various bases, Wheeler AFB, Schofield Barracks, Pearl Harbor, Ft. Shafter and Kaneohe Marine Corp Base.

Robert Meier – Project Manager/ Quality Control Officer and Employee of AEI, Hi-Tec's sister company on the mainland. 23 years experience with all types of construction. Experience includes but not limited to carpentry, roofing, sheet metal, and waterproofing, thermal insulation, solar. Over past 15 years managed multiple projects on various bases, Wheeler AFB, Schofield Barracks, Pearl Harbor, Ft. Shafter and Kaneohe Marine Corp Base.

5. SUBCONTRACTORS AND SUPPLIERS

A. Identification of Subcontractors

No subcontractors shall be used on said project.

Suppliers/Manufacturers:

Old Country Millwork – coil/metal

Roof Huggers – Sub Purlins

No suppliers or manufacturers will be on site: All deliveries are to Hi-Tec Roofing shop.

B. Means for Controlling and Coordinating Subcontractors and Suppliers

Each subcontractor shall be issued a copy of Hi-Tec Roofing, Inc. Corporation's Accident Prevention Plan. Subcontractors shall be instructed to comply with all provisions in this plan, the

COE EM 385-1-1, HIOSH Construction Standards, and all other applicable health and safety regulations.

Hi-Tec Roofing, Inc. shall require all subcontractors to acknowledge receipt and acceptance of the Hi-Tec Roofing, Inc. Accident Prevention Plan with a memorandum of understanding signed by a responsible managing employee. These documents shall be kept on file by the HI-Tec Roofing, Inc. Corporation Safety Officer who shall monitor their compliance.

Subcontractors shall be required to issue Activity Hazard Analyses for their definable features of work.

C. Safety Responsibilities of Subcontractors and Suppliers

Subcontractors and suppliers are required to comply with all federal, state, and local health and safety related regulations, as well as the safety guidelines as specified for this contract

Subcontractors and suppliers shall be responsible for providing ail necessary safety equipment and training to their employees.

Subcontractors and suppliers shall provide a drug-free work force.

Subcontractors are encouraged to chair weekly safety meetings for their employees or have their employees participate in Hi-Tec Roofing, Inc. Corporation's weekly safety meetings.

Subcontractors are required to provide a minimum of two first aid and CPR-trained personnel on each project work site during performance of their definable features of work as required.

6. TRAINING

A. Subjects to Be Discussed With Employees in Safety Indoctrination

1. Requirements and responsibilities for accident prevention and maintaining safe and healthful work environments
2. General health and safety policy
3. Procedures and pertinent provisions of the COB EM 385-1-1
4. Employee and supervisor responsibilities for reporting all accidents
5. Provisions for medical facilities, emergency responses and procedures for obtaining medical treatment or emergency assistance
6. Procedures for reporting and correcting unsafe conditions or practices
7. Job hazards and the means to control/eliminate those hazards, including applicable activity hazard analyses and Material Safety Data Sheets

B. Mandatory Training and Certifications

1. New employee safety indoctrination
2. Weekly safety meetings
   - Review past safety concerns such as accidents and unsafe activities
   - Review safe working procedures and safety training
   - Review Activity Hazard Analyses
   - Review Material Safety Data Sheets
   - Review accident and emergency procedures
3. Monthly supervisor's safety meetings

- Review job hazard analyses
- Review project safety concerns

4. Additional safety/safety related training to be conducted as required
   - Equipment operator's certification
   - Blood borne pathogen training
   - Hazard communication training
   - Eye protection training
   - Hearing protection training
   - Personal protective equipment training (hardhats, steel toed shoes, shirts w/sleeves, long pants)
   - Drug-free workplace training
   - First aid and CPR training

C. Requirements for Emergency Response Training

1. Emergency Exit Plan

   Hi-Tec Roofing, Inc. shall provide emergency exit plans for use in event of fire or other emergency. These plans shall include the following:

   - Escape routes for all areas of work
   - Personnel accounting after evacuation
   - Reporting procedures
   - Telephone numbers for ambulance, fire, and police

2. Foul Weather Plan

   Hi-Tec Roofing, Inc. shall monitor project work site weather conditions in order to protect workers from hazardous conditions caused by severe weather. These plans shall include the following:

   - Employee notification of severe weather
   - Immediate project work site evacuation
   - Securing all materials and equipment on the project work site
   - Utilization of shelters

3. First Aid and CPR Training

A minimum of two first aid and CPR certified personnel shall be on the project work site at all times during performance of work activities.

I). Requirements For Supervisory and Employee Safety Meetings

At the start of each work week (Monday at 7:30 am), there will be a half hour safety meeting for all workers. This meeting will be conducted by the safety officer. Each meeting will consist of a safety lesson on a topic related to the construction industry as well as review of project related activity hazard analysis and material safety data sheets (MSDS). These shall be located at a designated location on the job site. All meetings will be documented, and all documentation will be kept on the job site.

Once a month, all supervisory personnel shall participate in a supervisors' safety meeting. This meeting will be held at the beginning of the month (first Monday of the month at a time to be determined later). The project superintendent, QC manager, and general foreman shall attend. The meeting will be conducted by the project superintendent.

7. HEALTH AND SAFETY INSPECTIONS

A. Weekly unannounced on-site safety inspections shall be conducted by the Contract Safety Officer. The site shall be inspected for the following:

- Compliance with Hi-Tec Roofing, Inc. Accident Prevention Plan
- Compliance with COE EM 385-1-1
- Compliance with HIOSH
- Safe delivery and storage of materials
- Daily inspections and follow-up by the Site Safety and Health Officer
- Proper maintenance of equipment and tools

B. Daily on-site safety inspections shall be conducted by the Site Safety and Health Officer. These inspections will be recorded on the QC Daily reports.

C. Safety deficiencies shall be corrected immediately. If this is not possible, the area of work affected by the deficiency shall be properly isolated until the problem can be corrected. The Project Superintendent and the Site Safety and Health Officer shall have authority to expedite safety deficiency corrective action. The Project Manager/Contract Safety Officer, Project Superintendent, and Site Safety and Health Officer shall have authority to approve safety deficiency corrections. Once a safety issue is corrected, an authorized approving authority shall approve of the correction. This approval shall be recorded on the QC Daily report.

D. Other safety inspections may be conducted by the following agencies:

- US Department of the Army
- HIOSH

8. HEALTH AND SAFETY EXPECTATIONS. INCENTIVE PROGRAMS. AND COMPLIANCE

A. Safety Program Goals. Objectives And Accident Experience Goals Hi-Tec Roofing, Inc. safety program goal is to have an accident-free, injury-free contract performance. The Accident Prevention Plan shall be used toward this goal.

B. Policies and Procedures Regarding Noncompliance with Safety Requirements

Any non-compliance with the provisions of this Accident Prevention Plan must be reported to supervisory personnel immediately. All employees are encouraged to report close calls, unsafe conditions and unsafe acts to supervisory personnel.

The Project Superintendent shall then conduct an investigation. Personnel that have been found to be responsible for causing violation of safety provisions shall be issued a Safety Violation Warning. This warning shall be incorporated in the violator's employment file and shall be issued to supervisory personnel

Personnel involved in the violation of Accident Prevention Plan provisions for a second time shall be removed from the project work site.

C. Written Company Procedures for Project Managers and Supervisors Accountable For Safety

The Project Superintendent and the Site Safety Representative shall be accountable for enforcing the provisions of the corporate Accident Prevention Plan with the goal of providing a healthy and safe work environment for all employees.

The Project Manager/Contract Safety Officer shall oversee the safety management performance by these two personnel and shall have ultimate authority in all safety matters.

9. ACCIDENT REPORTING

A. Exposure Data

As required a monthly exposure report, written by the Project Superintendent, shall be submitted to the Contracting Officer attached to the monthly billing request. This report is a compilation of employee-hours worked each month for all site workers, both prime and subcontractor.

B. Accident Investigations and Recording/Immediate Notification of Major Accidents

All accidents, near-accidents, injuries, unsafe conditions, and unsafe acts shall be reported to supervisory personnel immediately. It is the supervisory personnel's responsibility to accept all such reports.

In case of accident, emergency response procedures shall be expedited to aid injured personnel, stabilize unsafe situations, and isolate accident scenes.

Supervisory personnel shall immediately notify the Site Safety Representative of the incident, and promptly produce an accident report for submittal td the job site safety officer.

The Site Safety Representative shall notify the Contracting Officer, within 4 hours, of any OSHA recordable occupational injury or illness. Information shall include contractor name;

contract title; type of contract; name of activity, installation or location where mishap occurred; date and time of mishap; names of personnel injured; extent of property damage, if any; and brief description of mishap (to include type of construction equipment used, PPE used, etc.) In addition to OSHA reporting requirements, initial notification shall be made of any accident involving significant mishaps.

For OSHA reportable accidents, the Site Safety Representative shall conduct a suitable investigation, complete a Contractor Significant Incident Report (CSIR) form, and provide this report to the Contracting Officer within 5 calendar days of a mishap.

Any lost time accident or accident resulting in property damage must be reported. A verbal report to the Contracting Officer shall be made followed by a written report using form POD 265-R. Written report is required within 48 hours after incident.

Copies of supervisory personnel accident reports, CSIRs, and POD 265-Rs shall be kept on file at YOUR COMPANY NAME Corporation offices.

State of Hawaii, Department of Labor, and Workman Compensation forms W-l and W-2 shall be completed and processed as required.

OSHA Form 300 shall be updated and posted as required.

A record of all first aid treatment shall be maintained at the main project work site treatment kit.

A list of all first aid supplies shall be maintained at the main project work site treatment kit.

10. MEDICAL SUPPORT

A. On-Site Medical Support

There shall be two workers on site certified in first aid and CPR. There will be a main project work site first aid kit maintained at all times. There will also be first aid kits in all supervisory personnel vehicles.

All supervisory personnel shall be equipped with cellular telephones that would enable them to summon emergency medical attention.

Primary and secondary medical support facilities shall be identified in the area of each work site.

An emergency response board shall be conspicuously posted at each work site indicating the following:

- Medical support facilities
- Poison control center
- Ambulance
- Fire
- Police
- Hot work permit contact
- Safety officer
- Project location map identifying:

  -primary and secondary medical support facilities

  -direction of emergency response team arrival

Please see list of emergency telephone numbers at the end of this section.

Emergency response information shall be reviewed at the first safety meeting of a construction contract and shall be reviewed regularly during on-going safety meetings.

A minimum of two first aid and CPR certified personnel shall be on a work site at all times during work hours. A current file of first aid and CPR certified personnel shall be kept on file.

Each work site shall be equipped with a large capacity first aid kit (mm. 16 unit) positioned at a conspicuous location.

All supervisory personnel vehicles shall be equipped with a fully stocked first aid kit.

B. Off-Site Medical Support

Hi-Tec Roofing, Inc. will use: Wahiawa General Hospital

128 Lehua Street

Wahiawa, HI. 96786

The telephone number is (808) 621-8411

11. PERSONAL PROTECTIVE EQUIPMENT

A. All workers shall be required to carry ear plugs for ear protection, safety goggles for eye protection and hard hats for head protection. All workers shall be required to wear short sleeve shirts and full length work pants for proper body protection. Workers shall be supplied with half face respirators and will be certified for their use prior to working on dust and gas generating tasks.

B. All personnel are required to properly maintain their personnel protective equipment.

C. Hard hats are to be worn at all times during work activity.

D. Safety glasses or goggles are to be worn in all situations where eye injury may occur. Examples of features of work that require eye protection are:

- Demolition
- Earthwork
- Concrete placement
- Any work requiring powder actuated devices
- Any work requiring metal welding, grinding, and cutting
- Any work requiring cutting

E. Safety shoes with steel toes are to be worn at all times during work activity except during certain roofing and carpet installation tasks.

F. Short pants and loose fitting clothing are not permitted to be worn during work activity.

G. Fall protection equipment shall be required when working in areas greater than 6 feet in height over adjacent surfaces. Hi-Tec Roofing, Inc. shall provide fall protection equipment to its employees. Subcontractors shall provide fall protection equipment to their employees. All workers requiring fall protection shall be trained in the use of fall protection equipment. Documentation of training shall be kept on file by Hi-Tec Roofing, Inc.. All fall protection shall comply with COE EM 385-1-1.

H. Respiratory protection equipment shall be required when working in tasks that generate nuisance or harmful dusts and gases. Hi-Tec Roofing, Inc. shall issue respirators with proper filters to all employees working in these situations. Respirators shall be fit tested for all such employees.

12. PLANS, PROGRAMS AND PROCEDURES (AS APPLICABLE)

A. Layout Plan (Please see Mobilization Plan at the end of this section.) The site specific layout plan will include:

1. Project ingress and egress

2. Haul routes

3. First aid kits

4. Emergency eye wash station

5. Emergency response bulletin board

6. On-site material storage containers

7. Combustible fuel storage

8. Toilet facilities

9. Project and quality control offices

10. Construction debris collection area

11. Temporary barricades

B. Emergency Response Plans

Hi-Tec Roofing, Inc. shall provide emergency response plans to ensure personnel safety in the event of any emergency. These emergency response plans shall have as their basis, the following:

1. Escape Procedures and Routes

   Hi-Tec Roofing, Inc. shall indicate emergency medical facility routes for all work sites.

2. Employee Accounting Following an Emergency Evacuation

   After an emergency evacuation~, the supervisor in the immediate area of the emergency will gather the employees and conduct an accounting of the employees. The supervisor will use a company roster to ensure an accurate accounting.

3. Rescue and Medical Duties

   Rescues and medical duties will be performed by fire and police personnel. Prior to arrival of professional rescue personnel, employees may attempt rescues and medical duties that are non-hazardous in nature. All employees are certified in first aid and **CPR.**

4. Means of Reporting Emergencies

   All supervisors shall be equipped with cellular telephones that can be used to summon help. Emergencies shall be reported to the proper authorities and to emergency re-

sponse personnel immediately. Emergency response personnel telephone numbers shall be conspicuously posted at all work sites.

5. Personnel to Be Contacted For Information or Clarification

   The Site Safety Representative at the work site shall be responsible for gathering information on all emergencies at that work site. This person shall be contacted for information or clarification.

6. Spill Plan

   Person discovering spill must:

   a. Turn off all sources of ignition (pumps, motors, etc.)

   b. Approach spill from upwind, attempt to stop the source (i.e. return containers to upright position, close valves, etc.) and move other materials that may pose hazards away from the incident scene without placing him/herself or coworkers at risk to injury.

   c. Evacuate and secure immediate area

   d. Fire Department phone numbers shall be posted in conspicuous locations

7. Fire Fighting Plan

   All supervisory vehicles shall be equipped with fire extinguishers.

   A fire extinguisher, rated at 2A, shall be provided for each 3,000 square feet of work area. The travel distance from any part of the area to the fire extinguisher shall be not more than *75* feet.

   A fire extinguisher, rated at JOB, shall be provided within 50 feet of areas where more than 5 gallons of flammable

or combustible liquids or 5 pounds of flammable gas are being used on a work site.

All fire extinguishers shall be inspected at regular intervals anti maintained in operational condition. Fire extinguisher training shall be provided to workers.

Combustible construction debris shall be removed from work sites at frequent, regular intervals.

All soldering and welding shall be conducted with proper permits, with one worker equipped with a fire extinguisher acting as fire watch.

Fire response telephone numbers shall be posted in conspicuous locations.

C. Hazard Communication Program

1. When hazardous substances are brought onto work sites, all employees potentially exposed to these substances shall be advised of information in the MSDS for the substances. A copy of the MSDS for each hazardous substance at a work site will be maintained in a hazardous substance file on the work site and will be provided to the designated authority and made available to all potentially exposed employees. For emergency response purposes, each entry in the file shall include the approximate quantities (e.g., liters, kilograms, gallons, pounds) of each hazardous substance that will be on site at any given time. In addition, a site map will be included in the file showing where inventoried hazardous substances are stored. The file and the site map shall be updated as frequently as necessary to ensure accuracy.

2. If an existing material to be disturbed is determined to possibly contain a hazardous substance, the Site Safety Representative shall be notified. At the Site Safety Repre-

sentative's discretion, the areas where this material occurs shall be immediately evacuated, and the proper authorities shall be notified.

Should a contract modification require abatement of a hazardous material, a fully licensed hazardous materials abatement firm, authorized to abate the specific hazardous material, shall be hired to perform this and all necessary related work.

This firm shall be required to provide a comprehensive hazardous materials abatement plan.

The Project Superintendent shall have supervisory responsibility over the safety management of hazardous materials removal.

D. Respiratory Protection Plan

Should a construction contract require hazardous materials abatement, a fully licensed hazardous material abatement firm shall be hired to perform this work. This firm shall be required to provide a respiratory protection plan.

In order to protect against general construction dust and other respiratory nuisances, all workers will be provided with respirators with half face pieces. The selection, fit testing, use, maintenance, and storage of respiratory protective equipment; the training of the use of respiratory equipment; and the physically and medically determined qualifications to wear respiratory protection devices will all be performed according to, and meet, industry standards.

A reputable firm will be contracted to supply and fit test the respiratory protective equipment. Fit test certifications will be issued by this firm. Fit tests will be conducted as often as is required.

Concentra Medical Centers will perform all required medical tests. Medical tests will be conducted as often as is required.

E. Health Hazard Control Program

1. Accident Prevention

    a. The Project Superintendent and Site Safety Representative shall inspect their work sites frequently. All other supervisory personnel shall have a heightened awareness of work site safety conditions and shall report any unsafe working situations to the Project Superintendent or Site Safety Representative immediately.

    b. The Project Superintendent and Site Safety Representative shall have authority and responsibility to correct any unsafe working condition or situation immediately

    c. It is the responsibility of each employee to report any unsafe working condition or situation to supervisory personnel

    d. All defective or otherwise unsafe tools, equipment, and machinery shall be locked and tagged as such and removed from the work site immediately

    e. Equipment of any kind shall only be operated by qualified personnel

2. Housekeeping

    a. Each work site is to be cleared of debris and put in orderly condition at the end of each work day and as necessary in the course of a work day

    b. Waste containers shall be provided at each work site. Construction debris shall be disposed of at frequent and regular intervals. Containers for flammable or hazardous materials shall be equipped with covers

3. Means of Egress

    a. Clear, unobstructed exit passageways shall be maintained at every structure that workers occupy

    b. If exits and passageways are not readily apparent, they shall be marked with clearly visible signage

F. Lead Abatement Plan

If an existing material to be disturbed is determined to possibly contain lead, the areas where this material occurs shall be immediately evacuated, and the proper authorities shall be notified.

Should a construction contract require lead abatement, a fully licensed hazardous materials abatement firm, authorized to abate lead, shall be hired to perform this and all necessary related work pending a contract modification.

This firm shall be required to provide a comprehensive lead abatement plan.

The Site Safety Representative shall have supervisory responsibility over the safety management of hazardous materials removal.

G. Asbestos Abatement Plan

If an existing material to be disturbed is determined to possibly contain asbestos, the areas where this material occurs shall be immediately evacuated, and the proper authorities shall be notified.

Should a construction contract require asbestos abatement a fully licensed hazardous materials abatement firm, authorized to abate asbestos, shall be hired to perform this and all necessary related work pending a contract modification.

This firm shall be required to provide a comprehensive asbestos abatement plan.

The Site Safety Representative shall have supervisory responsibility over the safety management of hazardous materials removal.

H. Abrasive Blasting Not applicable.

A. Confined Space Not applicable.

J. Hazardous Energy Control Plan Not applicable.

General Electrical Safety Procedures

A. Overhead Distribution

a. Quality Control Manager Robert Meier shall notify the Contracting Officer in writing within 30 days prior to electrical outage.

b. The electrical foreman shall inform all crews of upcoming outages and the duration.

c. The electrical foreman will conduct a meeting daily with his crew to review the AHA's for the assigned activity or activities. He will discuss the sequence of operations and detail what material and tools that will be needed to safely conduct the installations.

d. The electrical foreman shall check all crew members assigned to the days activities to insure that each of them have all the PPE needed for a safe installation.

e. The electrical foreman will check with his own test equipment and PPE to make sure the lines are de-energized before work begins.

f. After the installation the electrical foreman will check for ground faults and any wiring inconsistencies before energizing.

K. Miscellaneous Work Practice Requirements

a. Electrical wiring, cords, and cables shall be protected from damage

b. Extension cords for portable electrical tools, appliances and lights shall be of three-wire type and shall be designed for hard or extra hard usage

c. Electrical cords shall be connected to devices and fittings so that there will be no strain from pulling

d. All electrically powered hand tools shall be ground fault circuit interrupter protected. This includes double insulated tools.

e. Electrical cords shall be positioned so as to avoid paths of heavy equipment unless cords are protected from damage

f. Extension cords shall not be secured with staples, nails, screws or wire

g. Electrical cords shall not be used for raising or lowering equipment

h. Personnel working near energized lines shall have work areas properly illuminated

i. A minimum clearance of 10 feet shall be provided between vehicles/mechanized equipment and energized overhead electrical lines

j. Clearance of 10 feet may be reduced under the following conditions:

a) If machinery is in transit with its appendages lowered, the clearance may be reduced to 4 feet

b) If insulating barriers are provided, the clearance may be reduced to the distance as recommended by the insulating barrier manufacturer

k. Personnel shall not be permitted to work near the base of any elevated structure where any part of the structure is within 10 feet of an energized source

L. Critical Lift Procedures

Not applicable

M. Contingency Plan for Severe Weather

Hi-Tec Roofing, Inc. shall be responsible for regular monitoring of job site weather conditions in an effort to avoid hazardous conditions caused by severe weather. In the event of severe weather conditions, procedures shall be done in a timely manner to reduce job-site danger.

Inclement Weather: The below ERP states the procedures, notifications, and actions to be taken in the event of typhoon evacuation orders. The actions are based upon the different levels of typhoons to be expected in Hawaii.

1. Training: The following training requirements will be conducted and/or verified by the Safety Manager:

- All employees will be given typhoon emergency action training. This training will include the levels of typhoons and the need for a “Typhoon Kit”.

- All employees will be given training on the precautionary actions that should be taken to prepare the job site for the levels of typhoon intensity.
- All employees will be provided with information on evacuation routes, and their responsibilities in the event of a typhoon evacuation order.
- All employees will be trained in the location of the Safe Area, and emergencies that would require employees to assemble at the Safe Area.

2. Notifications: In the event of typhoon alerts or evacuations, the Project Superintendent/ Safety Manager will insure that all employees are notified and accounted for. Procedures for notifying employees of the return to work or All Clear will be established and disseminated to the employees.

3. Actions: Typhoon Condition of Readiness

- *Condition Four (Sustained winds of 93 km/hr or greater expected within 72 hours):* Normal daily jobsite cleanup and good housekeeping practices. Collect and store in piles or containers scrap lumber, waste material, and rubbish for removal and disposal at the close of each workday. Maintain the construction site including storage areas, free of accumulation of debris. Stack form lumber in neat piles less than one m high. Remove all debris, trash, or objects that could become missile hazards. Contact Contracting Officer for Condition Requirements.
- *Condition Three (Sustained winds of 93 km/hr or greater expected within 48 hours):* Maintain "Condition Four" requirements and commence securing operations necessary for "Condition One" which cannot be completed within 18 hours. Cease all routine activities, which might interfere with securing operations. Commence securing and stow all gear and portable equipment. Make preparations for securing buildings. Review requirements pertaining to "Condition Two" and continue action as necessary to attain "Condition Three" readiness. Contact Contracting Officer for weather and Condition of Readiness **(COR) updates and completion of required actions.**
- *Condition Two (Sustained winds of 93 km/hr or greater expected within 24 hours):* Curtail or cease routine activities

until securing operation is complete. Reinforce or remove formwork and scaffolding. Secure machinery, tools, equipment, materials, or remove from the jobsite. Expend every effort to clear all missile hazards and loose equipment from general base areas. Contact Contracting Officer for weather and Condition of Readiness (COR) updates and completion of required actions.

- *Condition One* (Sustained winds of 93 km/hr or greater expected within 12 hours): Secure the jobsite, and leave Government premises.

N. Access and Haul Road Plan

An access and haul route plan will be submitted for government approval

O. Demolition Plan (engineering and asbestos surveys)

See demolition plan

P. Emergency Rescue (tunneling1

Not Applicable

Q. Underground Construction Fire Prevention and Protection Plan

Not Applicable

R. Compressed Air Plan – Not Applicable

S. Form work and Shoring Erection and Removal Plans

Not Applicable

T. Jacking Plan

Not Applicable

U. Safety and Health Plan

A complete Accident Prevention Plan will be submitted for approval prior to start of work.

V. Blasting Plan

Not Applicable

W. Diving Plan

Not Applicable

X. Prevention of Alcohol and Drug Abuse Plan

1. The use of alcohol, drugs, or other mind-altering substances is not permitted as a condition of employment
2. Personnel found to be influenced by mind-altering substances or having such substances in possession shall be immediately removed from the work site and may face termination and/or legal consequences
3. Hi-Tec Roofing, Inc. shall establish a program to heighten alcohol and drug-free awareness among employees. This program shall consist of dissemination of printed material and periodic discussions of mind-altering substances during safety meetings.

Y. Fall Protection Plan

I. PURPOSE: This policy contains the requirements for practices and procedures to establish safe work operations to prevent falls. This policy establishes the minimum guidelines for Hi-Tec Roofing, Inc. employees involved in work at elevations. Hi-Tec Roofing, Inc. employees in some areas may be subject to more stringent requirements than those listed below depending upon the working conditions at the time. Falls are frequently "FATAL", and therefore all efforts to prevent falls will be given the utmost consideration(s).

II. SCOPE; Any person working at an elevation of six (6') feet or higher than the prevailing floor elevation, and not on permanent walkways surrounded by permanent guardrails, shall wear NIOSH approved fall protection equipment, and shall attach the lanyard to a substantial anchorage point at or above the waistline. Fall prevention techniques shall be used even when working on permanent platforms with installed guardrails and the risk of a slip and fall exist.

TIE OFF MUST BE TO A PERMANENT STRUCTURE ANCHORAGE POINT. Fall protection is required under the following circumstances:

Z. Steel Erection Plan

Not Applicable

AA. Night Operations Lighting Plan Not Applicable

BB. Site Sanitation Plan

a. The work site is to be cleared of debris and put in orderly condition at the end of each work day and as necessary in the course of a work day.

b. Waste containers shall be provided at the work site Construction debris shall be disposed of at frequent and regular intervals. Containers for flammable or hazardous materials shall be equipped with covers

CC. Fire Prevention Plan

All supervisory vehicles shall be equipped with fire extinguishers.

A fire extinguisher, rated at 2A, shall be provided for each 3,000 square feet of work area. The travel distance from any part of the area to the fire extinguisher shall be not more than 100 feet.

A fire extinguisher, rated at 10B, shall be provided within 50 feet of areas where more than *5* gallons of flammable or combustible liquids or *5* pounds of flammable gas are being used on a work site.

All fire extinguishers shall be inspected at regular intervals and maintained in operational condition. Fire extinguisher training shall be provided to workers.

Combustible construction debris shall be removed from work sites at frequent, regular intervals.

All soldering and welding shall be conducted with proper permits, with one worker equipped with a fire extinguisher acting as fire watch.

Fire response telephone numbers shall be posted in conspicuous locations.

13. Contractor Information (compliance)

A. Site Work

1. Mechanized equipment

a. All mechanized equipment to be used in the performance of this contract shall be certified by a mechanic to be in sound operating condition prior to its delivery to any task order work site.

b. A safety tire rack, cage, or equivalent shall be used when working on tires mounted on split rims or rims equipped with locking rings or similar devices

c. Parked mechanized equipment shall have parking brakes set Equipment parked on inclines shall have wheels chucked and parking brakes set.

d. Windows of operator control stations shall be glazed with non-distorting safety glass

e. All mechanized equipment shall be equipped with back up audio warning devices

f. All mechanized equipment shall be equipped with 5AB fire extinguishers mounted in the operator's control station

2. Motor vehicles

a. Tools, equipment, and materials shall be properly secured when transported in the same compartment as personnel

b. Personnel shall be transported in vehicles of adequate capacity

c. Personnel shall utilize seat belts while being transported

d. Vehicle drivers shall obey all traffic laws

3. Site clearing

Site clearing equipment shall be equipped with rollover protection

14. Electrical Safety

1. General

a. Electrical conductors and equipment shall meet the specifications of this contract

b. Electrical equipment shall be in good operational condition, presenting no hazards to personnel

c. Electrical equipment shall be permanently labeled with manufacturer's name, trademark, voltage, current, wattage, and/or other ratings as necessary to identify origination and operational parameters

2. Wiring design and protection

g. Grounded conductors shall be easily identifiable and distinguishable as such

h. No grounded conductor shall be attached to any terminal or lead so as to reverse designated polarity

3. Wiring methods, components and equipment for general use

1. No wiring of any type shall be installed in conduit used to transport dust, loose materials, or flammable vapors.

m. Electrical wiring and cords shall not be used to suspend temporary lights unless they are specifically designed for this purpose

n. Electrical wiring, cords, and cables shall be protected from damage

o. Extension cords for portable electrical tools, appliances and lights shall be of three-wire type and shall be designed for hard or extra hard usage

p. Electrical cords shall be connected to devices and fittings so that there will be no strain from pulling

q. All electrically powered hand tools shall be ground fault circuit interrupter protected. This includes double insulated tools.

r. Electrical cords shall be positioned so as to avoid paths of heavy equipment unless cords are protected from damage

4. Safety related work practices

a. When performing work in areas where exact locations of underground utility lines are unknown, personnel using jack hammers, and other metal hand tools which may contact lines shall be provided with insulated protective gloves.

b. When personnel, tools, or machinery are to be employed in areas where electrical or physical contact with energized electrical circuits may be made, warning signs shall be posted indicating such danger. Personnel shall be advised of the location of such lines, the dangers involved, and the protective measures to be taken

c. Circuits should be de-energized by the lockout/tag out requirements of EM 385-1-I if at all possible. Only qualified personnel may work on or near energized lines and equipment should these kinds of work conditions be unavoidable (Revision 1)

d. Defective extension cords and tools with damaged electrical cords shall be removed from use and repaired immediately by qualified personnel

e. Extension cords shall not be secured with staples, nails, screws or wire

f. Electrical cords shall not be used for raising or lowering equipment

g. Personnel working near energized lines shall have work areas properly illuminated

h. Clearance of 10 feet shall be provided between vehicles/mechanize equipment and energized overhead electrical lines

i. Clearance of 10 feet may be reduced under the following conditions:

1.) If machinery is in transit with its appendages lowered, the clearance may be reduced to *4* feet

2.) If insulating bathers are provided, the clearance may be reduced to the distance as recommended by the insulating barrier manufacturer.

j. Personnel shall not be permitted to work near the base of any elevated structure where any part of the structure is within 10 feet of an energized source

5. Gas powered generators

a. Gas and diesel powered electric generators shall be properly maintained and used in accordance to manufacturer's instructions. Generators shall not be modified

b. Gas and diesel powered electric generators shall be properly grounded

c. Devices powered by gas and diesel electric generators shall be equipped with UL listed GFCI devices

d. Gas and diesel powered electric generators shall not be positioned upwind of convened spaces, confined space entry points, or air supply entry point of any personnel. This is to prevent potential carbon monoxide poisoning.

e. Public Safety

1. Work areas shall be bounded by construction fencing to prevent public access. Warning signs shall be posted at regular intervals

2. Work area access shall be limited to Hi-Tec Roofing, Inc, subcontractor and supplier personnel, and Government representatives

15. SITE SPECIFIC HAZARDS AND CONTROLS

Please see Activity Hazard Analyses (AHAs) on the following pages. Note that additional AHAs may be submitted prior to start of construction.

16. Report discussed with contractor/superintendent on

17. Contracting Officer (Signature & Date)

Construction Management Engineer (signature

DEFINABLE FEATURE OF WORK: METAL **SUPPORT ASSEMBLIES**

Competent Person in Charge: Robert Meier

1. Contract No: W9132T-HIT-001	2. Contractor: Hi-Tec Roofing, Inc.	3. Date: 6/18/08
4. Title: Metal Roof at Wheeler AAF	5. Location: Wheeler AAF Hawaii	6. Est. Start Date: 7/14/08
7. PRINCIPLE STEPS	8. POTENTIAL HAZARDS	9.RECOMMENDED CONTROLS
1. Working with small tools	1. Electric shock	I. Perform scheduled inspections on all extension cords and tools. GFCI will be required on all temporary wiring.
2. Transporting materials	2. Falling and tripping hazards	2. Good housekeeping. Maintain clean and neat work and storage areas.
3. Fastening flashing	3. Cuts, metal shavings	3. Wear personal protective clothing and equip-

		ment.
10. EQUIPMENT TO BE USED	11.INSPECTION REQUIREMENTS	12.TRAINING REQUIREMENTS
1. Small power tools, saws, and drills.	1. Daily inspection of tools, power cords, and hoses	1. On the job training

Contractor:	Hi-Tec Roofing
CME/Project Superintendent (Signature and Date)	Robert Meier 6/18/08
Site Safety Representative (Signature and Date)	Robert Meier 6/18/08
Contracting Officer (Signature & Date)	
Report Discussed with Contractor *I* Superintendent on (Date)	

1.Contract No.: W9132T-HIT-001	2. Contractor: Hi-Tec Roofing, Inc.	3.Date: 6/18/08
4.Title: Metal Roof at Wheeler AAF	5. Location: Wheeler AAF Hawaii	6. Est. Start Date:7/14/08
7. PRINCIPLE STEPS	8. POTENTIAL HAZARDS	9.RECOMMENDED CONTROLS

Delivery and storage	Cuts Foot injuries Head injuries	First aid kits to be readily. Personal protective clothing and equipment to be worn available including gloves. Leather work shoes with steel toes to be worn at all times on the job Hard hats to be worn at all times on the jobsite. Review safe lifting techniques and body mechanics Good housekeeping. Maintain clean and neat work and storage areas. Follow all ladder safety procedures.
10. EQUIPMENT TO BE USED	11.INSPECTION REQUIREMENTS	12.TRAINING REQUIREMENTS
1. Small power tools 2. Small hand tools 3. Ladders 4. Boom Truck	I. Daily inspection prior to use 2. Daily inspection prior to use 3. Daily inspection 4. Daily Inspection	1.On the job training 2.On the job training 3.On the job training

Contractor:	Hi-Tec Roofing
CME/Project Superintendent (Signature and Date)	Robert Meier 6/18/08
Site Safety Representative (Signature and Date)	Robert Meier 6/18/08
Contracting Officer (Signature & Date)	
Report Discussed with Contractor *I* Superintendent on (Date)	

DEFINABLE FEATURE OF WORK: FLASHING AND SHEET METAL

Competent Person in Charge: Robert Meier

1. Contract No.: *W9132T-HIT-001*	2. Contractor: Hi-Tec Roofing, Inc.	3. Date: 6/18/08
4. Title: *: Metal Roof at Wheeler AAF*	5. Location: Wheeler AAF Hawaii	6. Est. Start Date: 7/14/08
7. PRINCIPLE STEPS	8. POTENTIAL HAZARDS	9. RECOMMENDED CONTROLS
1. Set up and Prep. 2. Install new metal roofing and flashing	1. Cuts. Falls 2. Electric shock. Falls	1. Personal protective clothing and equipment. Keep work areas clean and free from trip hazards. 2. Use GFI's. Follow all fall protection standards over 6 ft. fall hazard. Keep work areas clean and free from trip hazards
10.EQUIPMENTTO BE USED	11. INSPECTION REQUIREMENTS	12. TRAINING REQUIREMENTS
1. Ladders and scaffolds. 2. Power lifts and harness. 3. Panel Machine 4. Gas motors.	1. Check daily for cracks or broken rungs etc. 2. Check daily for brakes, hydraulics, and lanyards. 3. Check daily for electric cords, and cracks in hoses. 4. Check daily for muffler noise, and guards on any moving parts.	On the job training.

<table>
<tr><td colspan="2">13. Contractor (Signature & Date)</td></tr>
<tr><td>14. Report discussed with contractor/superintendent on</td><td rowspan="2">15. Contracting Officer (Signature & Date)</td></tr>
<tr><td>Construction Management Engineer (signature)</td></tr>
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Appendix 2C: Testing ASTM 1592 Report

CERNY & IVEY ENGINEERS, INC.
CONSULTING ENGINEERS – TESTING LABORATORY
5650 PEACHTREE PARKWAY, NORCROSS, GA 30092
TEL 770-449-6936 – FAX 770-368-1148
WWW.CERNYANDIVEY.COM
ENGINEERING SOLUTIONS SINCE 1967
...Celebrating 40 Years of Professional Engineering Services

April 14, 2008

Mr. Alan Meier
Hi Tec Roofing
5 Sand Island Road
Honolulu, HI

TEST REPORT NUMBER:
28026-2
This Report Supercedes 28026-1

DATE OF TESTING
2/11/2008 & 2/20/2008

MANUFACTURE PLANT
N/A

SCOPE OF TESTING
ASTM E1592 "Standard Test Method for Structural Performance of Sheet Metal Roof and Siding Systems by Uniform Static Pressure"

PRODUCT IDENTIFICATION
Roof Panels: 16in wide, 22ga, Double Lock Seam
Expansion Clip Top: 25ga Galvanized Steel
Expansion Clip Base: 19ga Galvanized Steel
Fixed Clip: 22ga Galvanized Steel
Screws: 12-14 PSD Pancake T/3 Grey Spex

PROCEDURE
The roof panels were unpackaged and installed by the Cerny and Ivey Engineers, Inc. laboratory personnel on top of 6mil clear plastic that was pleated at each panel to allow for expansion and prevent non-uniform load distribution. The pleats were provided under the flat of each panel because this is the area of greatest deflection and allows the plastic to move even after the clips are secured. Each specimen tested consisted of five (5) roof panels. The panels were placed on the test apparatus, CI-UAC-01, and secured with the supplied expansion clips to 14ga steel purlins. The clips were secured to the purlins using two (2) screws, provided by the client. The seams were machine sealed using a seamer manufactured by Roll Seamer.

A 21-foot test specimen was used for testing. This provided five (5) equal 4-foot spans for testing. The ASTM E1592 standard requires that at least three (3) equal spans are used. The ASTM standard also requires that one (1) end be restrained crosswise when using three (3) spans. This is usually done by using the screws to fasten the panel directly to the purlins. During this test neither end was restrained crosswise in order to simulate the most severe condition on the panels.

The roof panels were formed from steel coil. The gauge of the panels was 0.049in with paint. The thickness was verified using micrometer, CI-MC-01.

Cerny and Ivey Engineers, Inc. laboratory personnel sealed the edges of the test apparatus with duct tape to prepare for the test. Two layers of duct tape were used around the edges. One layer was tucked inside the pleats of the plastic and the other layer was not. This created an airtight seal without affecting the panel deflection or test results. The edges were then secured using nominal 2x2 lumber with C-Clamps every 6" along the width of the test apparatus and length of the test apparatus. The air pressure was measured with the digital manometer, CM-DI-01. Five (5) measurements were taken around the area where deflection was expected to be the most significant. The test apparatus was pressurized to 1in. of water (5.2 psf) and the digital indicators were zeroed in order to provide a reference for permanent set. The pressure was brought up incrementally and was held for 1 minute until failure was imminent. Between each increment the pressure was relieved to 1 in of water and held for a minute, so that permanent set could be measured. When failure was imminent the digital indicators were removed, as to

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prevent damage to the instruments, and the pressure was increased until failure occurred. Please see attached photos for reference.

Two (2) separate specimens were subjected to the above testing, one with expansion clips and the second with fixed clips. The clips were spaced 4 feet apart.

All testing was done in accordance with the ASTM E1592 standard.

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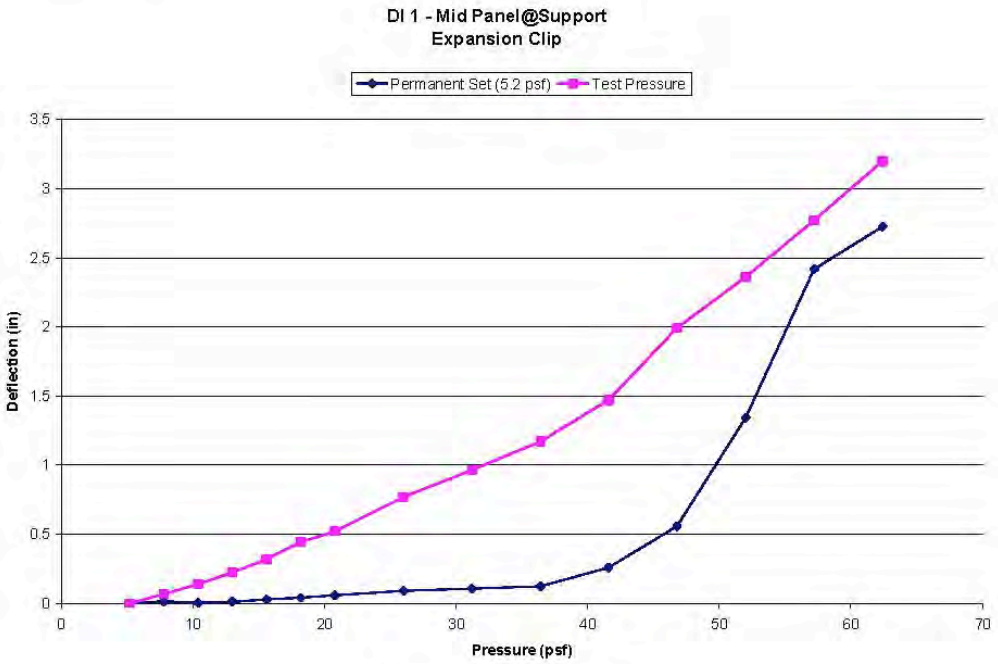
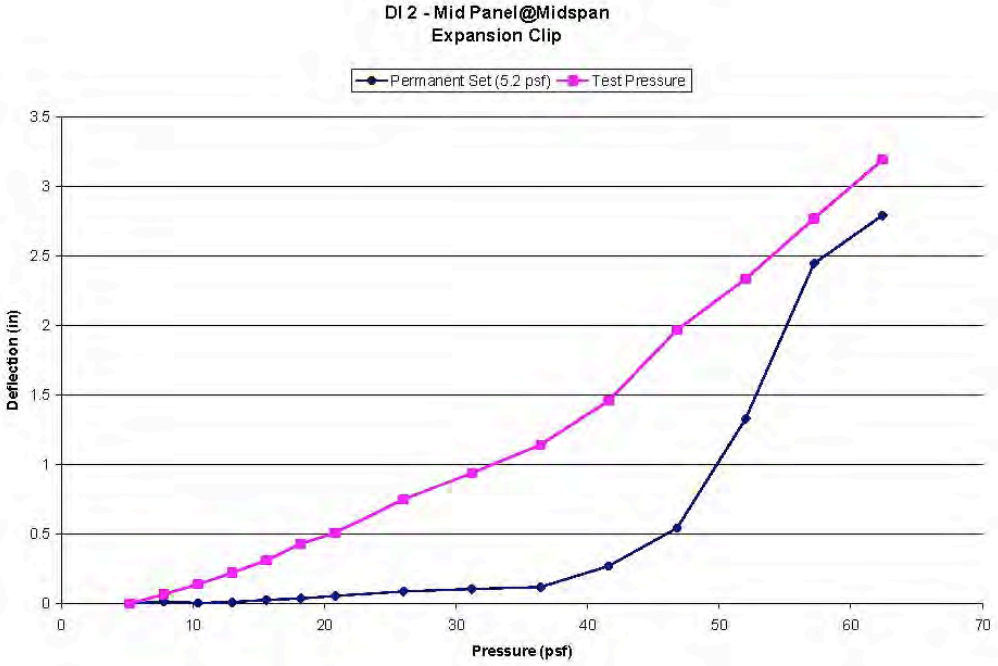
RESULTS





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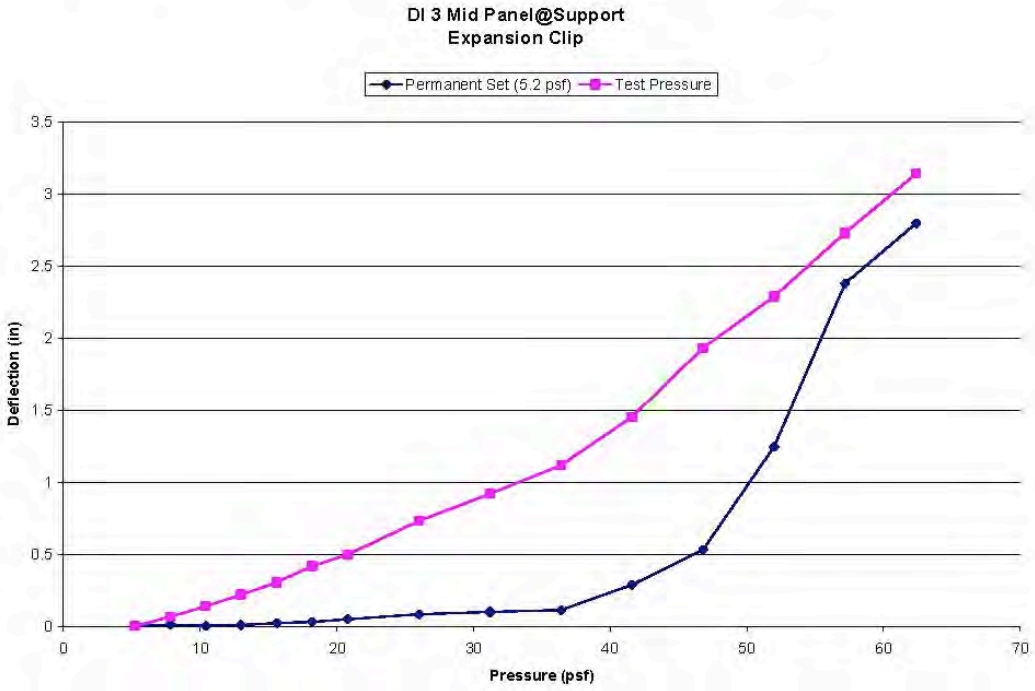

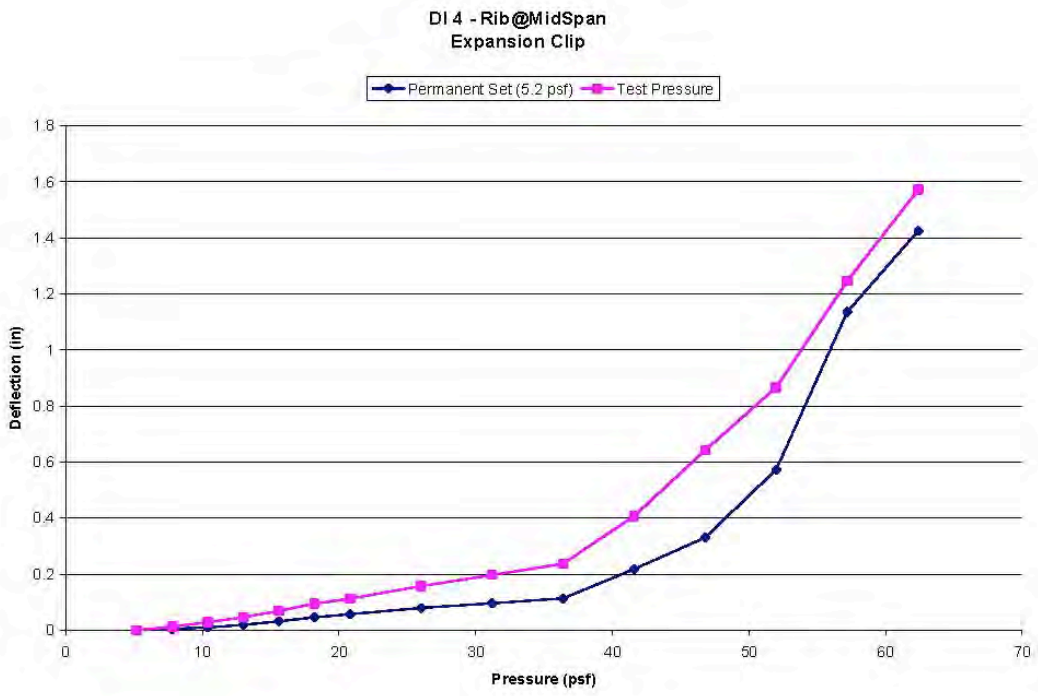

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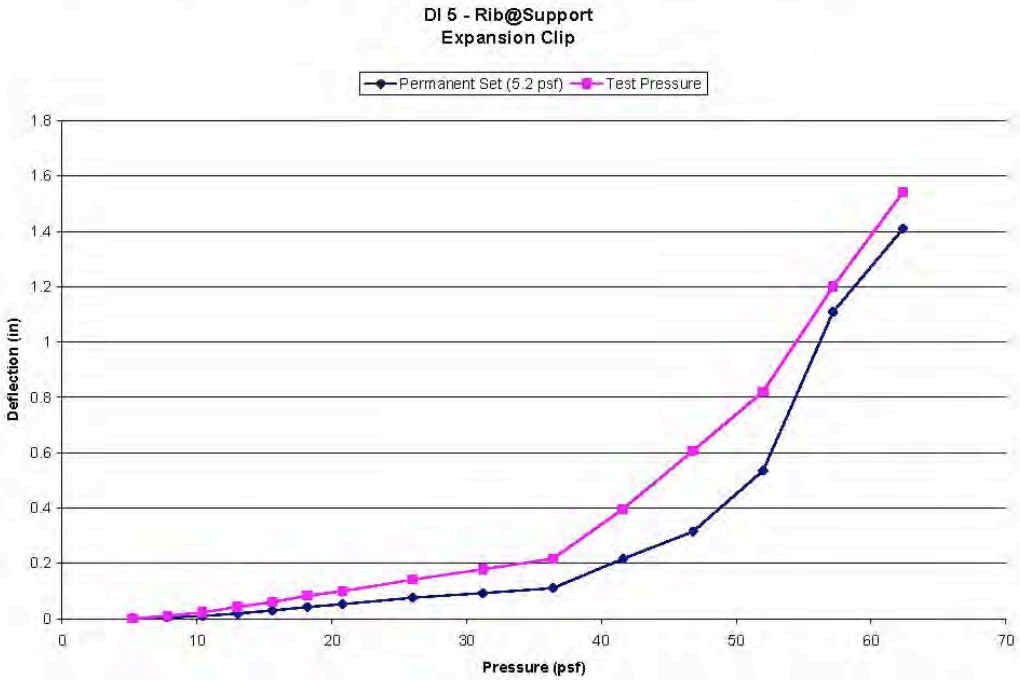

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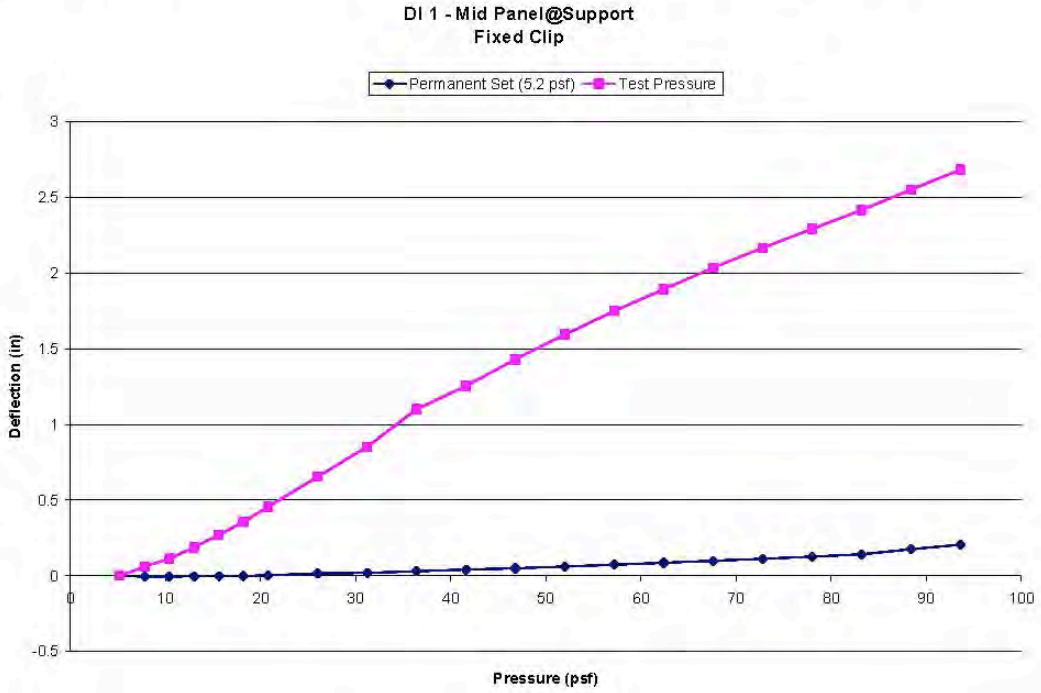

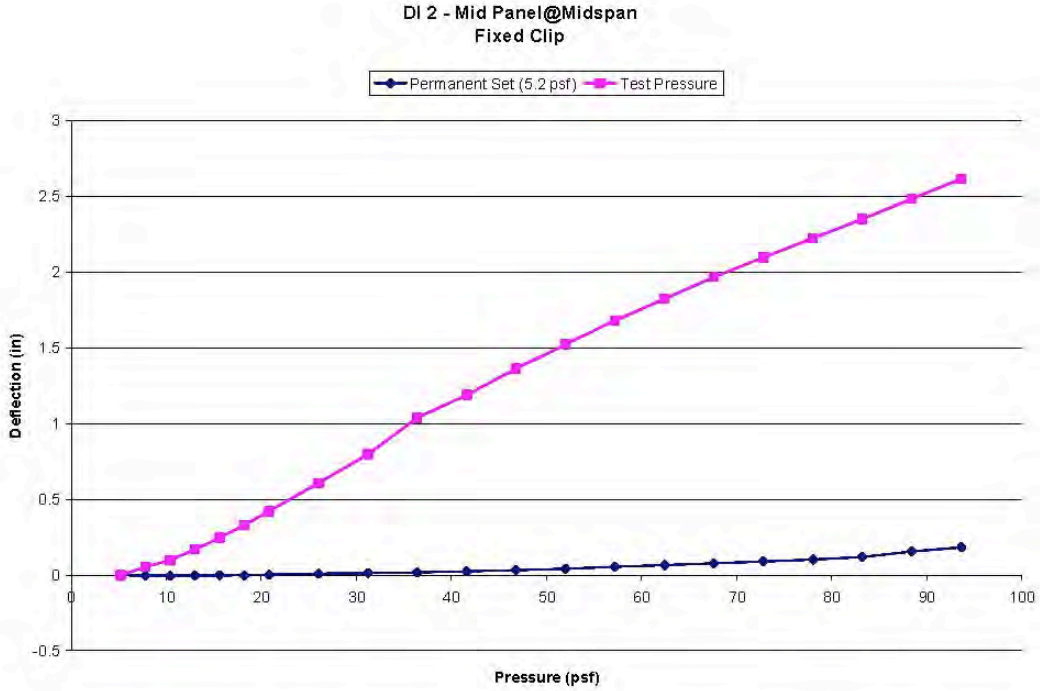

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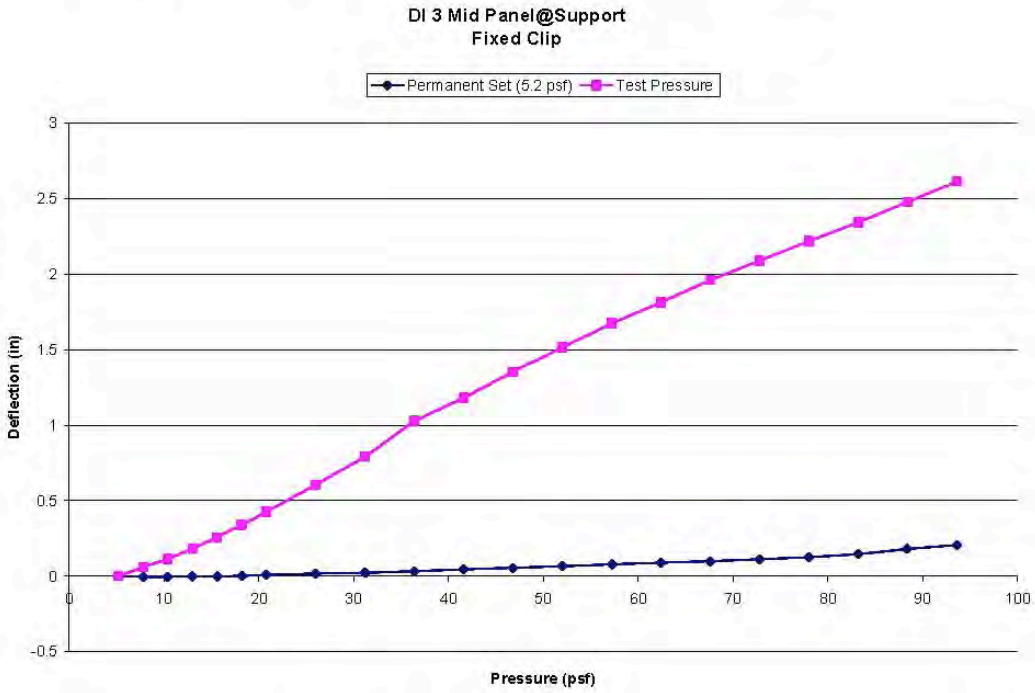

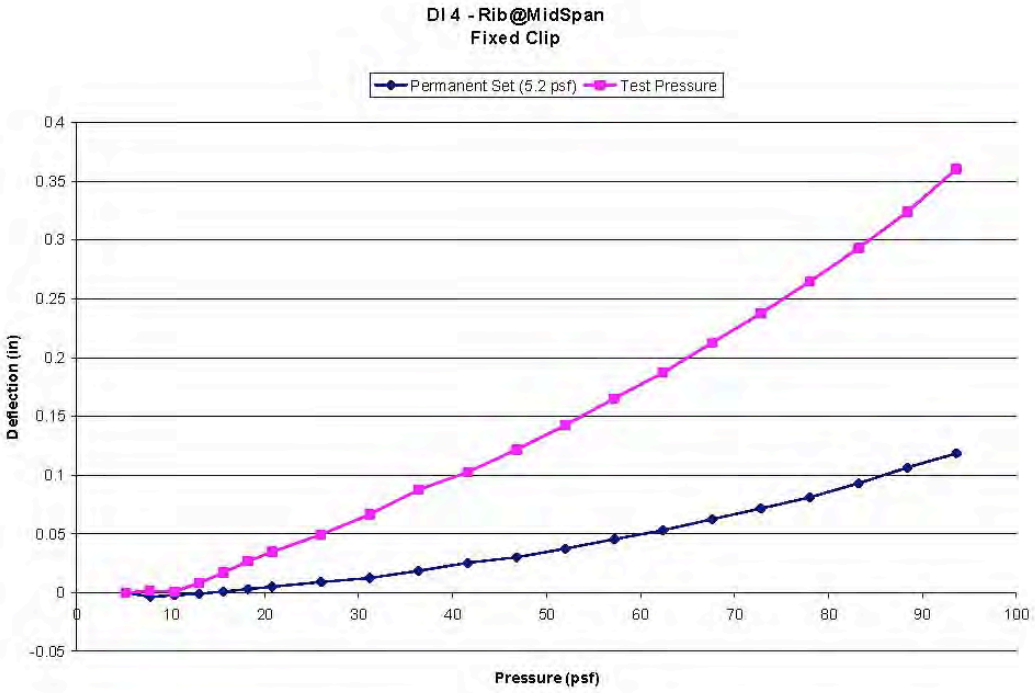

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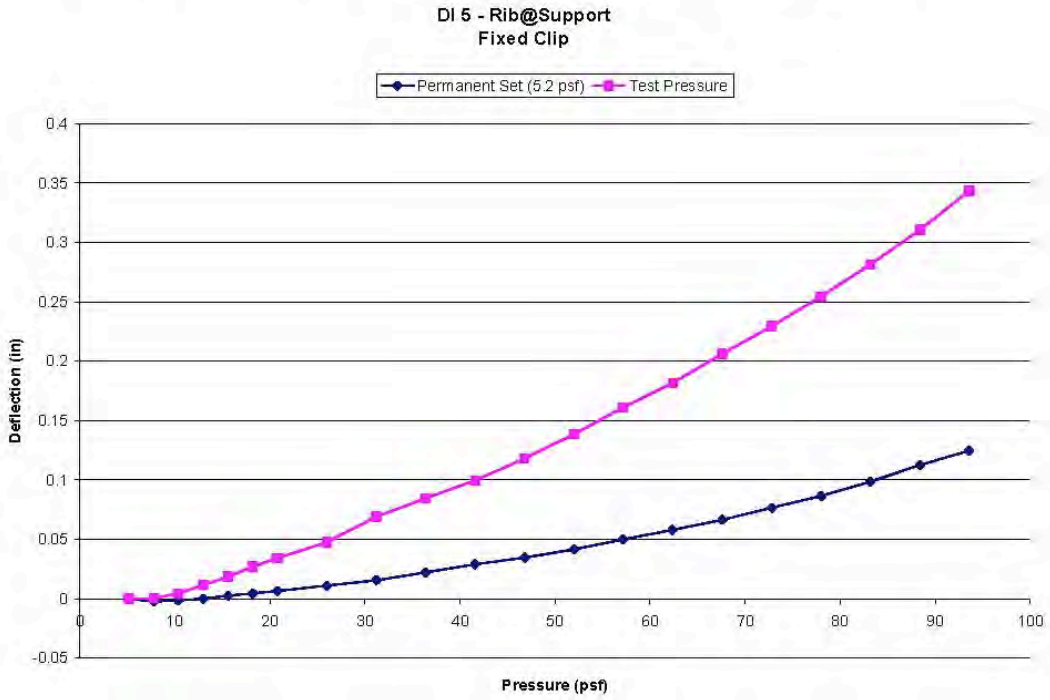

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CALCULATIONS

Hi-Tec Roof Panels

22ga Painted Steel Panel (thickness = 0.049 in.)
16in. Wide Panels
4ft. Clip Spacing

Hi-Tec roofing has requested that engineering calculations be completed by Cerny and Ivey Engineers, Inc. on the roof panels used at Wheeler Air Force Base for FY 85 NAF Project, HIC 81-7172A. Cerny and Ivey Engineers, Inc. is in receipt of sheets 4,5,6,7,8 and 9 dated 10/4/90, marked as-builts. Other information was provided verbally by the client, Hi-Tec Roofing.

All calculations are based on the requirements in ASCE 7-05 Minimum Design Loads for Buildings and Other Structures.

The following assumptions apply to all calculations:

- The maximum height of the building is 30ft.
- The F.S. for the building is 1.5
- The exposure category for the building is B, C, or D
- The maximum 3 second wind gust is 110mph
- The pitch of the roof is 3:12 (14 degrees)
- The building has a gable type roof
- There are no nearby hills or escarpments around the building.
- The building is regular shaped as defined by ASCE 7-05
- There are no special geographic conditions
- The building is enclosed as defined by ASCE 7-05

Based on the aforementioned assumptions the following constants can be derived using the tables in ASCE 7-05

Effective Wind Area ≤ 10 ft^2 (ASCE 7-05 Figure 6-11C Note 8)
GC_p = -2.6 (ASCE 7-05 Figure 6-11C) for Roofs
GC_p = -3.7 (ASCE 7-05 Figure 6-11C) for Overhangs
GC_{pi} = ± 0.18 (ASCE 7-05 Figure 6-5)
K_z = 1.16 (ASCE 7-05, Section 6.5.6.6 and Table 6-3)
K_{zt} = 1.0 (ASCE 7-05, Section 6.5.7.2 and Figure 6-4)
K_d = 0.85 (ASCE 7-05, Section 6.5.4.4 and Table 6-4)
I = 1.0 (Category II Hazard, ASCE 7-05, Tables 1-1 and 6-1

The velocity pressure (q_z) can be derived from the above information using the following formula:

$$q_z = 0.00256\, K_z\, K_{zt}\, K_d\, V^2\, I \text{ (psf)} \quad \text{(ASCE 7-05 eq. 6-15)}$$

$$q_z = 30.54$$

The test pressure (p) required in the ASTM E1592 test to meet the requirements of the project can be derived using the following formula:

$$p/(F.S.) = q_z\,(GC_p - GC_{pi}) \quad \text{(ASCE 7-05 eq. 6-23)}$$

p = 127.3 psf for the Roof
p = 177.7 psf for the Overhang

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CONCLUSIONS

With the 2-piece expansion clip installed the maximum test pressure reached was 66.0psf (12.7in. of water). The stress between the top and base of the expansion clip caused the top to deform and pull away from the base. Based on the pressures derived in the Calculations section of this report, this system could not be used on a building with the prescribed conditions in the calculations section of this report.

With a 1-piece fixed clip installed the maximum test pressure achieved was 179.9psf (34.6in. of water). There were three causes of failure 1) the roof panel pulled the screw holes in the clip off of the screw head, 2) the clip pulled the screw out of the purlin and 3) the clip pulled out of the doublelock seam. Based on the pressures derived in the calculations section of this report, this system could be used on a ASCE 7-05 Occupancy Category II, fully enclosed building with overhangs and a height no greater than 30ft located in an area with no nearby hills or escarpments.

Because a one-piece clip was used in lieu of the two-piece clip, the measured pressures were significantly higher during the second test. During the first test the pressures were able to separate the two-piece clip, where this did not happen during with the one-piece clip. The one piece clip essentially forced another part of the system to fail before the clip ruptured.

If you have any questions please don't hesitate to contact us.

Respectfully submitted,

Charles G. Lester IV
Laboratory Manager

Christopher B. Shiver
Vice President – Principal Engineer

CERNY & IVEY ENGINEERS, INC.
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Attachment - Raw Data

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ASTM E 1592 TEST - DIGITAL INDICATOR DATA SHEET

DATE:	2/11/08	CLIENT:	HI TEC ROOFING
JOB NUMBER:	28026	LABORATORY PERSONEL	J.Ivey, S. Smith, C.Lester
PANEL WIDTH	16in.	PANEL THICKNESS	0.049in.
RIB HEIGHT	0.94in.	PANEL MATERIAL	STEEL
CLIP SPACING	4ft.	CLIP TYPE:	19ga, 25ga Expansion Clip

Pressure		Digital Indicator				
		Mid-Panel@Support	Mid-Panel@Mid Span	Mid Panel@Support	Rib@Mid-Span	Rib@Support
PSF	Inches-Water	DI 1	DI 2	DI 3	DI 4	DI 5
5.2	1	0.0000	0.0000	0.0000	0.0000	0.0000
7.8	1.5	0.0675	0.0660	0.0645	0.0120	0.0105
5.2	1	0.0155	0.0140	0.0115	0.0045	0.0045
10.4	2	0.1395	0.1385	0.1375	0.0280	0.0225
5.2	1	0.0040	0.0040	0.0025	0.0095	0.0095
13	2.5	0.2235	0.2215	0.2180	0.0465	0.0425
5.2	1	0.0110	0.0100	0.0080	0.0185	0.0185
15.6	3	0.3185	0.3110	0.3045	0.0680	0.0605
5.2	1	0.0290	0.0255	0.0220	0.0315	0.0295
18.2	3.5	0.4425	0.4300	0.4175	0.0945	0.0830
5.2	1	0.0400	0.0360	0.0305	0.0455	0.0420
20.8	4	0.5210	0.5075	0.4970	0.1125	0.1000
5.2	1	0.0590	0.0545	0.0480	0.0570	0.0525
26	5	0.7685	0.7475	0.7315	0.1575	0.1415
5.2	1	0.0915	0.0875	0.0830	0.0790	0.0755
31.2	6	0.9640	0.9385	0.9190	0.1965	0.1785
5.2	1	0.1070	0.1040	0.0990	0.0960	0.0925
36.4	7	1.1710	1.1410	1.1170	0.2370	0.2165
5.2	1	0.1230	0.1180	0.1125	0.1130	0.1105
41.6	8	1.4700	1.4570	1.4525	0.4070	0.3960
5.2	1	0.2590	0.2690	0.2880	0.2175	0.2160
46.8	9	1.9920	1.9660	1.9310	0.6415	0.6070
5.2	1	0.5580	0.5425	0.5290	0.3300	0.3145
52	10	2.3600	2.3330	2.2875	0.8665	0.8200
5.2	1	1.3410	1.3285	1.2470	0.5725	0.5355
57.2	11	2.7700	2.7680	2.7295	1.2460	1.2005
5.2	1	2.4175	2.4445	2.3780	1.1355	1.1085
62.4	12	3.1980	3.1900	3.1400	1.5720	1.5415
5.2	1	2.7250	2.7890	2.7965	1.4250	1.4100
66.04	12.7	FAILURE OCCURRED				

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ASTM E 1592 TEST - DIGITAL INDICATOR DATA SHEET

DATE:	2/20/08	CLIENT:	HI TEC ROOFING
JOB NUMBER:	28026	LABORATORY PERSONEL:	J.Ivey, S. Smith, C.Lester
PANEL WIDTH	16in.	PANEL THICKNESS	0.049in.
RIB HEIGHT	0.94in.	PANEL MATERIAL	STEEL
CLIP SPACING	4ft.	CLIP TYPE:	22ga Galvanized Steel

Pressure		Digital Indicator				
		Mid-Panel@Support	Mid-Panel@Mid Span	Mid Panel@Support	Rib@Mid-Span	Rib@Support
PSF	Inches-Water	DI 1	DI 2	DI 3	DI 4	DI 5
5.2	1	0.0000	0.0000	0.0000	0.0000	0.0000
7.8	1.5	0.0605	0.0535	0.0610	0.0015	0.0005
5.2	1	-0.0060	-0.0040	-0.0045	-0.0035	-0.0025
10.4	2	0.1130	0.0975	0.1125	0.0010	0.0045
5.2	1	-0.0055	-0.0045	-0.0045	-0.0025	-0.0015
13	2.5	0.1875	0.1690	0.1825	0.0080	0.0115
5.2	1	-0.0035	-0.0025	-0.0015	-0.0010	0.0000
15.6	3	0.2680	0.2460	0.2570	0.0170	0.0185
5.2	1	-0.0035	-0.0025	-0.0020	0.0010	0.0025
18.2	3.5	0.3560	0.3290	0.3380	0.0265	0.0270
5.2	1	-0.0020	-0.0015	0.0015	0.0030	0.0045
20.8	4	0.4540	0.4205	0.4250	0.0345	0.0340
5.2	1	0.0030	0.0025	0.0065	0.0050	0.0065
26	5	0.6535	0.6070	0.6050	0.0495	0.0475
5.2	1	0.0140	0.0095	0.0165	0.0090	0.0110
31.2	6	0.8520	0.7965	0.7900	0.0665	0.0690
5.2	1	0.0190	0.0115	0.0225	0.0125	0.0155
36.4	7	1.0995	1.0380	1.0270	0.0875	0.0845
5.2	1	0.0290	0.0165	0.0330	0.0185	0.0220
41.6	8	1.2520	1.1895	1.1795	0.1025	0.0995
5.2	1	0.0400	0.0245	0.0440	0.0255	0.0290
46.8	9	1.4275	1.3620	1.3520	0.1215	0.1180
5.2	1	0.0495	0.0315	0.0560	0.0300	0.0345
52	10	1.5920	1.5245	1.5145	0.1425	0.1385
5.2	1	0.0600	0.0410	0.0660	0.0375	0.0415
57.2	11	1.7485	1.6805	1.6720	0.1650	0.1610
5.2	1	0.0730	0.0540	0.0780	0.0455	0.0500
62.4	12	1.8920	1.8235	1.8115	0.1870	0.1815
5.2	1	0.0850	0.0650	0.0890	0.0530	0.0580
67.6	13	2.0345	1.9680	1.9585	0.2125	0.2060
5.2	1	0.0985	0.0765	0.0995	0.0625	0.0665
72.8	14	2.1640	2.0970	2.0875	0.2375	0.2295
5.2	1	0.1120	0.0890	0.1120	0.0715	0.0765
78	15	2.2895	2.2240	2.2160	0.2645	0.2545
5.2	1	0.1260	0.1020	0.1255	0.0810	0.0865
83.2	16	2.4150	2.3495	2.3415	0.2930	0.2815
5.2	1	0.1420	0.1195	0.1450	0.0930	0.0985
88.4	17	2.5490	2.4825	2.4755	0.3240	0.3105
5.2	1	0.1755	0.1555	0.1800	0.1065	0.1125
93.6	18	2.6810	2.6165	2.6115	0.3605	0.3435
5.2	1	0.2050	0.1825	0.2060	0.1185	0.1245
179.92	34.6	FAILURE OCCURRED				

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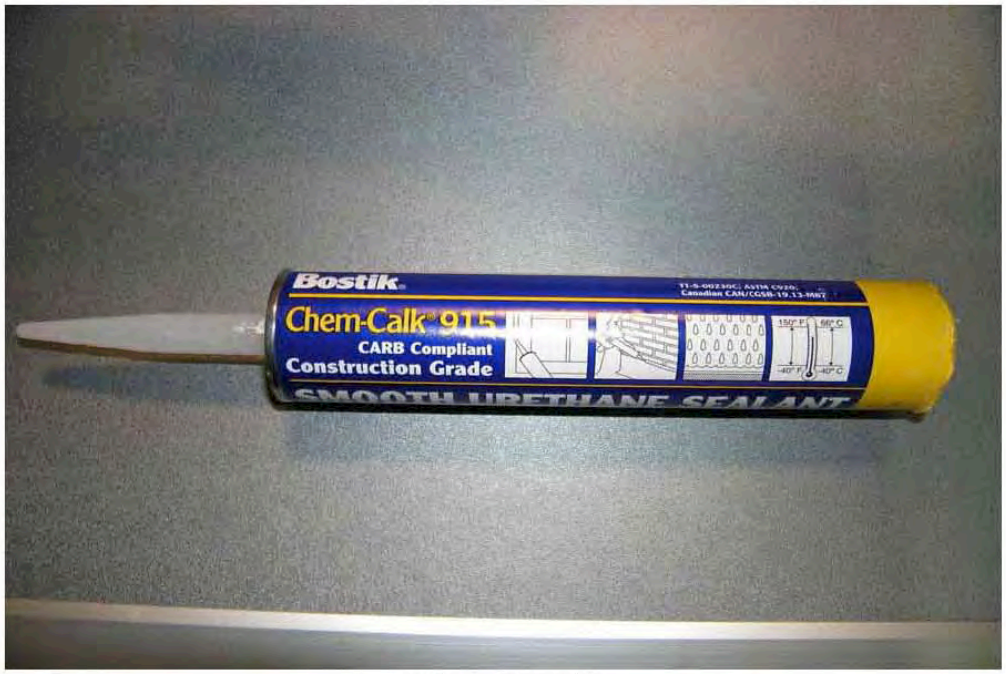

PHOTOGRAPH 1
CAULK USED BETWEEN ROOF PANELS

PHOTOGRAPH 2
CAULK APPLICATION

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PHOTOGRAPH 3
12-14 PSD PANCAKE T/3 GREY SPEX

PHOTOGRAPH 4
FIRST PANEL INSTALL

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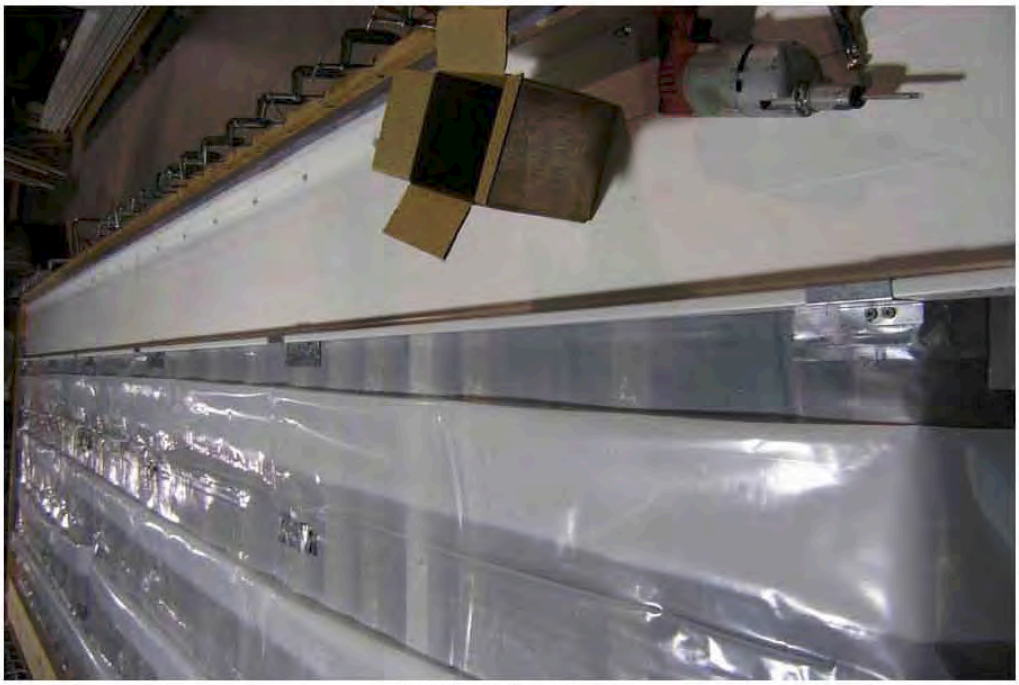

PHOTOGRAPH 5
FIRST PANEL INSTALL

PHOTOGRAPH 6
DEFLECTION GUAGE LAYOUT

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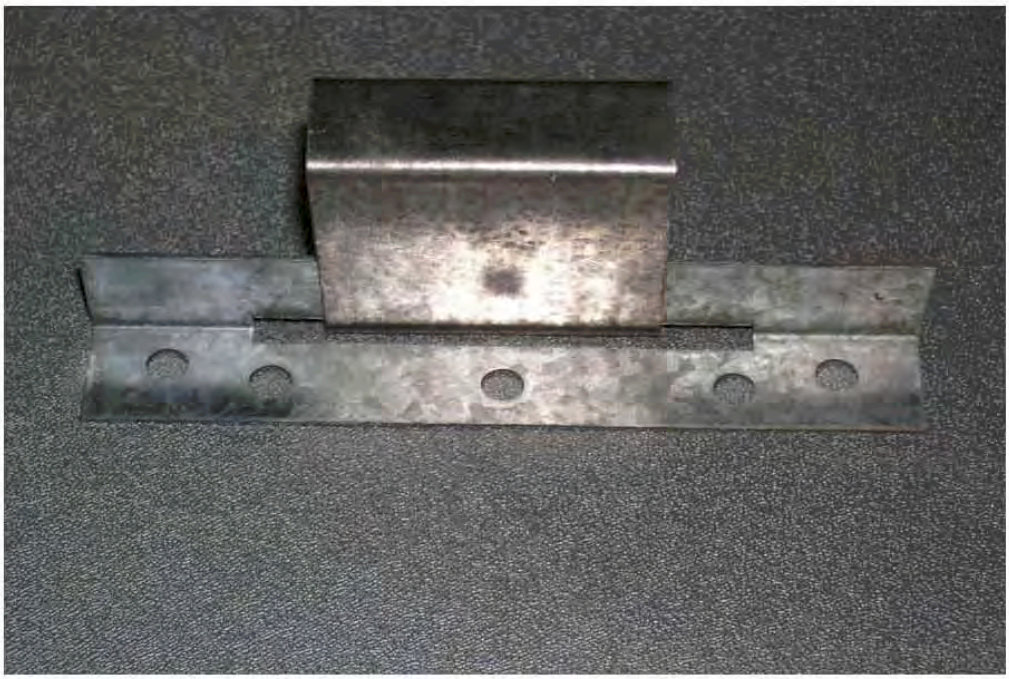
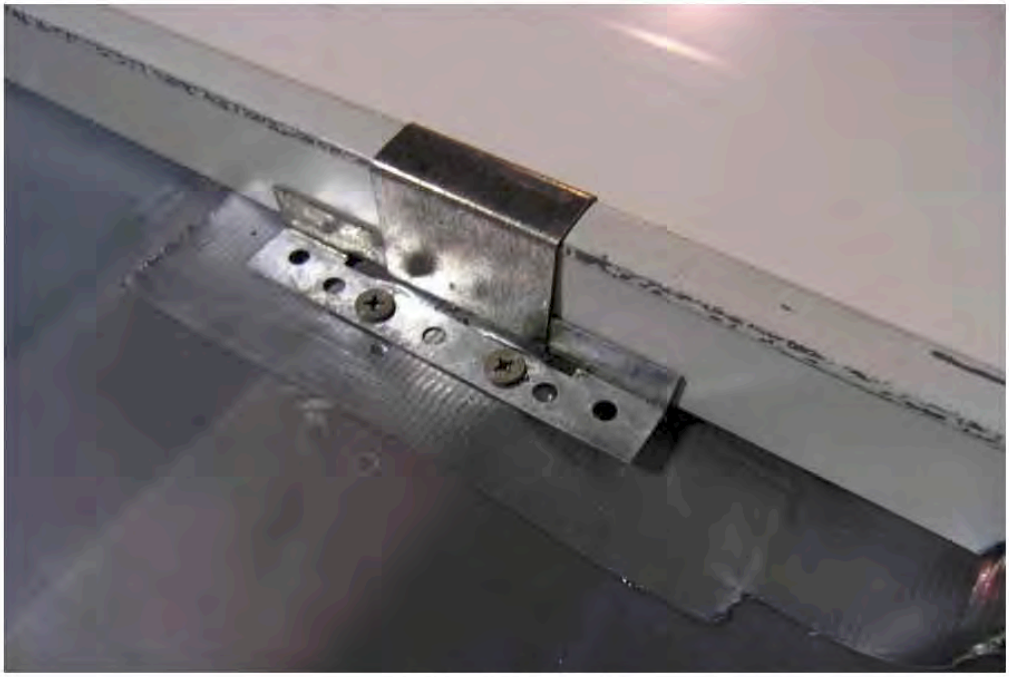


PHOTOGRAPH 7
EXPANSION CLIP



PHOTOGRAPH 8
EXPANSION CLIP INSTALL

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PHOTOGRAPH 9
EXPANSION CLIP TEST SETUP

PHOTOGRAPH 10
EXPANSION CLIP TEST DURING TESTING

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PHOTOGRAPH 11
EXPANSION CLIP TEST DURING TESTING

PHOTOGRAPH 12
EXPANSION CLIP FAILURE

CERNY & IVEY ENGINEERS, INC.
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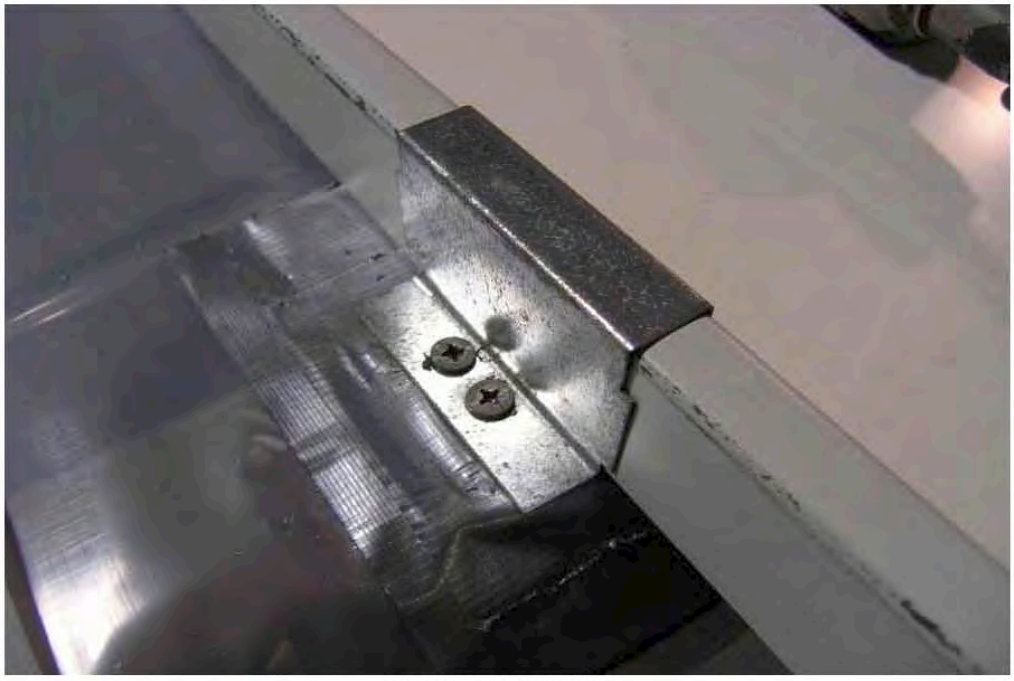
PHOTOGRAPH 13
FIXED CLIP



PHOTOGRAPH 14
FIXED CLIP INSTALL

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PHOTOGRAPH 15
FIXED CLIP TEST SETUP

PHOTOGRAPH 16
FIXED CLIP TEST DURING TESTING

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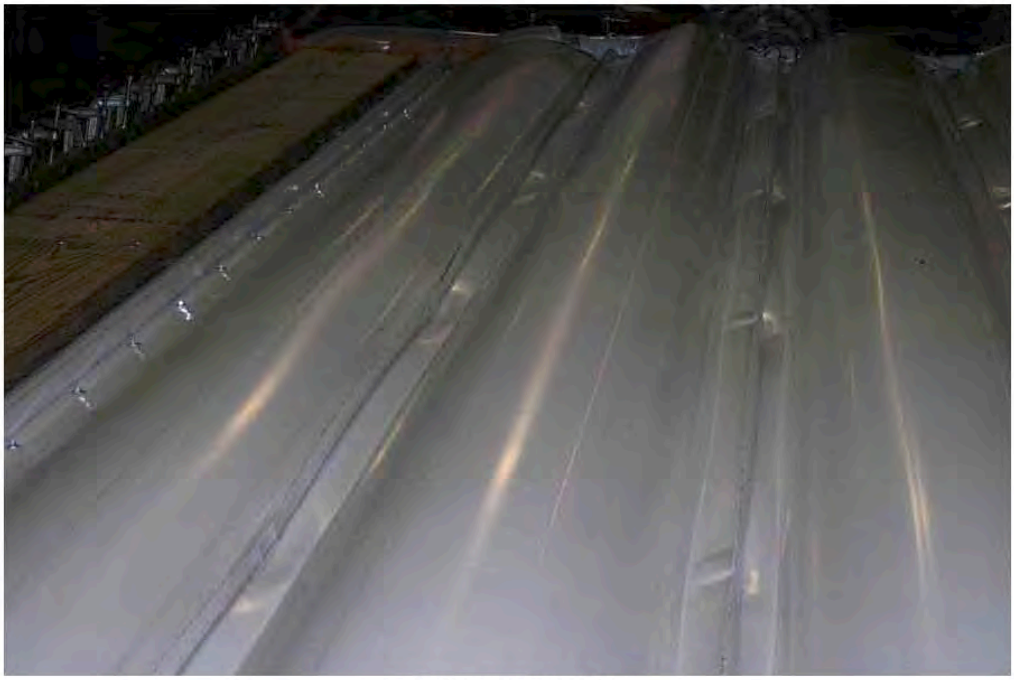
PHOTOGRAPH 17
FIXED CLIP TEST DURING TESTING



PHOTOGRAPH 18
FIXED CLIP TEST DURING TESTING

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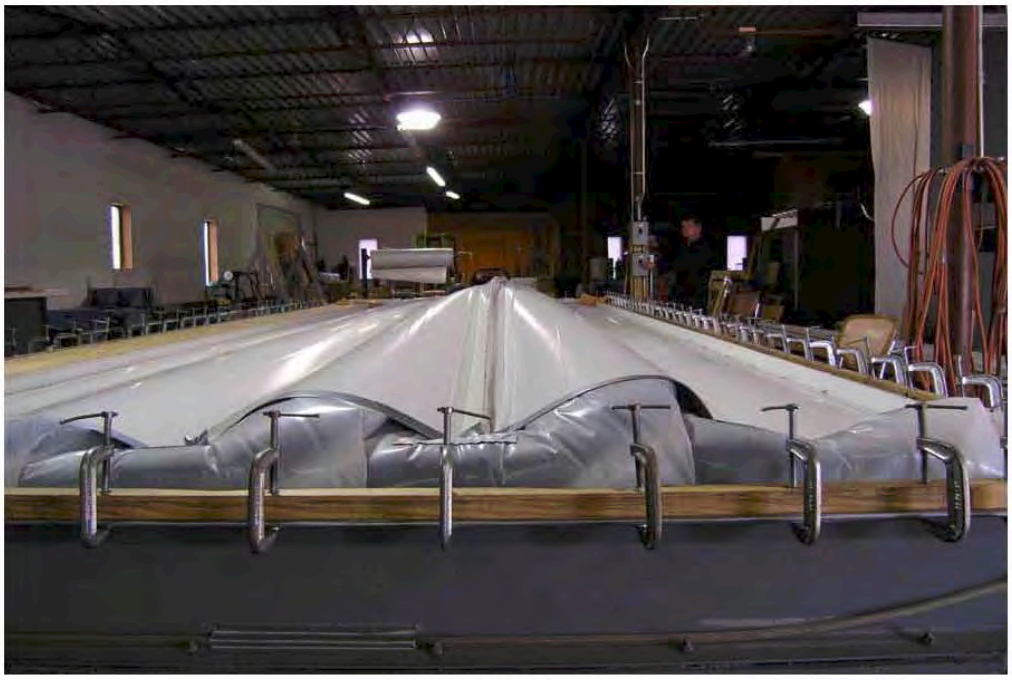
PHOTOGRAPH 19
FIXED CLIP FAILURE



PHOTOGRAPH 20
FIXED CLIP FAILURE

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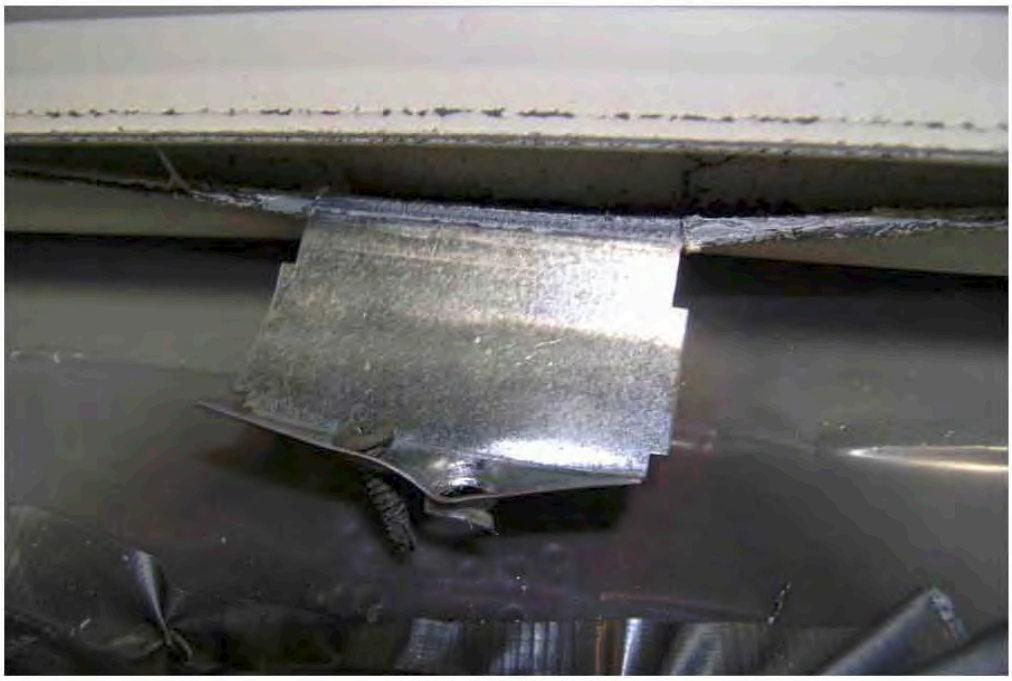

PHOTOGRAPH 21
FIXED CLIP FAILURE - 1,2

PHOTOGRAPH 22
FIXED CLIP FAILURE - 3

Appendix 2D: Design Calculations Report

CERNY & IVEY ENGINEERS, INC.
CONSULTING ENGINEERS – TESTING LABORATORY
5650 PEACHTREE PARKWAY, NORCROSS, GA 30092
TEL 770-449-6936 – FAX 770-368-1148
WWW.CERNYANDIVEY.COM
ENGINEERING SOLUTIONS SINCE 1967
Celebrating 40 Years of Professional Engineering Service

February 1, 2008

Mr. Alan Meier
Hi-Tec Roofing
5 Sand Island Road
Honolulu, HI 96819

SUBJECT: Engineering Report 28026
Hi-Tec Roofing ASTM E1592 Test Performance Requirements
Wheeler Air Force Base

Hi-Tec roofing has requested that engineering calculations be completed by Cerny and Ivey Engineers, Inc. on the roof panels used at Wheeler Air Force Base for FY 85 NAF Project, HIC 81-7172A. Cerny and Ivey Engineers, Inc. is in receipt of sheets 4,5,6,7,8 and 9 dated 10/4/90, marked as-builts. Other information was provided verbally by the client, Hi-Tec Roofing.

All calculations are based on the requirements in ASCE 7-05 Minimum Design Loads for Buildings and Other Structures.

The following assumptions apply to all calculations:

- The maximum height of the building in 30ft.
- The F.S. for the building is 1.5
- The exposure category for the building is D
- The maximum 3 second wind gust is 135mph
- The pitch of the roof is 3:12 (14 degrees)
- The building has a gable type roof
- There are no nearby hills or escarpments around the building.
- The building is regular shaped as defined by ASCE 7-05
- There are no special geographic conditions
- The building is enclosed as defined by ASCE 7-05

Based on the aforementioned assumptions the following constants can be derived using the tables in ASCE 7-05

Effective Wind Area ≤ 10 ft^2 (ASCE 7-05 Figure 6-11C Note 8)
GC_p = -2.6 (ASCE 7-05 Figure 6-11C) for Roofs
GC_p = -3.7 (ASCE 7-05 Figure 6-11C) for Overhangs
GC_{pi} = ± 0.18 (ASCE 7-05 Figure 6-5)
K_z = 1.16 (ASCE 7-05, Section 6.5.6.6 and Table 6-3)
K_{zt} = 1.0 (ASCE 7-05, Section 6.5.7.2 and Figure 6-4)
K_d = 0.85 (ASCE 7-05, Section 6.5.4.4 and Table 6-4)
I = 1.0 (Category II Hazard, ASCE 7-05, Tables 1-1 and 6-1

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The velocity pressure (q_z) can be derived from the above information using the following formula:

$$q_z = 0.00256\ K_z\ K_{zt}\ K_d\ V^2\ I\ (psf)\ (ASCE\ 7\text{-}05\ eq.\ 6\text{-}15)$$

$$q_z = 46.00\ (Roof)$$

The test pressure (p) required in the ASTM E1592 test to meet the requirements of the project can be derived using the following formula:

$$p/(F.S.) = q_z\ (GC_p - GC_{pi})\ (ASCE\ 7\text{-}05\ eq.\ 6\text{-}23)$$

p = 191.83psf for the Roof
p = 267.74psf for the Overhang

Respectfully submitted,

Charles G. Lester IV
Laboratory Manager

Christopher B. Shiver
Vice President – Principal Engineer

GEORGIA REGISTERED No. 16312 PROFESSIONAL ENGINEER CHRISTOPHER B. SHIVER

Appendix 2E: Rust-Inhibiting Primer Product Information

HYDRO STOP LLC
A Subsidiary of Quest Specialty Chemicals™

Technical Data Sheet

StableRust Primer

Product # 2000-001 & 2000-005

Updated - January 2, 2008

DESCRIPTION

StableRust Primer is a water based surfactant-free acrylic primer used in direct to metal applications to stabilize and protect metal surfaces.

RECOMMENDED USES

- Direct to metal applications
- Metal protection primer
- Anticorrosion primer
- Stain blocker on other types of surfaces.

ADVANTAGES & BENEFITS

- Excellent adhesion to all types of metal such as ferrous and non-ferrous metals, steel (smooth, degreased, sand blasted, and galvanized), aluminum and copper.
- High film hardness with good blocking resistance.
- Excellent water resistance and resistance to salt spray.
- May be applied directly to surface rust.
- Meets V.O.C. emissions and regulations to eliminate facility downtime during installation.
- Nontoxic formulation is safe to apply
- Easy application and cleanup
- No special training or equipment required to install

PRODUCT CHARACTERISTICS

VOC:	228 gm/lt
Vol. Solids:	56 %
Weight Solids:	50 %
Density:	9.88 lb/gal 1183.89 gm/lt
PH:	9.0
Color:	Deep Green
Shelf Life:	18 months unopened
Freeze Point	32F / 0C

APPLICATION INSTRUCTIONS:

Surface Preparation

As a minimum, clean and prepare surfaces to receive waterproofing by removing all loose and flaking particles, grease and laitance with the use of a stiff bristle push broom and or washing. Care should be taken not to inject water into the substrate during washing. In some cases additional drying time may be required after the cleaning process. Please consult your Hydro-Stop Inc. Technical Sales Representative for additional advice on cleaning various roofing substrates.

Application

StableRust Primer comes ready to use; however StableRust Primer must be vigorously shaken or stirred before application.

Apply **StableRust Primer** by brush, roller, or sprayer to the application area at the recommended coverage rate. Allow to dry before proceeding with additional products.

Coverage

Coverage may vary due to porosity of substrate. The average surface will use 150-200 square feet per gallon (3.68-4.91 meters^2/L). The minimum dry thickness should be 4 mils (101.6 micrometers) per coat.

CLEAN UP

Thoroughly rinse application equipment with clean water.

SAFETY & HANDLING

For specific information regarding safe handling of this material please refer to the Material Safety Data Sheet (MSDS).

StableRust Primer can be used in a safe and environmental friendly manner. It is designed to reduce the output of V.O.C.'s while providing the customer with a high performance primer.

For more information: *Contact your Hydro-Stop technical sales representative.*

ORDERING INFORMATION

StableRust Primer can be purchased in one gallon or five gallon pails at any official distributor of Hydro-Stop. For a distributor in your area please call us at 1-800-739-5566.

MATERIAL SAFETY DATA SHEET

HYDRO-STOP INCORPORATED
1465 PIPEFITTER STREET
CHARLESTON, SC 29405

HEALTH EMERGENCY: (800) 739-5566
SPILL EMERGENCY: (800) 739-5566

Section I –Compositional Information

Product Identification

Product Name – **StableRust Primer**
Product Code - 2001-005 & 2001-001
MSDS DATE - 07/15/05

Component Information	CAS REG NUMBER	AMOUNT
1- Water	Not Hazardous	38%
2- Acrylic Polymer	Not Hazardous	48%
3- Ethylene Glycol	111-76-2	3%
4- Chromium Oxide	1308-38-9	5%
5- Ammonia	7664-41-7	<.04%
6- Zinc Phosphate	7779-90-0	5%
7- Inorganic Solvent	Mixture	<1%

Section II – Physical Property Information

Appearance – Odor
Color – Green – no odor

Solubility in Water
Dilutable

Freezing Point
0° C/32°F

Volatile Organic Compounds
Less than 232 gm/lt

Section III – Fire and Explosion Hazard Information

Flash Point
Non-Combustible

Auto Ignition Temperature
Not applicable

Extinguishing Media
Not applicable

Special Fire Fighting Procedures
None

Unusual Fire and Explosion Hazards
Material can splatter above 100°C/212°F

Section IV – Health and Hazard Information

Emergency Response Information

Inhalation
Move subject to fresh air. Not Hazardous

Skin Contact
Prolonged contact may cause slight irritation. Wash affected skin areas thoroughly with soap and water.

Eye Contact
Slightly irritating to eyes. Flush with a large amount of water for 5 minutes. Consult a physician if irritation persists.

Ingestion
If swallowed dilute by giving 2 glasses of water to drink. See a physician. Never give anything by mouth to an unconscious person.

Section V – Storage and Handling Information

Storage Conditions
Keep from freezing; material may coagulate. The minimum recommended storage temperature for this material is 1°C/34°F. The maximum recommended storage temperature for this material is 49°C/120°F.

Handling Procedures
No special handling required.

Section VI-Spill or Leak Procedure Information

Steps to be taken in case material is released or spilled
Keep spectators away. Floor may be slippery; use care to avoid falling. Dike and contain spill with inert material (e.g. sand, earth). Transfer liquid to containers for recovery or disposal and solid diking material to separate containers for disposal. Keep spills and cleaning runoffs out of municipal sewers and open bodies of water.

Waste Disposal Methods
Coagulate by the stepwise addition of ferric chloride and lime. Remove the clear supernatant liquid and flush to a chemical sewer. Incinerate the solids and contaminated diking material according to local, state and federal agencies.

Section VII - Special Protection Information

Ventilation Type
Mechanical local exhaust ventilation at point of contaminant release.

Respiratory Protection
Wear suitable respirator (MSHA/NIOSH-approved or equivalent) where exposure limits are exceeded. PEL upper limits N/A and lower limits N/A

Protective Gloves
Impervious

Eye Protection
Chemical splash goggles (ANSI Z-87.1 or approved equivalent)

Section VIII - Storage and Handling Information

Storage Temperature
Maximum 60 C/140 F Minimum 1 C/34 F

Precautionary Labeling
Keep from freezing. Product may coagulate.

Section IX - Toxicity Information

Toxicity Information
The effects of overexposure shown in Section IV are based on information about similar materials and on toxicity profiles for the solvents in this product.

Section X - Miscellaneous Information

Footnote to Section VII: Refer to Industrial Ventilation: A Manual of Recommended Practice published by the American Conference of Governmental Industrial Hygienist.

Appendix 2F: Material Information–Seam Sealant

Bostik

TECHNICAL DATA SHEET

Chem-Calk® 915

ONE-COMPONENT, POLYURETHANE SEALANT, CONTRACTOR GUN GRADE

DATE OF LAST REVISION: 05/12/06

PRODUCT

Bostik® Chem-Calk® 915 — A One-Component, Smooth Polyurethane, Elastomeric Sealant. Contractor Gun Grade.

MANUFACTURER

Bostik, Inc.
211 Boston Street
Middleton, MA 01949-2128 USA
Telephone: (888) 603-8558
In MA: (978) 777-0100
Technical Service: (800) 523-2678
Technical Fax: (215) 957-0716
http://www.bostik-us.com

APPLICABLE STANDARDS

- ASTM C920, TYPE S, GRADE NS, CLASS 25, USE NT, A AND M.
- US Federal Specification TT-S 00230C (COMB-NBS) for one-component sealants as Class A, non-sag.
- Canadian Specification CAN/CGSB 19.13-M87.
- CARB and SCAQMD Compliant.

  Meets VOC Requirements for OTC Regulation.

PRODUCT DESCRIPTION

Bostik® Chem-Calk® 915 sealant is a one-component, contractor construction grade, smooth polyurethane sealant capable of dynamic joint movement totaling 50% of original joint geometry (±25%). The sealant cures to a tough, flexible rubber when exposed to moisture present in the atmosphere.

Chem-Calk® 915 polyurethane sealant has a consistency like toothpaste, its physical properties will remain relatively stable over time and in varying weather conditions. Its physical properties are relatively unchanged over a wide temperature range, -40°F to 150°F (-40°C to 66°C).

Where textured appearance is needed, please use Bostik® Chem-Calk® 916.

BASIC USES

- Designed for sealing expansion and control joints in pre-cast concrete panels, for sealing various roofing and siding applictions, and for sealing perimeters of doors, windows, and other wall penetrations.
- Sealant cures to form a durable, flexible bond with most building materials in any combination including stone, masonry, ceramic, marble, wood, steel, aluminum, fiber cement board and many other synthetic materials.

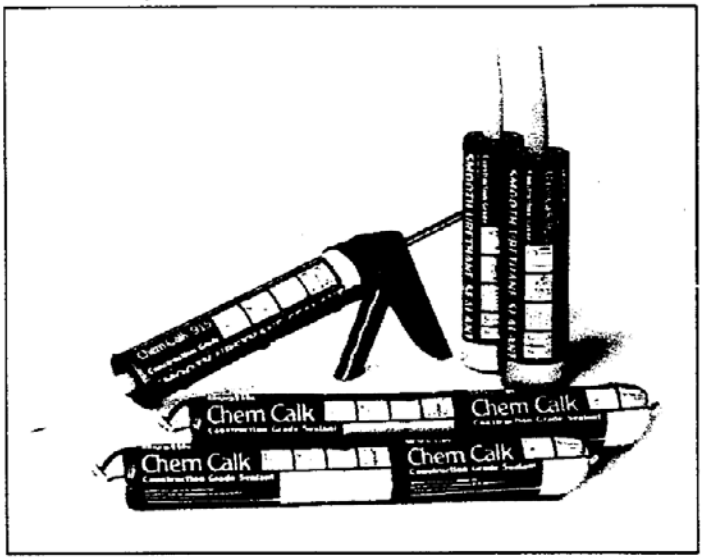


TABLE 1: CHEM-CALK® 915
TYPICAL UNCURED PROPERTIES*

Property	Value	Test Method
Tool/Work Time	60 min.	Bostik Test Method
Skin Time	4 hrs.	Bostik Test Method
Curing Time @ 77°F	2 - 7 days	Varies w/ relative humidity
Flow, Sag or Slump	0.1 inch	Bostik Test Method

TABLE 2: CHEM-CALK® 915
TYPICAL CURED PROPERTIES*
(After 14 days cure at 77°F and 50% RH)

Property	Value	Test Method / Note
Hardness (Shore A)	42	ASTM D 2240
Modulus @ 100% Elongation	65 psi	ASTM D 412
@ 25% Elongation	45 psi	ASTM D 412
Tensile Strength @ Break	133 psi	ASTM D 412
Elongation @ Break	685%	ASTM D 412
Adhesion Peel	>5 piw	TT-S-00230C / ASTM C 794
Joint Movement Capability	+25%	TT-S-00230C / ASTM C 719
UV Resistance	Pass	ASTM C 793 (Not related to color retention)

* Values given above are not intended to be used in specification preparation.

FEATURES & BENEFITS

■ Easy gunning	Helps reduce installer's fatigue
■ Tenacious bonds to common building materials	Helps maintain a weatherseal
■ Quicker skin and cure times	Helps reduce jobsite dirt pickup

APPLICATION LIMITATIONS

- Construction substrates have become complex and diverse by nature and origin. Substrate chemistries and structures can interfere with adhesive performances of the sealant. Adhesion to Substrate Pretest (ASP) is therefore MANDATORY to assess any adhesion and sealing characteristics—see Adhesion to Substrates Pretest section and see Installation Protocol section. This must be done pre-installation to avoid potential failures. Call Technical Service for more information about surface preparation and possible priming.
- Do not apply over damp, contaminated, loose surfaces (See Installation Protocol and Surface Preparation), old sealants or other foreign substances that may impair the adhesion bond. Avoid air entrapment.
- Dampness and substrates with high moisture will trigger extensive curing of the sealant within a very short period of time. This may cause an excess of bubbling and foaming within the sealant and at the bottom of the bead.
- Porous substrates such as but not limited to marble, limestone and granite might absorb components of the Bostik® Chem-Calk® 915 leading to staining of the substrate. ASP with sufficient aging is mandatory to assess this potential issue.
- The ultimate performance of Bostik® Chem-Calk® 915 depends on proper joint design and proper application with joint surfaces properly prepared (See Installation Protocol). Bostik® Chem-Calk® 915 is not recommended for joints with dimension less than or greater than what is recommended below. (See Installation Protocol—Joint Design section.)
- Bostik® Chem-Calk® 915 must not be used to seal narrow joints, fillet joints and face nail holes.
- Smearing and feathering Bostik® Chem-Calk® 915 over joints is not recommended.
- Bostik® Chem-Calk® 915 is not recommended for horizontal joints or traffic-bearing joints where abrasion resistance is required (walkways, driveways, runways, etc.). Please refer to Chem-Calk® 950 for this application.
- Bostik® Chem-Calk® 915 is not recommended for continuous immersion in water or any other fluid. When fully cured avoid exposure, even incidental, to fuels, chlorinated, acid and alkaline solutions. Bostik® Chem-Calk® 915 is not recommended for exterior or interior sealing below the waterline; please refer to Bostik® 940 Fast Set for marine applications.
- Contact of Bostik® Chem-Calk® 915 with asphalts (i.e., back coating of window flashing, etc.) and other filler compounds impregnated with oil, asphalt, tar, etc., may deteriorate the cohesive strength of the substrate and ultimately compromise the seal.
- During the curing of Bostik® Chem-Calk® 915, do not expose to curing silicone sealants, curing Bostik® Chem-Calk® 2000, alcohol, acids or solvent-based materials.
- Lower relative humidity and temperature will significantly extend the curing time. Confined areas, deep joints and moisture barrier substrates may also affect the full cure time and extend it by many days.
- Until the sealant is fully cured, do not expose the sealant to any mechanical stress. Uncured sealant will not respond properly to cyclic expansion and contraction of the joint specified for the cured sealant only.
- The surface of a Bostik® Chem-Calk® 915 seal when exposed to UV rays and sunlight will yellow and not retain its gloss. This phenomenon can occur within a few weeks after exposure. The change of color is limited to the surface layer of the seal and should not compromise the sealing properties of the Bostik® Chem-Calk® 915 if the dimensions of the joint are proper and the sealant is otherwise properly applied. In areas where color retention is critical, please refer to Bostik® Chem-Calk® 2000. Bostik® Chem-Calk® 915 may remain tacky for a few hours and attract dust and dirt from the jobsite which may affect the appearance of the sealant. Check tack-free time to prevent dirt pickup.
- Bostik® Chem-Calk® 915 is not recommended for glazing applications. Bond line strength can be affected by UV rays through the clear material (glass, acrylic glass, polycarbonate, etc.).
- Bostik® Chem-Calk® 915 is not RTV silicone and therefore is suitable for painting with latex based paints. Paint chemistries and flexibility characteristics of the paint films over the sealant may affect wetting, adhesion and integrity of the paint layer; and it is therefore mandatory to pretest the paint or other coating over the Bostik® Chem-Calk® 915 to ensure the successful compatibility between the sealant and the paint/coating after a sufficient amount of time. See your paint manufacturer for specifications and limitations and call our Technical Service for more information. In general, oil-based paints are not recommended because of their poor elastic properties and because of their potential interaction with the sealant chemistry, which may create non-curing conditions for the sealant. Do not paint over the polyurethane sealant until it has fully cured.

INSTALLATION PROTOCOL

Joint Design:

In general, more joint movement can be accommodated in a thin bead of sealant than a thick bead. Bostik® Chem-Calk® 915 polyurethane sealant should be no thicker than 1/2" (12.7mm) and no thinner than 1/4" (6.4mm). In joints between 1/2" and 1", the ratio of sealant width to depth should be approximately 2:1. Sealant depth in joints between 1/4" and 1/2" should be 1/4" deep. Joints with dynamic movement should not be designed in widths less than 1/4".

Surface Preparation:

See limitations about surface preparation. Surfaces must be structurally clean, dry (no frost) and structurally sound, free of contaminants, including but not limited to dust, dirt, loose particles, tar, asphalt, rust, mill oil, etc. If substrate is painted or coated, scrape away all loose and weakly bonded paint or coating. Any paint or coating that cannot be removed must be tested to verify adhesion of the sealant or to determine the appropriate surface preparation if needed. (See Mandatory Adhesion to Substrates Pretest—ASP section on next page for details.)

To remove laitance and any other loose material, clean concrete, stone or other masonry materials with nonalcoholic-based solvent by washing, grinding, sandblasting or wire brushing as necessary. Do not use water to clean substrates. Dust must be thoroughly removed after cleaning.

Backer Rods and Bond Breaker Tapes:

Bond breakers, including but not limited to closed-cell polyethylene backer rods, are used to control depth of the sealant bead, provide a firm tooling surface and avoid three-sided adhesion. Where the depth of joint prevents use of backer rods, a polyethylene strip or tape must be used as a bond breaker to prevent 3-sided adhesion. Do not prime or damage the surface of the bond breaker. Refer to instructions given by rod and tape manufacturers for the correct backer rod and tape size related to joint size.

Priming:

In general, application of Bostik® Chem-Calk® 915 does not require priming the substrates. However, some substrates may require a Bostik primer. It is the user's responsibility to check adhesion of the cured sealant on typical test joints at the project site before and also during application as weather conditions may affect the adhesion results (See ASP section on next page.). Refer to Bostik Primer product data sheet or call Technical Service for proper selection and application of Bostik Primers. (See Primer Coverage Chart on last page.)

Tooling:

Bostik® Chem-Calk® 915 comes ready-to-use. Cut spout or tip to desired bead size. Apply moderate pressure to break seal inside the nozzle. Apply

by using a professional caulking gun such as Bostik® K410042TG. Use opened cartridges and sausages the same day they are opened. Apply Bostik® Chem-Calk® 915 polyurethane sealant in a continuous operation using positive pressure to the bottom of the joint to properly fill and seal the joint. When applying, avoid air entrapment and overlapping. Tool the sealant before the skin forms with adequate pressure to spread the sealant against the backup material at the bottom and sides of the joint. A dry tool with a concave profile is recommended for that operation. Do not use water or soapy water for this operation. Avoid smearing and feathering of the sealant to allow full performance of the cured seam. Excess sealant should be dry-wiped or joints should be properly taped.

Cleaning:

After dry-wiping uncured sealant from substrates and tools, remaining uncured sealant can be removed by using Xylene, Toluene or similar aromatic solvents. Please refer to the MSDSs provided for these solvents before use. Bostik® Hand and Tool towels can also remove uncured sealant. Cured sealant is usually very difficult to remove without altering or damaging the surface to which the sealant has been misapplied. Cured sealant can be removed by abrasion or other mechanical means (scrapers, putty knives).

Curing Time:

Bostik® Chem-Calk® 915 is a moisture cure, polyurethane sealant. On wood, with ambient air at 50% relative humidity and at 73°F, polyurethane sealants will generally skin within one hour and cure 1/16 of an inch per day. Lower temperature and lower relative humidity will significantly increase the skin time and cure time of a polyurethane sealant.

Painting and Coating:

Bostik® Chem-Calk® 915 is not RTV silicone and therefore is suitable for painting with latex-based paints. Paint chemistries and flexibility characteristics of the paint films over the sealant may affect wetting, adhesion and integrity of the paint layer, and it is therefore mandatory to pretest the paint or other coating over the Bostik® Chem-Calk® 915 to ensure the successful compatibility between the sealant and the paint/coating after a sufficient amount of time. See your paint manufacturer for specifications and limitations and call our Technical Service for more information. In general, oil-based paints are not recommended because of their poor elastic properties and because of their potential interaction with the sealant chemistry, which may create non-curing conditions for the painted sealant. Do not paint over the polyurethane sealant until it has fully cured.

Maintenance:

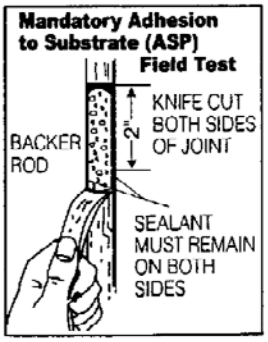
If the sealant becomes damaged, replace the damaged portion by removing the old sealant completely, cleaning the surfaces and reapplying a fresh and appropriate amount of new sealant in accordance with the directions and information contained in this data sheet.

MANDATORY ADHESION TO SUBSTRATES PRETEST— (ASP)

A hand pull test must be run before the job starts and at regular intervals during the job. It must be run on the job site after the sealant is fully cured, usually within 7 to 21 days. (Adhesion may develop fully after at least 14 days.)

The hand pull test procedure is as follows:

1. Make a knife cut horizontally from one side of the joint to the other.
2. Make two vertical cuts approximately two inches long, at the sides of the joint, meeting the horizontal cut at the top of the two-inch cuts.



3. Grasp the two-inch piece of sealant firmly between the fingers and pull down at a 90° angle or more, and try to pull the uncut sealant out of the joint.
4. If adhesion is sufficient, the sealant should tear cohesively in itself.
5. Sealant may be replaced by applying more sealant in the same manner as it was originally applied. Care should be taken to ensure that the new sealant is in contact with the original, and that the original sealant surfaces are clean, so that a proper bond between the new and old sealant will be obtained.

STORAGE • PACKAGING • SHELF LIFE

Shelf life of Bostik® Chem-Calk® 915 must be checked prior to using the product; do not use past its shelf life. Caulk past its shelf life may not perform or adhere as described by this data sheet. High temperature and high relative humidity may reduce significantly the shelf life of polyurethane sealants. If you are unsure of the expiration date of your Bostik product, please call customer service at 1-888-603-8556 to check if the product is still within its shelf life.

COLORS

White	Stone	Bronze	Tan
Black	Limestone	Med. Bronze	Almond
	Aluminum Stone	Hunter Green	

AVAILABILITY

Available from authorized Bostik distributors. Go to www.bostik-us.com and check on our distributor locator for the closest distributor in your location or call customer service at 1-888-603-8556.

HEALTH AND SAFETY

Please refer to the MSDS for First Aid Information. Most current MSDS's can be found on Bostik's website at www.bostik-us.com or call customer service at 1-888-603-8556.

TECHNICAL SERVICE

TECH SERVICE phone number: 1-800-523-2678.

Field visits by Bostik personnel, Bostik manufacturer representatives or Bostik authorized distributor personnel are for the purpose of making technical recommendations only and not for supervising or providing quality control on the jobsite.

WARRANTY (LIMITED WARRANTY) — IMPORTANT NOTICE

All statements, technical information and recommendations set forth herein are based on tests which Bostik believes to be reliable. However, Bostik does not guarantee their accuracy or completeness. The buyer and/or user should conduct its own tests of this product before use to determine proper preparation technique and suitability for proposed application. Any sales of this product shall be on terms and conditions set forth on Bostik's order acknowledgment. Bostik warrants that the product conforms with Bostik written specifications and is free from defects at the time it leaves Bostik's control. BOSTIK DISCLAIMS ALL OTHER WARRANTIES, EXPRESSED AND/OR IMPLIED, INCLUDING THE WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. THE BUYER'S SOLE REMEDY FOR NONCOMPLIANCE WITH THIS WARRANTY SHALL BE FOR THE REPLACEMENT OF THE PRODUCT OR REFUND OF THE BUYER'S PURCHASE PRICE. IN NO CASE WILL BOSTIK BE LIABLE FOR DIRECT, CONSEQUENTIAL ECONOMIC OR OTHER DAMAGES.

Bostik Coverage Charts

COVERAGE FOR 10.1 FL. OZ. CARTRIDGE (298 mL)

Depth \ Width	1/8"	1/4"	3/8"	1/2"	5/8"	3/4"	7/8"	1"
1/8"	97	49	32	24	19	16	13	12
1/4"		24	19	12	9	7	6	5
3/8"			10	7	6	5	4.5	4
1/2"				5.5	5	4	3.5	3

LINEAR FEET PER 10.1 FL. OZ. CARTRIDGE

COVERAGE CHART FOR 5 GALLON PAIL (18.9 L)

Depth \ Width	1/8"	1/4"	3/8"	1/2"	5/8"	3/4"	7/8"	1"
1/8"	6150	3100	2050	1540	1230	1025	870	770
1/4"		1540	1240	770	615	510	440	370
3/8"			680	510	410	310	290	245
1/2"				370	305	245	220	185

LINEAR FEET PER 5 GALLON PAIL

COVERAGE FOR 28 FL. OZ. CARTRIDGE (828 mL)

Depth \ Width	1/8"	1/4"	3/8"	1/2"	5/8"	3/4"	7/8"	1"
1/8"	268	137	88	66	53	44	36	33
1/4"		66	53	33	25	19	17	14
3/8"			27	19	17	14	12	11
1/2"				15	14	11	10	8

LINEAR FEET PER 28 FL. OZ. CARTRIDGE

COVERAGE CHART FOR 52 GALLON DRUM (196.8 L)

Depth \ Width	1/8"	1/4"	3/8"	1/2"	5/8"	3/4"	7/8"	1"
1/8"		63960	32240	16016	12792	10660	9048	8008
1/4"			12896	8008	6396	5304	4523	3848
3/8"			7072	5304	4264	3224	2907	2548
1/2"				3848	3172	2548	2261	1294

LINEAR FEET PER 52 GALLON DRUM

COVERAGE FOR 20 FL. OZ. SAUSAGE (591 mL)

Depth \ Width	1/8"	1/4"	3/8"	1/2"	5/8"	3/4"	7/8"	1"
1/8"	192	97	63	48	39	31	27	24
1/4"		48	39	24	19	15	14	12
3/8"			21	15	11	10	9	7
1/2"				11	10	8	7	5

LINEAR FEET PER 20 FL. OZ. SAUSAGE

PRIMER COVERAGE RECOMMENDATIONS

For one (1) quart of primer, coverage is as follows:	
1 unit	5 gallon pail
5 units	1.5 gallon unit
7 gallons	1 gallon unit
103 cartridges	10.1 fl.oz. cartridge
35 cartridges	28 fl.oz. cartridge

NOTE: All values are approximations and can vary due to joint dimension variations, porosity, and texture of substrates.

TABLE 3: CHEM-CALK® 915 ASTM C-794 ADHESION-IN-PEEL TO COMMON CONSTRUCTION SURFACES*

Surface	Failure Type – %
Mill Finished Aluminum**	Adhesive – 100
Anodized Aluminum	Cohesive – 100
Steel**	Adhesive – 100
Galvanized Steel	Cohesive – 100
Stainless Steel**	Adhesive – 100
Fiberglass	Cohesive – 100
ABS**	Adhesive – 100
Rigid PVC**	Adhesive – 100
Plywood***	Cohesive – 100
Concrete***	Cohesive – 100
Brick	Cohesive – 100
Granite	Cohesive – 100
Marble**	Adhesive – 100
Limestone***	Cohesive – 100

* Values given above are not intended to be used in specification preparation.

** With primer, value is >25, Cohesive – 100.

***Peel values are reduced when unprimed samples are water-immersed.

MATERIAL SAFETY DATA SHEET

1. CHEMICAL PRODUCT & COMPANY IDENTIFICATION

Product name	**CC-915 Sealant/Adh Series**
Product name(s) covered	See Section 16 for Product Names Covered.
MSDS name	CC-915 Sealant/Adhesives - Various Colors
CAS number	Mixture
Generic description	Polyurethane Sealant
Manufacturer	Bostik, Inc. 211 Boston Street Middleton, MA 01949 USA
24 hour emergency assistance	Telephone: 1-800-227-0332
General assistance	Telephone: 1-978-777-0100
MSDS assistance	Telephone: 1-414-607-1347

2. COMPOSITION / INFORMATION ON INGREDIENTS

Hazardous component(s)	CAS #	Percent
Xylenes (o-, m-, p- isomers)	1330-20-7	1 - 5
Ethyl benzene	100-41-4	0.5 - 1.5
Methylene Diphenyl Isocyanate (MDI)	101-68-8	0.1 - 1
Methyl alcohol	67-56-1	< 0.1

Composition comments Methanol can be formed through hydrolysis and be released during the curing process.

3. HAZARDS IDENTIFICATION

Emergency overview

Harmful: danger of serious damage to health by prolonged exposure through inhalation, in contact with skin and if swallowed. Methanol is formed during curing. Inhalation of vapors in high concentrations may cause nausea, abdominal pain, vomiting, headache, dizziness, shortness of breathe, weakness, fatigue, leg cramps, restlessness, confusion, drunken behavior, visual disturbances, drowsiness, coma, and death. Visual effects include blurred vision, diplopia, changes in color perception, restriction of visual fields, complete blindness. Ingestion of moderate quantities of methanol produces metabolic acidosis. Onset of symptoms may be delayed up to 48 hours. OSHA has established a PEL of 200 ppm, 8 hour TWA. Provide ventilation adequate to control vapor exposure within inhalation guidelines when handling.

This product is irritating to the eyes and skin. Thermal decomposition/burning may produce toxic gases and fumes. Closed containers may rupture when exposed to high temperatures, or when the product has been contaminated with water.

Avoid breathing hot mists and vapors. This product contains a respiratory and skin sensitizer. Causes respiratory tract irritation and may cause allergic respiratory reaction. May cause permanent respiratory damage. Product vapors are potentially irritating to skin. May cause allergic skin reaction and dermatitis.

Potential health effects

Skin Skin contact may cause irritation. Isocyanates may react with skin protein and moisture to cause itching, reddening, swelling, scaling or blistering. Individuals previously sensitized to this material may experience these symptoms from exposure to very small amounts of liquid or vapor.

Eyes This product may cause irritation to the eyes. May cause temporary corneal injury.

Inhalation	This product may cause irritation to the respiratory system. Methanol is formed during curing. Use with adequate ventilation. Repeated inhalation may be harmful; lung irritation and serious central nervous system disorders may result. Inhalation of vapours in high concentration can cause narcotic effects and metabolic acidosis. Single large does, and/or repeated exposures, may lead to sensitization to diisocyanates or polyisocyanates (asthma or asthma-like symptoms), causing an individual to experience adverse effects at exposure levels well below exposure limits or guidelines. Symptoms may include chest tightness, wheezing, shortness of breath, coughing or asthmatic attack, and may be delayed up to several hours. Extreme asthmatic reactions can be life threatening. Once sensitized, an individual may experience adverse symptoms upon exposure to dust, cold air or other irritants. Sensitization can last several months, years or be permanent in some cases.
Ingestion	May cause irritation and corrosive action in the mouth, throat and digestive tract. This product can cause gastrointestinal irritation, nausea, vomiting, and diarrhea. Ingestion of this product may result in central nervous system effects including headache, sleepiness, dizziness, slurred speech and blurred vision. Small amounts of this product, if aspirated into the lungs, may cause mild to severe pulmonary injury.
Target organs	Central Nervous System. Kidneys and Liver. The lungs and skin may be targeted and damaged by components of this product.
Signs and symptoms of overexposure	Signs and symptoms of overexposure to this product include headache, irritation of upper respiratory tract, asthmatic symptoms, chest tightness, breathing difficulty, coughing, sore throat, eye irritation, skin irritation and/or diarrhea.
Hazard statements	This product contains Methylene Diphenyl Isocyanate (MDI) which is a potential skin sensitizer and has been shown to alter cells in certain experiments. Although inconclusive, these cellular changes are thought to indicate potential carcinogenicity. Risk to your health depends on duration and concentration of exposure.

4. FIRST AID MEASURES

First aid

Skin	Remove contaminated clothing to prevent further skin exposure and dispose of properly. In situations involving considerable skin contact, place the contaminated person in a deluge shower for at least 15 minutes. For minor exposures, wash thoroughly with soap and clean water. Get medical attention if irritation persists.
Eye	Immediately flush eyes with plenty of water for at least 15 minutes. Get medical attention or advice.
Inhalation	Remove to fresh air. Get medical attention immediately for a large dose exposure or if cough or other symptoms develop. Administer oxygen or artificial respiration as needed.
Ingestion	If ingested, get immediate medical attention. Do not induce vomiting unless instructed to do so by medical personnel. Never give anything by mouth to a victim who is unconscious or is having convulsions.
Notes to physician	Treat symptomatically and supportively. Contact Bostik to determine whether any additional information is available. Eyes: Stain for evidence of corneal injury. If cornea is burned, apply antibiotic/steroid preparation as needed. Skin: This product contains a skin sensitizer. Treat symptomatically as for contact dermatitis or thermal burn. Ingestion: Treat symptomatically. Inhalation: This material contains a known pulmonary sensitizer. Any individual experiencing dermal or pulmonary sensitization should be removed from exposure to any diisocyanate. May aggravate existing heart conditions, particularly those with abnormal heart rhythms. If overexposure to the solvents in this product is suspected, testing should include nervous system and brain effects including recent memory, mood, concentration, headaches and altered sleep patterns. Liver and kidney function should be evaluated. This material, if aspirated into the lungs, may cause chemical pneumonitis; treat the affected person appropriately.

5. FIRE FIGHTING MEASURES

Hazardous combustion products	Additional decomposition products include oxides of nitrogen, amines, hydrogen cyanide and isocyanate-containing compounds.
Extinguishing media	Use dry chemical, carbon dioxide, or foam. Water spray (fog).
Dust explosion hazard	None Known
Sensitivity to mechanical impact	None Known
Sensitivity to static discharge	None Known

Fire fighting equipment/instructions	Firefighters should wear NFPA compliant structural fire fighting protective equipment, including a self-contained breathing apparatus, helmet, hood, boots and gloves. Avoid contact with isocyanates. During a fire, isocyanate vapors and other irritating and highly toxic gases may be produced.
Flash point	166 °F (74.4 °C)

6. ACCIDENTAL RELEASE MEASURES

Emergency action	Appropriate safety measures and protective equipment should be used. See Section 8. Do not discharge to lakes, streams, ponds, or sewers. Dispose of in compliance with local, state, and federal regulations.
Spill or leak procedure	Scrape up paste and place in steel drums that are in good condition. Thoroughly clean area where spill occurred.
Containment	Isolate spill area. Stop discharge if safe to do so. Stop material from contaminating soil or from entering sewers or water streams.
Reporting	See Federal reporting requirements listed in Section 15. We recommend you contact local authorities to determine if there may be other local reporting requirements.

7. HANDLING & STORAGE

Handling	Wash hands thoroughly after handling, especially before eating, drinking, smoking, and using restroom facilities. Wash contaminated goggles, face shields, and gloves. Professionally launder contaminated clothing before re-use. Do not breathe vapors, mists or dusts. Do not breathe fumes generated when the material is overheated or burned. Use adequate ventilation. Wear respiratory protection if the material is heated, sprayed, used in a confined space or if exposure limit is exceeded. This product can produce asthmatic sensitization. Individuals with lung or breathing problems or prior allergic reactions to isocyanates must avoid fumes from this product. Wear appropriate protective equipment to avoid contact with skin and eyes.
Storage	Store in a cool, dry, well-ventilated area away from heat, ignition sources and direct sunlight. Water contamination should be avoided. Cool location should be 60-80 degrees F or 15-30 degrees C.
Empty container precaution	Attention! Follow label warnings even after container is emptied since empty containers may retain product residues. Do not reuse empty container without professional cleaning for food, clothing, or products for human or animal consumption, or where skin contact can occur.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

Engineering controls	Use local exhaust or general ventilation where the potential exists to exceed the PEL or TLV exposure limits. Methanol is formed during curing. Methanol vapors are toxic and flammable so special ventilation may be needed.
Eye protection	Wear goggles or safety glasses with side shields.
Skin and body protection	Wear appropriate clothing to minimize skin contact with this product.
Respiratory protection	Avoid breathing vapor and/or mists. If airborne concentrations are above the applicable exposure limits, use NIOSH approved respiratory protection. High airborne concentrations may necessitate the use of self-contained breathing apparatus (SCBA) or a supplied air respirator.

Exposure limits

ACGIH - Threshold Limits Values - Time Weighted Averages (TLV-TWA)	
Ethyl benzene	100-41-4 100 ppm TWA
Methyl alcohol	67-56-1 200 ppm TWA
Methylene Diphenyl Isocyanate (MDI)	101-68-8 0.005 ppm TWA
Xylenes (o-, m-, p- isomers)	1330-20-7 100 ppm TWA
NIOSH - Pocket Guide - TWAs	
Ethyl benzene	100-41-4 100 ppm TWA; 435 mg/m3 TWA
Methyl alcohol	67-56-1 200 ppm TWA; 260 mg/m3 TWA
Methylene Diphenyl Isocyanate (MDI)	101-68-8 0.005 ppm TWA; 0.05 mg/m3 TWA
OSHA - Final PELs - Time Weighted Averages (TWAs)	
Ethyl benzene	100-41-4 100 ppm TWA; 435 mg/m3 TWA
Methyl alcohol	67-56-1 200 ppm TWA; 260 mg/m3 TWA
Xylenes (o-, m-, p- isomers)	1330-20-7 100 ppm TWA; 435 mg/m3 TWA
OSHA - Vacated PELs - Ceilings	
Methylene Diphenyl Isocyanate (MDI)	101-68-8 0.02 ppm Ceiling; 0.2 mg/m3 Ceiling
OSHA - Vacated PELs - TWAs	
Ethyl benzene	100-41-4 100 ppm TWA; 435 mg/m3 TWA
Methyl alcohol	67-56-1 200 ppm TWA; 260 mg/m3 TWA
Xylenes (o-, m-, p- isomers)	1330-20-7 100 ppm TWA; 435 mg/m3 TWA

9. PHYSICAL & CHEMICAL PROPERTIES

Density	1.346 g/cc
Odor	Solvent
Color	Various
Physical state	Paste
Freeze protect	No
VOC (Volatile Organic Compounds)	3.9 %

10. STABILITY & REACTIVITY

Hazardous reactions/decomposition products	Unknown due to the complex nature of this material. Fumes from complete or incomplete combustion may include carbon dioxide, carbon monoxide, water vapor, oxides of nitrogen and a wide variety of innocuous or toxic fumes. Additional decomposition products include oxides of nitrogen, amines, hydrogen cyanide and isocyanate-containing compounds.
Hazardous polymerization	Hazardous polymerization can occur with elevated temperatures or contact with water.
Conditions to avoid	Avoid Strong Acids. Avoid water, amines, strong bases, alcohols and metallic hydrides.
Stability	This product is stable under normal conditions but will react slightly with water to release some heat and carbon dioxide. The reaction is not violent. Carbon dioxide, carbon monoxide and in high temperature (800° F) low oxygen atmospheres such as in fire situations, hydrogen cyanide may be released.

11. TOXICOLOGICAL INFORMATION

Toxicological data If any toxicological data is available, it will be listed below:

LD50

Toxicology Data - Selected LD50s and LC50s

Ethyl benzene	100-41-4	Inhalation LC50 Rat: 17.2 mg/L/4H; Oral LD50 Rat: 3500 mg/kg; Dermal LD50 Rabbit: 15354 mg/kg
Methyl alcohol	67-56-1	Inhalation LC50 Rat: 83.2 mg/L/4H; Inhalation LC50 Rat: 64000 ppm/4H; Oral LD50 Rat: 5628 mg/kg; Dermal LD50 Rabbit: 15800 mg/kg
Methylene Diphenyl Isocyanate (MDI)	101-68-8	Oral LD50 Rat: 9200 mg/kg
Xylenes (o-, m-, p- isomers)	1330-20-7	Inhalation LC50 Rat: 5000 ppm/4H; Oral LD50 Rat: 4300 mg/kg; Dermal LD50 Rabbit: >1700 mg/kg

Carcinogenicity If this product contains any carcinogens, they will be noted below:

This product contains Methylene Diphenyl Isocyanate (MDI). MDI is not listed by the NTP, IARC or regulated by OSHA as a carcinogen. However, it has been shown to alter cells in certain experiments. Although inconclusive, these cellular changes are thought to indicate potential carcinogenicity.

IARC - Group 2B (Possibly Carcinogenic to Humans)

Ethyl benzene	100-41-4	Monograph 77 [2000]

OSHA - Hazard Communication Carcinogens

Ethyl benzene	100-41-4	Present

Local effects Single large does, and/or repeated exposures, may lead to sensitization to diisocyanates or polyisocyanates (asthma or asthma-like symptoms), causing an individual to experience adverse effects at exposure levels well below exposure limits or guidelines. Symptoms may include chest tightness, wheezing, shortness of breath, coughing or asthmatic attack, and may be delayed up to several hours. Extreme asthmatic reactions can be life threatening. Once sensitized, an individual may experience adverse symptoms upon exposure to dust, cold air or other irritants. Sensitization can last several months, years or be permanent in some cases. Chronic exposure may cause lung damage, including fibrosis and decreased lung function, which may be permanent.

12. ECOLOGICAL INFORMATION

VOC (Volatile Organic Compounds)	3.9 %
Ecotoxicological information	No data available for this product.

13. DISPOSAL CONSIDERATIONS

It is the obligation of each user of the product mentioned herein to determine and comply with the requirements of all applicable local, state and federal regulations.

Waste disposal Dispose of waste material according to Local, State, Federal, and Provincial Environmental Regulations.

14. TRANSPORT INFORMATION

Department of Transportation (DOT) Requirements

Not regulated as dangerous goods.

IATA

Not regulated as dangerous goods.

IMDG

Not regulated as dangerous goods.

15. REGULATORY INFORMATION

This MSDS is prepared and distributed pursuant to the Federal Hazard Communication Standard, 29 CFR 1910.1200.

Federal regulations All components are on the U.S. EPA TSCA Inventory List.

CERCLA/SARA - Hazardous Substances and their Reportable Quantities

Ethyl benzene	100-41-4	1000 lb final RQ; 454 kg final RQ
Methyl alcohol	67-56-1	5000 lb final RQ; 2270 kg final RQ
Methylene Diphenyl Isocyanate (MDI)	101-68-8	5000 lb final RQ; 2270 kg final RQ
Xylenes (o-, m-, p- isomers)	1330-20-7	100 lb final RQ; 45.4 kg final RQ

CERCLA/SARA - Section 313 - Emission Reporting

Ethyl benzene	100-41-4	0.1 % de minimis concentration
Methyl alcohol	67-56-1	1.0 % de minimis concentration
Methylene Diphenyl Isocyanate (MDI)	101-68-8	1.0 % de minimis concentration (listed under Chemical Category N120, Diisocyanates)
Xylenes (o-, m-, p- isomers)	1330-20-7	1.0 % de minimis concentration

CWA (Clean Water Act) - Hazardous Substances

Ethyl benzene	100-41-4	Present
Xylenes (o-, m-, p- isomers)	1330-20-7	Present

TSCA (Toxic Substances Control Act) - Section 12(b) - Export Notification

Chlorobenzene	108-90-7	Section 4
Xylenes (o-, m-, p- isomers)	1330-20-7	Section 4

State regulations If this product contains any ingredients listed under California Proposition 65, they will be noted below:

California - Proposition 65 - Carcinogens List

Ethyl benzene	100-41-4	carcinogen, initial date 6/11/04
Lead	7439-92-1	carcinogen, initial date 10/1/92 Trace impurity
Nickel	7440-02-0	carcinogen, initial date 10/1/89 Trace impurity

California - Proposition 65 - Developmental Toxicity

Lead	7439-92-1	developmental toxicity, initial date 2/27/87 Trace impurity

California - Proposition 65 - Reproductive Toxicity - Female

Lead	7439-92-1	female reproductive toxicity, initial date 2/27/87 Trace impurity

California - Proposition 65 - Reproductive Toxicity - Male

Lead	7439-92-1	male reproductive toxicity, initial date 2/27/87 Trace impurity

International regulations This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations and contains all the information required by the Controlled Products Regulations.

HMIS Ratings
Health: 2*
Flammability: 2
Physical hazard: 0
Personal protection: X

SARA 311/312 HAZARD CATEGORIES
Immediate Hazard - Yes
Delayed Hazard - Yes
Fire Hazard - Yes
Pressure Hazard - No
Reactivity Hazard - No

WHMIS status Controlled

WHMIS labeling

WHMIS classification D2A - Other Toxic Effects-VERY TOXIC
D2B - Other Toxic Effects-TOXIC

16. OTHER INFORMATION

Product name(s) covered

A27010 - CC-915 WHITE 24/10.1
A27028 - CC-915 WHITE S/PK 12/20.0
A28310 - CC-915 STONE 24/10.1
A28324 - CC-915 STONE S/PK 12/20.0
A28410 - CC-915 LIMESTONE 24/10.1
A28412 - CC-915 LIMESTONE S/PK 12/20.0
A28423 - CC-915 LIMESTONE UNLAB 24/10.1
A28426 - CC-915 LIMESTN UNL S/P 12/20.0
A28510 - CC-915 BRONZE 24/10.1
A28523 - CC-915 BRONZE S/PK 12/20.0
A28610 - CC-915 TAN 24/10.1
A28619 - CC-915 TAN S/PK 12/20.0
A28710 - CC-915 BLACK 24/10.1
A28724 - CC-915 BLACK S/PK 12/20.0
A30610 - CC-915 MEDIUM BRONZE 24/10.1
A30710 - CC-915 ALMOND 24/10.1
A30712 - CC-915 ALMOND S/PK 12/20.0
A33710 - CC-915 ALUMINUM STONE 24/10.1
A33715 - CC-915 ALUM-STONE S/PK 12/20.0
A39212 - CC-915 CORAL RED 24/10.1
A39312 - CC-915 TERRA COTTA 24/10.1
A61210 - CC-915 HUNTER GREEN 24/10.1

Disclaimer The data in this MSDS has been compiled from publicly available sources. This data relates only to the designated product and not to the use of said product in combination with other materials. All materials may present unknown hazards and should be used with caution. Although certain hazards are described herein, we cannot guarantee that these are the only hazards which exist. Responsibility for proper precautions and safe use of the product lies with the user. All data in this MSDS is typical of the product as a whole, and does not represent any individual lot or batch, therefore, Bostik, Inc. makes no warranty about the accuracy of the data herein and assumes no liability for the use of such data. It is the responsibility of the user to comply with all applicable federal, state, and local laws and regulations.

Issue date 10/03/2006

Prepared by Pam Larsen

Appendix 2G: Coating Manufacturer 20-Year Warranty

PPG Industries

20-YEAR HAWAII LIMITED WARRANTY

DURANAR®, DURANAR®II, DURANAR® ULTRA-COOL, DURANAR®FC AND DURANAR®FC ULTRA-COOL® STANDARD COLORS

Effective Date: **June 1, 2008**

To: **OLD COUNTRY MILLWORKS**
1212 E. 58TH Pl.
Los Angeles, CA 90001

Site: **WHEELER AIR FORCE BASE**
Bowling Alley
Kamehameha Hwy
Wahiawa, HI 96786

This Limited Warranty ("Limited Warranty") applies to any Product shipped after **June 1, 2008** and no previous warranty shall apply such Product sold after **June 1, 2008**.

PPG INDUSTRIES, INC. (hereinafter "PPG INDUSTRIES") warrants that the Product listed above, when: (1) purchased by a customer (hereinafter the "Purchaser") to coat Aluminum, Hot-Dipped Galvanized Steel (HDG) or Aluminum/Zinc-coated Steel (Galvalume) (hereinafter the "Metal") (2) cured by the Purchaser or a third party (hereinafter the "Coater") on behalf of the Purchaser in accordance with the Product Data Sheets supplied to Coater, will retain its Film integrity, Color and Chalk, as defined below, after the installation of the Metal coated with the Product consistent with the table attached hereto.

DEFINITIONS:

1. Film Integrity shall be defined as the absence of peeling, checking, chipping or cracking, except for such crazing or slight cracking as may occur on tightly roll-formed edges or brake bends at the time of forming pre-painted sheet.
2. Color Change shall be defined as freedom from fade or change as warranted in ΔE units calculated in accordance with ASTM D2244-02, paragraph 6.2.2 CIEL*a*b*, 10° Observer, specular included. Color Change is measured on an exposed painted surface that has been cleaned of surface soils and chalk and the compared to corresponding values measured on the original or unexposed coated surface.
3. Chalk or Oxidation shall be defined as a numerical rating as warranted when measured in accordance with the standard procedures specified in ASTM D4214-98.

THIS LIMITED WARRANTY IS SUBJECT TO THE FOLLOWING CONDITIONS AND LIMITATIONS. ALL OF THE FOLLOWING CONDITIONS AND ADDITIONAL CONDITIONS CONSTITUTE MATERIAL TERMS OF THIS LIMITED WARRANTY AND FAILURE TO SATISFY ANY ONE OR MORE OF THE CONDITIONS OR ADDITIONAL CONDITIONS BY PURCHASER OR COATER OR THEIR AGENTS OR REPRESENTATIVES SHALL RENDER THIS LIMITED WARRANTY NULL AND VOID AND RELEASE PPG INDUSTRIES FROM ITS OBLIGATIONS HEREUNDER.

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Date

CONDITIONS:

1. Purchaser, if not coating the Metal itself, must select a coater that complies with industry standards for cleaning the metal, and applying and curing the coating.

PPG Industries
5875 New King Ct.
Troy, Michigan 48098
Telephone (248) 641-2078

PPG Industries 20-Year Hawaii Limited Warranty

Effective Date: **June 01, 2008**

DURANAR®, DURANAR®II, DURANAR® ULTRA-COOL, DURANAR®FC AND DURANAR®FC ULTRA-COOL® STANDARD COLORS

2. The coated Metal must be a surface on which no standing water accumulates, or a vertical trim or sidewall surface of an external architectural, commercial, pre-engineered building.
3. Product must be applied over a PPG INDUSTRIES approved Pretreatment in accordance with the PPG INDUSTRIES product data sheet.
4. Metal cleaning and pretreatment must be sufficient to meet the performance requirements described in AAMA 621-02 for Coil Coated Hot Dipped Galvanized (HDG) and Zinc-Aluminum Coated Steel (Galvalume) Substrates or AAMA 620-02 for Coil Coated Aluminum and processed in accordance with the specifications and recommendations of the pretreatment supplier.
5. Metal must be of sufficient quality and uniformity to meet the performance requirements described in AAMA 621-02 for Coil Coated Hot Dipped Galvanized (HDG) and Zinc-Aluminum Coated Steel (Galvalume) Substrates, or for Coil Coated Aluminum AAMA 620-02.
6. The coated Metal must not be cleaned with abrasive or chemical cleaners.
7. Claims under this Limited Warranty must be sent by Purchaser or Coater in writing to PPG INDUSTRIES and must be received by PPG INDUSTRIES within thirty (30) days after discovery of the condition giving rise to the claim.
8. In the event of a claim under this Limited Warranty, Purchaser or Coater must supply documentation that the product in question was produced by PPG INDUSTRIES. In addition, Purchaser or Coater shall demonstrate to the reasonable satisfaction of PPG INDUSTRIES that the failure of the Product was due to a breach of the Limited Warranty stated herein.

ADDITIONAL CONDITIONS FOR COATERS:

The Purchaser shall fulfill, and shall cause the Coater to fulfill if Purchaser is not coating the Metal, each of the following obligations:

1. Each batch of Product must be checked prior to use to assure the product meets or exceeds the fabrication requirements of Purchaser or Coater, as the case may be. Standard pre-ship testing and evaluation is acceptable.
2. The Purchaser or Coater coating the Metal shall maintain adequate records to identify the coil coater, coil numbers, Product identification, date of application, and shall retain two (2) representative coated coupons for five (5) years from each batch of Product purchased from PPG INDUSTRIES.
3. All paper records Purchaser or Coater are required to prepare and maintain under the terms of this Limited Warranty shall be retained by Purchaser or Coater for ten (10) years. Computer records shall be retained for twenty (20) years, and in the event of a claim hereunder PPG INDUSTRIES shall have the right to inspect such records.

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4. PPG INDUSTRIES shall, at reasonable times and in such manner as will not unreasonably interfere with Purchaser's or Coater's operations, be permitted to inspect the production line, coating equipment, metal treatment, curing conditions, and quality control facilities of Coater.

01/06/09
Date

PPG Industries
5875 New King Ct.
Troy, Michigan 48098
Telephone (248) 641-2078

PPG Industries 20-Year Hawaii Limited Warranty Effective Date: **June 01, 2008**

DURANAR®, DURANAR®II, DURANAR® ULTRA-COOL, DURANAR®FC AND DURANAR®FC ULTRA-COOL® STANDARD COLORS

5. All colors supplied in this technology by PPG INDUSTRIES to the Purchaser or Coater are covered by this Limited Warranty unless PPG INDUSTRIES specifically and in writing notifies the Customer otherwise prior to sale of the Product.
6. This Limited Warranty shall not apply where PPG INDUSTRIES Product is mixed, used in combination with, or combined with any other material.

LIMITATIONS:

1. The Limited Warranty shall extend from the date of installation of the Metal coated with the Product or, should installation occur after six (6) months from application of the Product to the Metal by the Coater, from a date six (6) months after application of the Product on the Metal, whichever occurs first. Product applied to Metal that is later embossed is warranted provided the embossing process does not fracture the coating or metal or adversely effect paint adhesion or film integrity. Any corrosion or loss of adhesion as a result of the embossing process is not covered under this Limited Warranty.
2. Non-uniform color changes that result from unequal exposure to sunlight and/or the elements are not covered by this Limited Warranty unless such color change meets the definition of Color Change above.
3. This Limited Warranty does not extend to, or cover: (a) damage to the Product occasioned by improper storage of the coated Metal prior to installation (NCCA guidelines described in the series titled "How To Fabricate Pre-paint") or moisture or other contamination detrimental to the Product because of improper packaging, handling, shipping, processing and/or installation; or (b) damage to the Product which suffers from improper forming, fabrication, cut edge exposure, corrosion of the substrate or any other condition between the substrate and coating which causes coating degradation or delamination or (c) any deficiency in the cleaning, metal pretreatment, installation or failure of the metal for any reason.
4. This Limited Warranty does not cover damage or failure of Product which damage or failure is attributable to acts of God, falling objects, external forces, explosions, fire, or other such similar or dissimilar occurrences beyond PPG INDUSTRIES' control.
5. Purchaser's and Coater's sole and exclusive remedy, and PPG INDUSTRIES' liability under this Limited Warranty will be limited, at PPG INDUSTRIES' option, to recoating or replacing the Metal coated with the Product claimed to be defective, including re-installation costs. In no event will PPG INDUSTRIES' obligation for a breach of this Limited Warranty exceed Five United States Dollars (US$5.00) per square foot of metal substrate to be refinished or replaced. Under no circumstances will PPG INDUSTRIES be held liable for any incidental, special, punitive or consequential damages.
6. PPG INDUSTRIES must approve any recoating of the Metal substrate through submission of three (3) estimates that each includes the name of the coating products to be used, labor and material costs as well as any other costs associated with the work for refinishing or replacing the metal substrate. PPG INDUSTRIES reserves the right to approve or negotiate the contract for such recoating or replacement work if the initial estimate is unacceptable to PPG INDUSTRIES. In no event will the original applicable warranty period set forth in the warranty table be extended by a warranty claim.

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PPG Industries 20-Year Hawaii Limited Warranty Effective Date: **June 01, 2008**

DURANAR®, DURANAR®II, DURANAR® ULTRA-COOL, DURANAR®FC AND DURANAR®FC ULTRA-COOL® STANDARD COLORS

7. In the event of any subsequent failure of any recoated or replaced coated Metal, Purchaser or Coater shall first make any claims against the supplier of those replacement materials.
8. The warranty for any refinished or replaced metal substrate shall be only for the remainder of the original warranty period applicable to the original coated metal substrate.

   EXCEPT AS EXPRESSLY PROVIDED ABOVE, IN NO EVENT SHALL PPG INDUSTRIES BE LIABLE UNDER ANY THEORY OF RECOVERY, WHETHER BASED ON NEGLIGENCE OF ANY KIND, STRICT LIABILITY OR TORT, FOR ANY DIRECT, INDIRECT, SPECIAL, PUNITIVE INCIDENTAL OR CONSEQUENTIAL DAMAGES IN ANY WAY ARISING OUT OF THE PURCHASE OF THE PRODUCT OR FROM ANY POSSESSION OR USE MADE OF A PRODUCT.
9. This Limited Warranty is extended to Purchaser or Coater only and shall not inure to the benefit of any other party. PPG INDUSTRIES' name, trademark, or Limited Warranty shall not to be used in any warranty given by the Purchaser or Coater to their customers.
10. This Limited Warranty is non-transferable and non-assignable by Purchaser or Coater, and Purchaser or Coater shall not permit their agents, representatives, customers, distributors, applicators, or contractors to claim, represent, or imply that this Limited Warranty extends to or is available to anyone other than Purchaser or Coater.
11. The applicable warranty period shall be limited to, and shall in no event extend beyond, the warranty period as set forth in the warranty table or the warranty period extended by Purchaser or Coater to its customers, whichever is shorter.
12. PPG INDUSTRIES and the Purchaser or Coater agree that this Agreement does not constitute an obligation of any kind whatsoever on the part of Purchaser or Coater to purchase any Product from PPG INDUSTRIES or an obligation on PPG INDUSTRIES' part to sell any Product to the Purchaser or Coater; but rather, it provides the governing terms and conditions as to the parties' respective liabilities and rights if, and when, any such purchase/sale of any of Product occurs.

PPG INDUSTRIES reserves the right to terminate this Limited Warranty at any time upon thirty (30) days advance written notice, except with respect to any Product which has already been shipped to Purchaser or Coater.

EXCEPT AS SET FORTH HEREIN, PPG INDUSTRIES MAKES NO OTHER EXPRESS WARRANTIES AND DISCLAIMS ANY IMPLIED WARRANTIES, INCLUDING ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE OR USE, WITH RESPECT TO ANY OF THE PRODUCTS.

MISCELLANEOUS:

1. All notices given under or pursuant to this Agreement shall be in writing and documented in any of the following forms: personally delivered, via email, fax, or certified mail, postage prepaid, return receipt requested, to the party to whom such notice is to be given as follows:

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Date

PPG	PPG Industries 5875 New King Ct. Troy, Michigan 48098 ATTN: **Warranties Department**	Purchaser/Coater:	Old Country Millworks 1212 E. 58TH Pl. Los Angeles, CA 90001 ATTN: **Ivan Padilla**

PPG Industries 20-Year Hawaii Limited Warranty

Effective Date: **June 01, 2008**

DURANAR®, DURANAR®II, DURANAR® ULTRA-COOL, DURANAR®FC AND DURANAR®FC ULTRA-COOL® STANDARD COLORS

2. No terms or conditions other than those stated herein, and no agreement or understanding, oral or written, in any way purporting to modify this Limited Warranty shall be binding on PPG INDUSTRIES unless made in writing and signed by its authorized representative.
3. This Agreement shall be governed by and construed in accordance with the laws of the Commonwealth of Pennsylvania, United States of America without giving effect to any choice of conflict of law provision or rule that would cause the application of the law of the jurisdiction other than Pennsylvania. The Purchaser/Coater hereby consents to the jurisdiction of, and hereby waives any defenses based on lack of jurisdiction or venue by, the Commonwealth of Pennsylvania, Allegheny County, for all purposes and proceedings related to any dispute related to or arising out of this Agreement.

In agreement with all provisions set herein, the parties sign in acceptance:

PPG INDUSTRIES, INC.	**OLD COUNTRY MILLWORKS**
Signature: Thomas W McKay	Signature:
By: **Thomas McKay**	By: IVAN I. PADILLA
Title: Product Manager	Title: CUSTOMER SERVICE
Date: 1/12/09	Date: 01/06/2009

PPG Industries 20-Year Hawaii Limited Warranty

Effective Date: **June 01, 2008**

DURANAR®, DURANAR®II, DURANAR® ULTRA-COOL, DURANAR®FC AND DURANAR®FC ULTRA-COOL® STANDARD COLORS

WARRANTY TABLES

DURANAR®, DURANAR®II, DURANAR® ULTRA-COOL, DURANAR®FC AND DURANAR®FC ULTRA-COOL® STANDARD COLORS

Warranty in years for all Exposure Conditions			
Type of Environment or Location	Film Integrity (Years)	Color $\Delta E \leq 5.0$ (Years)	Chalking ≥ 8 Rating (Years)
Residential, Commercial and School – Buildings used for habitation Distribution Centers, Hotels, Shopping Malls, Office Buildings Assembly Factories and Schools located in rural or residential areas	**20**	**20**	**20**
Industrial – Steel mills, Power Generating Stations, Oil Fields, Oil Refineries, Ore Mines, Chemical Plants, Paper Mills, or other unusual environmental exposure	**10**	**No Warranty**	**5**
Severe Marine – One mile to within 1000 feet of salt water. There is no warranty if closer than 1,000 feet	**20**	**20**	**20**

THIS LIMITED WARRANTY APPLIES ONLY TO PRODUCTS SOLD BY PPG INDUSTRIES AND APPLIED TO METAL THAT IS USED IN THE **CONTINENTAL UNITED STATES, HAWAII, ALASKA, CANADA, AND MEXICO** (THE CARIBBEAN EXCLUDED) unless PPG INDUSTRIES specifically and in writing notifies the Customer otherwise prior to sale of the Product

PPG INDUSTRIES retains the right to determine the Environmental Location condition during a warranty investigation and may deem the specific warranty performance based on close proximity to one of the severe environmental conditions noted above.

For the purpose of this Limited Warranty, Standard Colors use a group of pigments suitable for the majority of color matches. Some color requests cannot be formulated with durable pigments and will not carry the above mentioned warranty. The customer will be informed as to these exceptions.

FOR ALL INDUSTRIAL APPLICATIONS - Customer is required to consult with PPG INDUSTRIES **before** any installation takes place and PPG INDUSTRIES reserves the right to change the terms of this warranty based on the findings of such environmental exposures and/or conditions.

FOR ALL SEVERE MARINE APPLICATIONS - Homeowner or building owner is required by PPG INDUSTRIES to perform annual maintenance of the building in the form of a sweet water rinse (tap water). Homeowner or building owner is required to keep records of such maintenance for the warranty to be enforceable. **THERE IS NO WARRANTY** if building is located less than one mile from seashore or any other body of salt water.

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Date

PPG Industries
5875 New King Ct.
Troy, Michigan 48098

Appendix 2H: Suggested Maintenance/Care

1. Inspect and clean gutters and downspouts of all debris on a bi-annual basis.
2. Inspect exposed sealants and fasteners on an annual basis. Repair as required.
3. Visually inspect roof surface for collection of debris or mold/mildew. Pressure wash without chemical to correct as needed.
4. Do not let any grease, solvents or contaminants, etc. come in contact with roof surface. Carefully clean and remove any foreign materials using a non abrasive /water soluble cleaner. Test cleaner in small area before use and consult with coil manufacturer for compatibility prior to use of cleaner.
5. Contact original installer if any damage to Structural Standing Seam Roofing System due to any cause to initiate proper repairs.

Appendix 2I: Roof Hugger™ Guide Specification

C. Section 07400 (07 40 00) - Roofing and Siding Panels.

D. Section 07720 (07 72 00) - Roof Accessories.

E. Section 13120 (13 34 19) - Pre-Engineered Structures (Metal Building Systems).

1.3 REFERENCES

A. ASTM A 653/A 653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

B. ASTM A 1011/A 1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.

1.4 SUBMITTALS

A. Comply with Section 01330 (01 33 00) - Submittal Procedures.

B. Product Data: Submit manufacturer's product data, including installation instructions.

Specifier Notes: Edit the following paragraph regarding shop drawings as required for the project. Sub-purlins are typically produced 3/8 inch to 1 inch taller than the height of the major ribs of the existing roof panels. Indicate on the shop drawings if a specific sub-purlin height is required.

C. Shop Drawings: Submit manufacturer's shop drawings for sub-purlins indicating gage, yield strength, flange and web sizes, cutout dimensions, and punch pattern for attachment holes in base flange.

D. Design Data: Submit design data from independent engineering firm indicating table of wind uplift capacity of sub-purlins.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Delivery: Deliver materials to site in manufacturer's original, unopened bundles, containers, and packaging, with labels clearly identifying product name and manufacturer.

B. Storage:
1. Store materials in accordance with manufacturer's instructions.
2. Protect sub-purlins from corrosion, deformation, and other damage.
3. Store sub-purlins off ground, with 1 end elevated to provide drainage.

C. Handling: Protect materials during handling and installation from corrosion, deformation, and other damage.

PART 2 PRODUCTS

2.1 MANUFACTURER

A. Roof Hugger, Inc., PO Box 1027, Odessa, Florida 33556. Toll Free Phone (800) 771-1711. Toll Free Fax (877) 202-2254. Phone (813) 909-4424. Fax (813) 909-4511. Website www.roofhugger.com. E-Mail dale@roofhugger.com.

2.2 RETROFIT STEEL SUB-PURLINS

A. Retrofit Sub-Purlins: "Roof Hugger".
   1. Description:
      a. 1-piece, custom-punched, Z-section.
      b. Prepunched to nest into existing rib profiles.
      c. Prepunched for fasteners.
      d. Fastens directly into existing purlins with fasteners.
   2. Material: Galvanized steel, ASTM A 653 or A 1011, G-90, yield strength 50 ksi.

Specifier Notes: Specify gauge. 16 gauge is standard. Consult Roof Hugger for other gauges, including engineering values and lead time.

   3. Thickness: [16] [14] [_____] gauge.

Specifier Notes: Sub-purlins are typically produced 3/8 inch to 1 inch taller than the height of the major ribs of the existing roof panels. Consult Roof Hugger for cost-efficient sizes to meet project requirements if web height other than manufacturer's standard is needed.

   4. Web Height: [_____ inches] [manufacturer's standard].

Specifier Notes: The number of holes provided in the base flange will be greater than or equal to the required number of fasteners to be installed per linear foot. Custom hole punching of the base flange is available upon request. Roof Hugger may punch additional unused holes in the base flange to aid in installation or to minimize conflict with existing fasteners.

B. Base Flange: Prepunch base flange to manufacturer's standard.

C. Fasteners:

Specifier Notes: The following fasteners are typical minimum for attachment of new sub-purlins to existing metal building purlins. Fastener length will vary with thickness of existing insulation. Fastener length of 1-1/4 to 1-1/2 inches is typical.

Attachment of sub-purlins to existing structural steel (i.e. bar joist/structural channels) will require appropriate fasteners. Roof Hugger does not supply fasteners. Consult Roof Hugger for additional information regarding fasteners.

   1. Attachment to Existing Purlins: #12-14 threads per inch, self-drilling, Tek-2.
      a. Length: Required to penetrate existing purlins in accordance with fastener attachment standards.
   2. Sub-Purlins Installed Mid-Span: Expansion-type fasteners, #10-4 Fablock fasteners or equal.

Specifier Notes: Delete Accessories if "Webtherm™" thermal spacer is not required.

2.3 ACCESSORIES

A. Thermal Break: "Webtherm" thermal spacer. 5/8 inch high.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine areas to receive sub-purlins. Notify Architect if areas are not acceptable. Do not begin installation until unacceptable conditions have been corrected.

B. Verify existing purlins and eave struts are in good serviceable condition, without rust-thru of flanges.

C. Field Verify Before Installation of Sub-Purlins:
   1. Existing panel profile and panel rib dimensions.
   2. Existing panel run-out by measuring roof over several 20-foot areas to confirm panels were installed on module and in-square. Note variations.

Specifier Notes: Indicate on the Drawings details of the major and minor rib configurations of the existing roof panels. If the existing roof is standing seam, indicate thickness of thermal blocking, if installed. Roof Hugger existing panel details are available to aid in obtaining this information. Refer to www.roofhugger.com/roof_details.html, details 17, 18, 19, and 20.

3.2 INSTALLATION

Specifier Notes: Consult Roof Hugger for information regarding the installation of sub-purlins for special situations.

A. Install sub-purlins in accordance with manufacturer's instructions at locations indicated on the Drawings.

Specifier Notes: The existing roof is not weathertight until new roof panels are installed over the sub-purlins. Installation of sub-purlins may need to be limited to the amount that can be roofed over each day. Consult Roof Hugger to discuss other options to minimize weather issues.

Edit the following paragraph as required.

B. Limit installation of sub-purlins to amount that can be roofed over each day.

Specifier Notes: Specify number of fasteners (typically less than or equal to the number of holes specified in paragraph 2.2.B) required to be installed per linear foot, as determined by wind load criteria. Typically 2 fasteners per linear foot are required. Refer to Roof Hugger chart for allowable uplift loads. Edge zones and field can be specified separately if desired.

C. Install [1] [2] [3] fasteners per linear foot.

D. Install sub-purlins directly over existing purlins and fasten to existing purlin through existing panel pan section.

Specifier Notes: In high-wind zones, sub-purlins can be attached to existing serviceable roof panels mid-span between existing purlins to add capacity to the new roof panels. (See Engineering Chart) This is typically done in roof edge and corner zones when existing purlin spacing is inadequate. The next three sentences refer to attachment of sub-purlins to existing panels. Delete if not required.

E. Install expansion-type fasteners by field-drilling through sub-purlin and existing roof panel for sub-purlins installed in mid-span.

F. Install 1 expansion-type fastener on each side of main rib for attachment of sub-purlin to existing standing-seam panels.

G. Install 1 expansion-type fastener between main ribs for attachment of sub-purlin to existing screw-down panels for mid-span attachment.

Specifier Notes: Typically, roof fasteners are located adjacent to the major panel ribs. Fasteners located in the center of the existing roof pan can cause sub-purlins to roll or "porpoise". Special punching by Roof Hugger may be possible to minimize the removal of existing roof fasteners located in the center of the existing roof pan. Consult Roof Hugger to review options.

H. Removal of Existing Roof Fasteners:
   1. Do not remove existing roof fasteners unless installation of sub-purlins over fasteners causes sub-purlins to roll or "porpoise". Some distortion of base flange of sub-purlins caused by existing roof fasteners is normal.

Specifier Notes: In colder climates, special attention should be given to flashing the opening created by removal of the existing skylights to minimize migration of warm, moist air into this cavity.

Delete the following paragraph if there are no existing skylights.

I. Existing Skylights:
   1. Install sub-purlins over existing skylights.
   2. Cut out existing skylights after sub-purlins are installed if new skylights are to be installed over existing skylights.
   3. Trim openings as required.

Specifier Notes: Delete the following sentence if "Webtherm™" thermal spacer is not required.

J. Install thermal break in accordance with manufacturer's instructions.

END OF SECTION

Appendix 2J: BASF Certified Test Report

BASF
The Chemical Company

2008 CERTIFIED TEST REPORT

ACCELERATED WEATHERING – 2000HRS

BASF Corporation certifies the test results given below for the Ultra Cool Fluoroceram® and Fluoroceram® coil coatings system when properly applied and baked per BASF specifications.

Product Tested
Fluoroceram®, Fluoroceram® Ultra Cool,

Procedure
Panels were tested for 2000hrs per ASTM G154 using UVA-340 bulb, with 8hr UV followed by 4hr condensation exposure.

Results
2000hrs – Passes adhesion per ASTM D3359, Chalk rating (8) per ASTM D4214, and color change (<5 DE) per ASTM D2244

Average Performance

Adhesion	(ASTM D 3359):	10 no loss of adhesion
Chalk Rating	(ASTM D 4214):	10 no chalking
Color Change	(ASTM D 2244):	1.74 Delta E

Date
April 23, 2008

Approval

Mark Slawikowski
Group Leader
BASF Corporation

BASF Corporation
3000 Continental Drive - North
Mount Olive, N.J. 07828 -1234
Tel: (800) 526-1072
www.basf.com/usa

BASF
The Chemical Company

2008 CERTIFIED TEST REPORT

CYCLIC CORROSION

BASF Corporation certifies the test results given below for the Ultra Cool Fluoroceram® and Fluoroceram® coil coatings system when properly applied and baked per BASF specifications

Product Tested
Fluoroceram®, Fluoroceram® Ultra Cool,

Procedure
Panels were tested in cyclic corrosion per ASTM D5894.

Results
2016hrs – Passes per ASTM D714, ASTM D610 and ASTM D1654.

Average Performance

Blistering	*(ASTM D 714) :*	*10 no blistering*
Rust	*ASTM D 610) :*	*10*
Scribe Creep	*(ASTM D 1654):*	*8*
Edge Creep	*(ASTM D 1654):*	*7*

Date
April 23, 2008

Approval

Mark Slawikowski
Group Leader
BASF Corporation

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BASF
The Chemical Company

2008 CERTIFIED TEST REPORT

MANDREL BEND

BASF Corporation certifies the test results given below for the Ultra Cool Fluoroceram® and Fluoroceram® coil coatings system when properly applied and baked per BASF specifications.

Product Tested
Fluoroceram®, Fluoroceram® Ultra Cool,

Procedure
Panels were prepared and evaluated per ASTM D522. Samples were bent at 180° over a 3/8" and 1/8" mandrel.

Results
No visual cracking.

Average Performance

ASTM D 522: No cracking seen on bend.

Date
April 23, 2008

Approval

Mark Slawikowski
Group Leader
BASF Corporation

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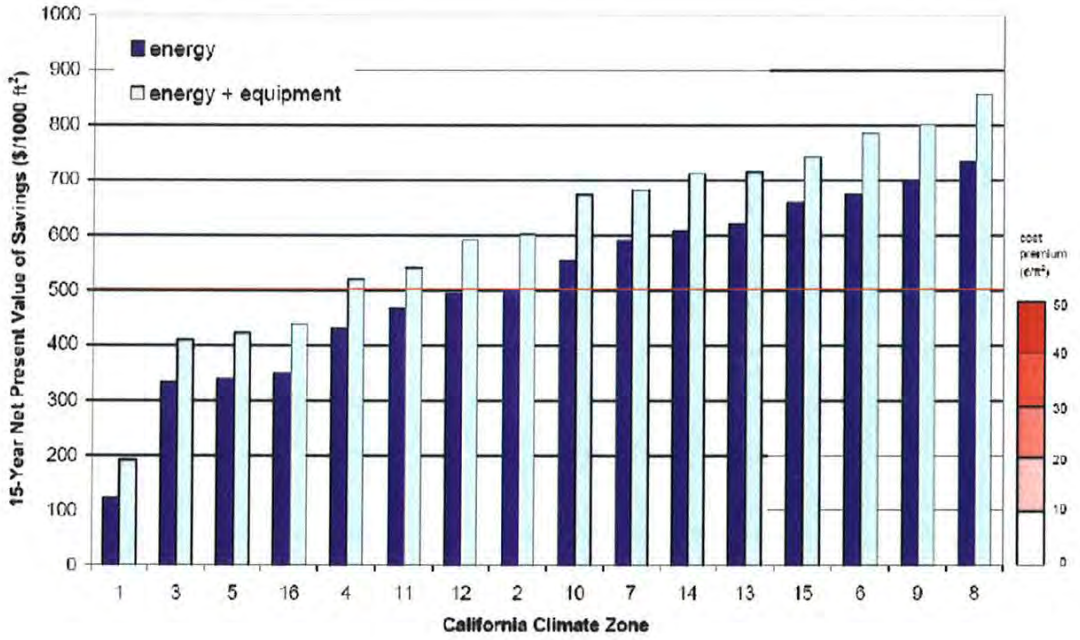
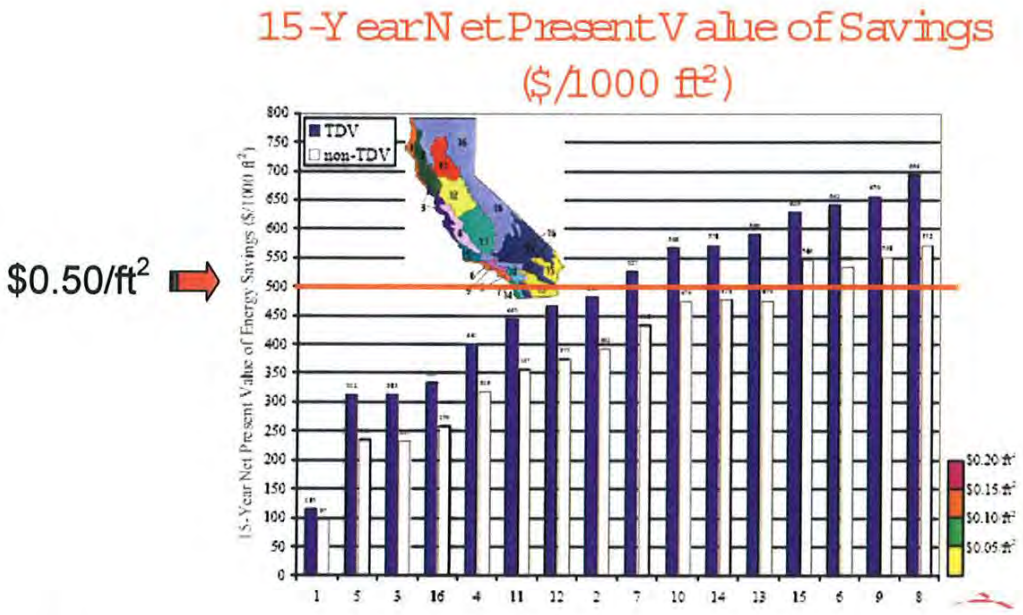
Appendix 2K: Cool Metal Roofing Coalition Report

1. **Cool Roof Prescriptive Requirements for Low Slope Non-Residential** – We are in agreement with the cost effective study that was performed as noted below:



This analysis, that assumed a $0.50/sq. ft. cost premium for cool roofing, indicated that Zones 1, 3, 5, and 16 should be excluded because cool roofing is not cost effective in those zones. Furthermore, Zones 4 and 11 are not cost effective unless the equipment savings are included. Our position is that Zones 1, 3, 4, 5, 11, and 16 should all be excluded from the cool roof requirement. The arguments presented at the May 17 meeting by the CEC that Zones 3 and 5 should not be excluded because cool roofs are required in these zones in the 2005 Title 24, and that there was going to be a tradeoff given in these zones with regard to the prescriptive insulation requirement, are not acceptable. The argument that these zones should be included because they are in 2005 is not consistent with the recent CEC analyses with the most up-to-date cost numbers, as illustrated above. If one looks at the analysis done for the 2005 Title 24, and uses the same cost premium of $0.50/sq. ft, even more zones (2 and 12) should have been excluded as noted below:

(June 13, 2007)



We also do not agree with the policy decision to include equipment costs in the analysis. This is not consistent with the assumptions made for all other roofing types, and it is not a reasonable assumption for alterations—where more efficient equipment will not likely be considered by home and building owners when making decisions on a new roof covering.

With regard to the proposed tradeoff in Zones 3 and 5 with insulation requirements, we are reviewing the recent report on this and are not in a position to evaluate it at this time, but it would be more consistent and reasonable to see the cool roof and insulation prescriptive requirements stand on their own merits, rather than artificially including zones in this manner.

We strongly recommend that the additional climate zones 3, 4, 5, and 11 be excluded from the 2008 cool roof requirements for low slope non-residential.

2. **Above Sheathing Ventilation (ASV)** The Cool Metal Roofing Coalition strongly supports the proposed language in the template submitted by the Metal Construction Association in March 2007. We feel that the cooling benefit from Above Sheathing Ventilation has been scientifically demonstrated and that the CEC has not specifically included the six-year PIER/industry research project results. The CEC's proposed cool roof equivalence for alterations (R=0.85 or greater above roof deck thermal resistance over a vented attic) represents the thermal resistance offered by at least ¾" air space that would be created from roofing products offset mounted. The submitted study by ORNL demonstrated that natural convective airflow occurs with ASV, which is also supported by

(June 13, 2007)

Physics. The research shows that ASV is a viable prescriptive equivalence for cool roofing.

As mentioned above, we appreciate the language that recognizes the energy efficiency benefits of a ¾ inch space above the roof deck for re-roofing, alterations applications. And we strongly recommend that ASV also be applicable to new construction as well as alterations, as proposed in our March 2007 Measure Information Template for ASV. We support the wording as presently included in the proposed 2008 standards and look forward to presenting additional substantiating research results on this topic.

Thank you again for taking the time to incorporate stakeholder input and to work together to reduce California's energy consumption and associated climate change emissions, while allowing the use of roof colors desired throughout California.

Addendum with Editorial Suggestions

The Cool Metal Roofing Coalition continues evaluating all proposed updates to Title 24 and wishes to note several editiorial items that the CEC should consider:

Section 118(i)1 - Exception - Default values for non-CRRC labeled products are not inclusive of all roofing types, such as membrane, metal other than tile. Suggest specifying "asphalt shingles", then "all other roofing" as second category but not listing separately.

Section 118(i)2 - The equation for determining the aged value of reflectance if only the CRRC initial value is known is incorrect. It should be 0.2 + 0.70(rho initial - 0.2). Also, this equation is only valid for nonresidential low-slope roofs, where the prescriptive aged value requirement is 0.55. Appropriate equations will have to be provided for the other roofing categories.

SRI equivalent - Where the equivalent SRI is referenced in several sections (e.g. Section 118(i)3, Section 143(a)1A), this needs to be determined for the aged reflectance to be consistent. As it stands, the equivalent is based on initial properties, which undermines the intent of basing the standard on aged performance.

Suggest replacing "high-sloped" roof with "steep-sloped" roof, where it occurs which is more consistent with conventional terminology and what is used in the building codes. Also, a definition should be added for "steep-sloped" roof that would be a roof that has a ratio of rise to run greater than 2:12.

(June 13, 2007)

Appendix 2L: Return On Investment Calculations

Roof Huggers

New Material Roof Huggers		Comments
Material cost - roof huggers	$29,420.00	
Material cost - fasteners	$1,000.00	
Labor - installation	$9,800.00	Assumption - Roof Hugger installation is !0% of total labor costs
Cleaning & treatment of existing roof	$500.00	

Existing Roof Materials		Comments
Demolition of Existing Roof	$100,000.00	
Disposal of roof debris	$25,000.00	
Cost of Facility Closure	$21,000.00	Assumption - $1000/day lost revenue, 21 day closure
	$146,000.00	

Total Initial Cost	$40,720.00	
Cost savings	$105,280.00	
Return on Investment	3.59	Since all costs are initial costs, return on investment is immediate in this case

Energy Reduction

Ultra-Cool Roof Material combined with air gap created by using two roofs		Conventional Roofing Material		Cost Difference
Material Cost (Ultra-Cool)	$100,00.00	Material Cost (Conventional Material)	$50,000	$50,000.00
		Assumed Power use (Bldg 835)	$12,000	
		Assume Half building power used for cooling	$6,000	

YR	Ultra-Cool Roof Material combined with air gap created by using two roofs - energy cost (cooling from roof heat)	Conventional Roofing Material- energy cost (cooling from roof heat)	Annual difference	Cumulative Cost of improved cooling (negative numbers represent positive r)		
1	$1,800.00	$6,000.00	-$4,200.00	$45,800.00	Difference in Lifetime cost	$229,043.16
2	$1,890.00	$6,300.00	-$4,410.00	$41,390.00	30-year ROI	4.58
3	$1,984.50	$6,615.00	-$4,630.50	$36,759.50	Breakeven occurs in year	10
4	$2,083.73	$6,945.75	-$4,862.03	$31,897.48		
5	$2,187.91	$7,293.04	-$5,105.13	$26,792.35		
6	$2,297.31	$7,657.69	-$5,360.38	$21,431.97		
7	$2,412.17	$8,040.57	-$5,628.40	$15,803.56		
8	$2,532.78	$8,442.60	-$5,909.82	$9,893.74		
9	$2,659.42	$8,864.73	-$6,205.31	$3,688.43		
10	$2,792.39	$9,307.97	-$6,515.58	-$2,827.15		
11	$2,932.01	$9,773.37	-$6,841.36	-$9,668.51		
12	$3,078.61	$10,262.04	-$7,183.43	-$16,851.93		
13	$3,232.54	$10,775.14	-$7,542.60	-$24,394.53		
14	$3,394.17	$11,313.89	-$7,919.73	-$32,314.25		
15	$3,563.88	$11,879.59	-$8,315.71	-$40,629.97		
16	$3,742.07	$12,473.57	-$8,731.50	-$49,361.47		
17	$3,929.17	$13,097.25	-$9,168.07	-$58,529.54		
18	$4,125.63	$13,752.11	-$9,626.48	-$68,156.02		
19	$4,331.91	$14,439.72	-$10,107.80	-$78,263.82		
20	$4,548.51	$15,161.70	-$10,613.19	-$88,877.01		

21	$4,775.94	$15,919.79	-$11,143.85	-$100,020.86
22	$5,014.73	$16,715.78	-$11,701.04	-$111,721.90
23	$5,265.47	$17,551.56	-$12,286.10	-$124,008.00
24	$5,528.74	$18,429.14	-$12,900.40	-$136,908.40
25	$5,805.18	$19,350.60	-$13,545.42	-$150,453.82
26	$6,095.44	$20,318.13	-$14,222.69	-$164,676.51
27	$6,400.21	$21,334.04	-$14,933.83	-$179,610.33
28	$6,720.22	$22,400.74	-$15,680.52	-$195,290.85
29	$7,056.23	$23,520.77	-$16,464.54	-$211,755.39
30	$7,409.04	$24,696.81	-$17,287.77	-$229,043.16
Total	$119,589.93	$398,633.09	-$279,043.16	
Total w/up front costs	$219,589.93	$448,633.09		
Difference in initial investment	$50,000.00			

Composite ROI

Roofing Cost		Conventional Roof Cost		Comments
Equipment	$ 15,000.00	Construction and Materials	$351,570.00	Wheeler AAF programmed replacement schedule, FY07
Materials	$ 129,420.00			
Shipping	$ 15,000.00	Facility Expenses	$ 21,000.00	Estimated cost of closing the facility during construction
Labor	$ 98,000.00			
Overhead/profit	$ 64,355.00	Total Estimate	$372,570.00	
Total Cost	$ 321,775.00			

Net Benefit – Roof removal	$105,280.00
Net Benefit – Energy Reduction	$229,043.16
Total Net Benefits	$334,323.16

Initial Cost of Using New Roofing Technology	$(50,795.00)
Cost/Benefit	0.2
ROI	6.6

Appendix 2M: Photographic Documentation

CERL ROOF INSTALL 835 WHEELER ARMY AIRFIELD
DMWR BOWLING CENTER
CONTRACT # W9132T-06-D-0001

ROOF BEFORE - 03 AUG 08

ROOF AFTER - 17 SEPT 08

Roof Before - 03 Aug 08

ROOF AFTER - 17 SEPT 08

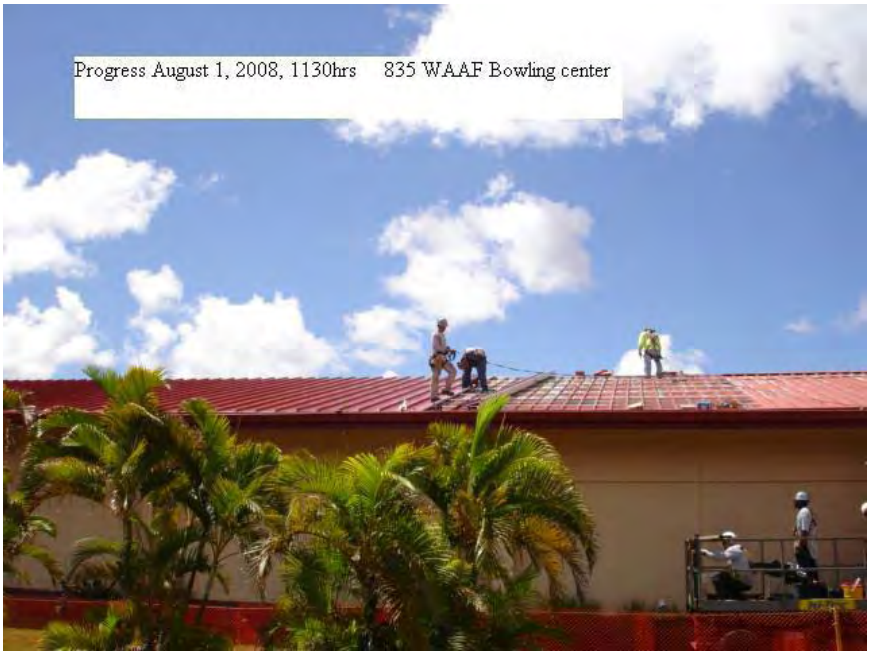
origional roof 835 WAAF July 2008

ROOF BEFORE

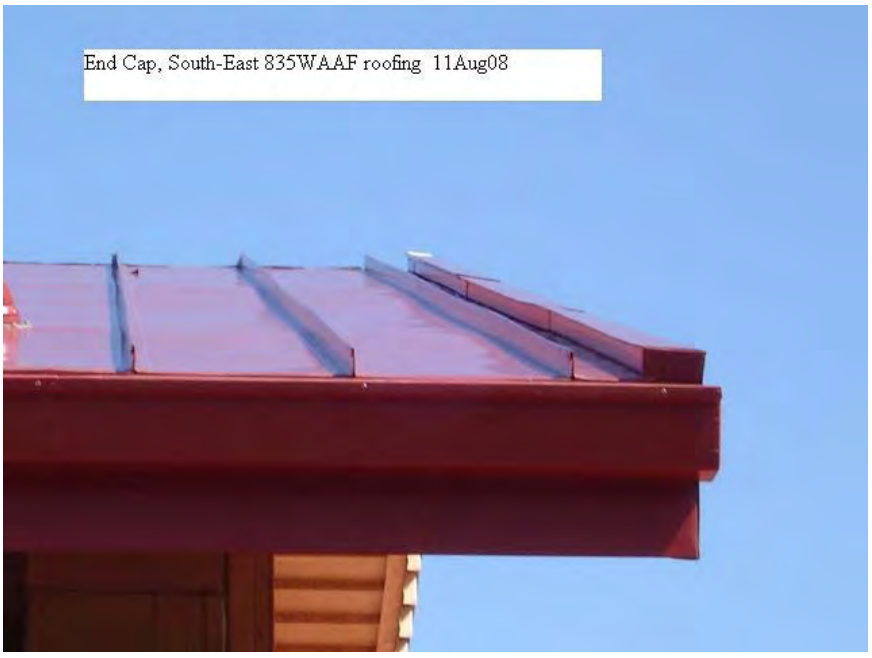
ROOF AFTER - 17 SEPT 08

Roof Installation Sequence


Roof Install, 835 WAAF 30July08 / 1400hrs


Progress August 1, 2008, 1130hrs 835 WAAF Bowling center


11Aug08, S-E 835WAAF


End Cap, South-East 835WAAF roofing 11Aug08


crimp seamer in operation 835WAAF 04Aug08


Completed upper roof end cap 835 WAAF
14Aug08/1545hrs


835 WAAF backside roof transition 02Sept08


backside 835 lower roof 02Sept08

Troop self-help interface: detail, storage add-on, back side.

Project Completion Photos, 17 September 2008

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

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March 2012	Final	

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5b. GRANT NUMBER

5c. PROGRAM ELEMENT NUMBER

6. AUTHOR(S)

David M. Bailey, L.D. Stephenson, Ashok Kumar, Katharine Sweeton, Lawrence Clark, Michael W. Surratt, Karl Palutke, and Alan Meier

5d. PROJECT NUMBER

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Approved for public release; distribution is unlimited.

13. SUPPLEMENTARY NOTES

14. ABSTRACT

The objective of this project was to successfully demonstrate and evaluate two technologies for extending in place the service life of failed metal roofs on two different buildings at Wheeler Army Airfield, which is located in a severely corrosive marine environment. A polyurea-hybrid coating was applied to a leaking corrugated aluminum-panel roof on a barracks building, and a structural standing-seam metal roofing (SSSMR system) with an innovative sub-purlin framing system was used to re-cover a severely corroded metal roof over the Bowling Center.

Because both technologies allowed the existing metal panel roof to remain in place, rehabilitation could be completed more quickly and cost-effectively than a full replacement. The projected return on investment (ROI) for these technologies ranged from 21.6 to 28.7 depending on assumptions. Additional benefits not quantified in the ROI analyses include deferred roof-removal costs; reduced costs for restoring protection of building occupants and interior furnishings; and reduced disruptions of building operations during rehabilitation.

When full replacement of a failed metal roofing system is being considered, Army facility managers should also evaluate the feasibility of using one or both of the demonstrated technologies to reduce roof rehabilitation time and cost burdens.

15. SUBJECT TERMS

Corrosion Prevention and Control Program, roofing, facility management, maintenance and repair (M&R), Wheeler Army Airfield (AAF)

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT	b. ABSTRACT	c. THIS PAGE			19b. TELEPHONE NUMBER *(include area code)*
Unclassified	Unclassified	Unclassified		262	