



Thermographic Investigation Report

Customer: H.I Konzern
24356 Ocean Place Redwood City Ca



Investigation Date: November 31, 2004
Jeff Frishof, President, Level 1 Thermographer

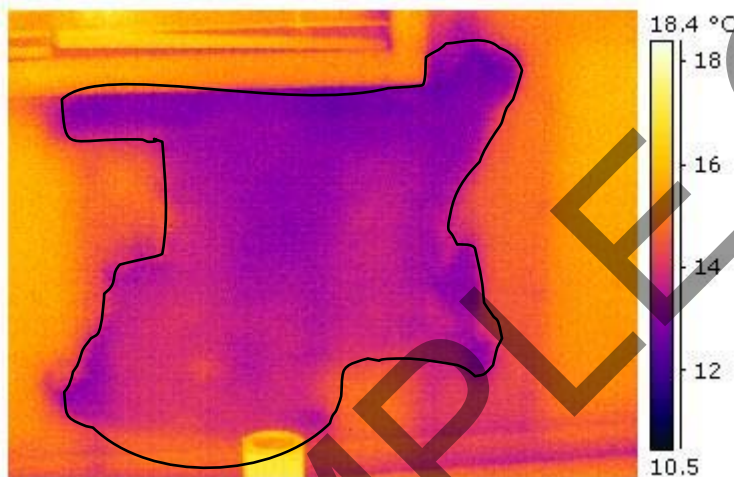
Eagle One Services LLC Po Box 2425 Redwood City, Ca 94064
Phone: 650.365.4778, website: www.ea1services.net

This document is not to be used for disclosure or by anyone not identified by the title page or other signed agreements. Copywrite protected© 1995-2008. All Rights Reserved Eagle One Services LLC 650.365.4778.

Description of Investigations

What is thermal imaging?

Thermographic Investigation for the determination of potential moisture intrusion of the building is a noninvasive investigation using infrared sensing cameras to produce images to describe thermal anomalies within the building envelope. Images may or may not produce enough of a difference to warrant that all sources of moisture have been located. Typical differences in temperature when water is introduced to the building materials and then evaporates ranges by approximately 4°celcius. Winds of approximately 15-20 MPH can also affect the image capabilities and must be considered when viewing exterior surfaces. Imagery produced by this technology will provide the reader with areas of dark and light. Depending on the “palette” or colors used will assist in determination of areas of concern. Coloring when used is for visual improvement only. The temperature scale provided along with the image is designed to determine the temperature of areas in the images.



An example in the image provided to the left would describe an area where the darker portions or cooler temperatures may indicate that moisture has been trapped within the wall cavity below an interior window. Since the wall surface has been exposed to a warmer level of temperature, the water being cooler, demonstrates the differential of temperature. This investigation would then be followed by the use of a moisture sensing meter to verify that a potential area should be opened. For that reason other more destructive testing may be recommended. This would include but not be limited to the use of surface penetrating moisture meters or the drilling of test inspection holes. Additionally, the findings and recommendations of the initial visit may recommend you retain the advice and services of outside contractors. If this

type of recommendation is made in our report, you should hire only licensed, certified or other qualified specialists who will use only approved methods of testing and repairs.

Scope of the Investigations

Scope of our services

The scope of the moisture intrusion investigation will be a non-invasive and visual examination of the readily accessible areas of both/either the exterior or interior areas of the building at those locations discussed in the paragraph below. The investigator will use a FLIR® Systems EX320 thermal imaging camera. Also the investigator may use moisture sensing equipment to verify findings that may be discovered within the images. Specifications such as but not limited to ASTM Standards, E1105ⁱ, E1186ⁱⁱ, C 1153ⁱⁱⁱ or ISO Standard 6781^{iv} or ACI Standards 530^v and 530.1. However, conditions at the site may not be ideal for these standards and adaptation may better suite the investigation. Copies of these standards can be provided for additional fees. This report will include a narrative description of those observations and recommendations as to the next steps that should be taken by the client.

Report Use and Reliance

This report reflects the findings of our observations at the date and time of our visit to the site located at 24356 Oceana in Redwood City, California. Any changes to our findings after the delivery of the originally prepared document will be reflected in an addendum report and will be furnished to all parties named in our signed agreement.

This report is prepared for the exclusive use of the Client solely for its use and reliance in assessing the presence of moisture intrusion and insulation deficiencies in target areas of the site. The Client was/will be the only party to which we will explain the risks and was/will be solely involved in shaping the scope of our services. Accordingly, reliance on this report by any other party may involve assumptions leading to and unintended interpretation of our findings and opinions. With the consent of the Client, we may offer reliance to third parties or contract with other parties to develop findings and opinions related to such party's unique risk management concerns. Notwithstanding the foregoing, any and all third party reliance upon this Report shall be limited in the aggregate to the fair market value of the services undertaken to perform this investigation on the date and time of the report delivered.

Concerns raised by the client

Eagle One Services LLC has been contacted by the client to investigate potential areas where moisture has been trapped within the exterior wall causing damage to related window and door trim.

Site Descriptions

Weather

At the time of our investigation the weather conditions were, partly cloudy. Precipitation in the form of moderate rain had been present in the previous 24-48 hours. The humidity of the exterior was approximately 48%. Exterior temperature was approximately 12° Celsius and interior temperature was approximately 22° Celsius.

Material composition

The materials installed at the exterior area investigated consisted of stucco cladding with wood trim around the perimeters of the windows and garage door.

Investigation

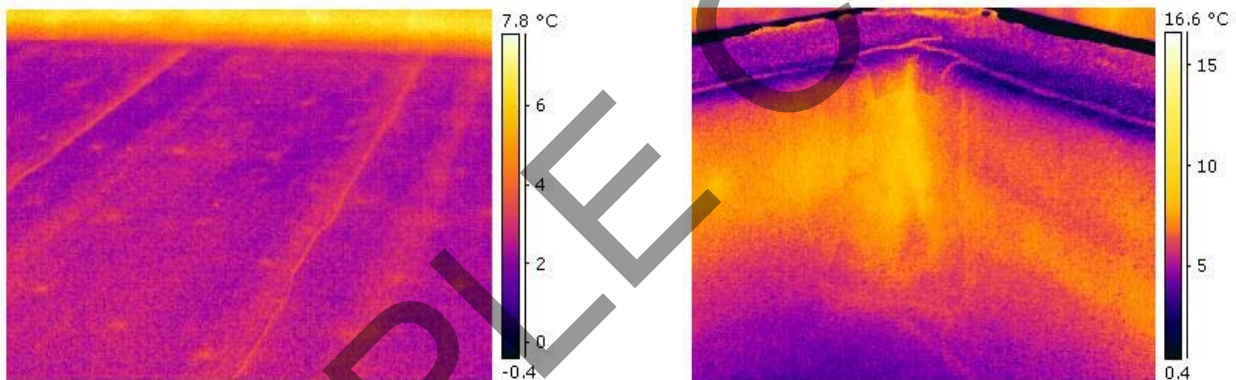
1.1 The investigation began at approximately 16:30 on the afternoon of November 31. The investigator examined the wall cladding and trim above the garage vehicle door for signs of cracking and moisture damage. It was observed that water was exiting from the trim around the vehicle door at the area identified by a **red** arrow in the photo to the left.

1.2 Investigation of the stucco above this area revealed no signs of visible cracking that could be associated with moisture entry. The trim around all three windows was examined and the materials were discovered to be soft to the touch, common with extensive exposure to moisture.

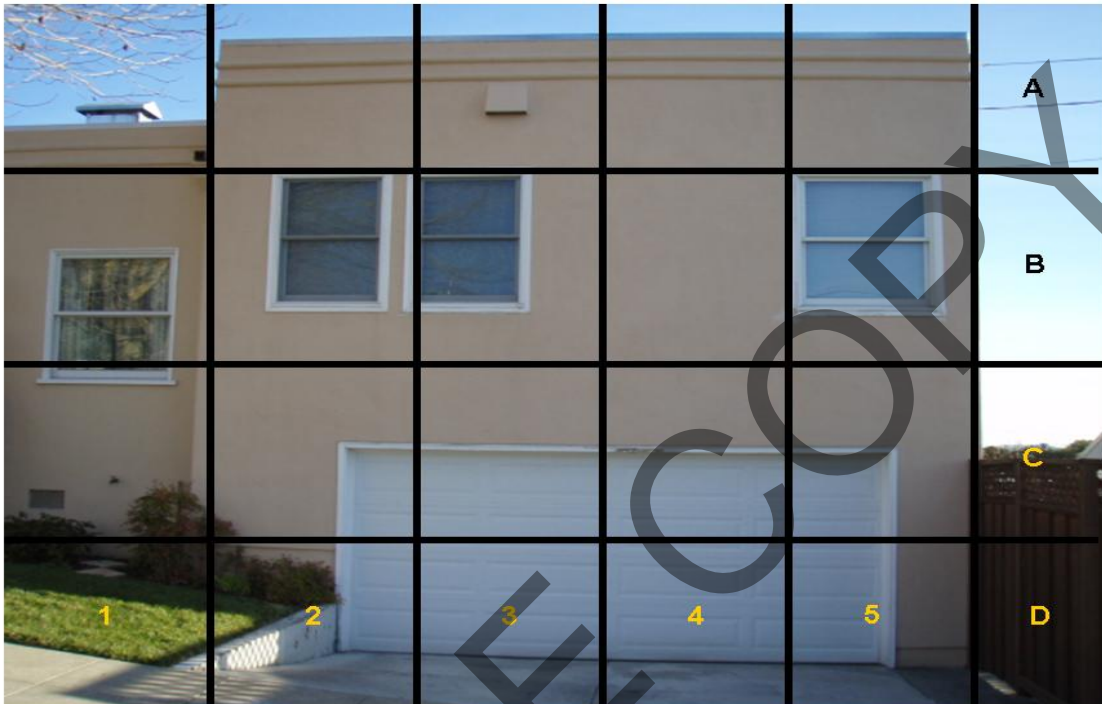


1.3 Observations were made of the interior side of the garage above the vehicle door opening to inspect the wall sheathing for signs of active moisture entry to the wall system. Stains were present along the area above the header and the inspector used a non invasive moisture sensing device (Tramex Surface test) to test the materials for moisture content. At the areas tested near the center of the header beam, moisture readings were between 14-22%. Generally this would be considered as above the standard for the climate involved of readings between 9-15%.

1.4 It was then decided that the roof area above this location should be inspected for any signs of tears, holes, or other reasons for moisture to enter the wall system in this area. With access to the roof, the material in our opinion has been installed within the past 1-2 years and was a membrane material single ply or modified bitumen installation overlapped approximately 3 inches and sealed with oil at all locations. Thermal images taken of this area does not reveal any areas of concern at this time.

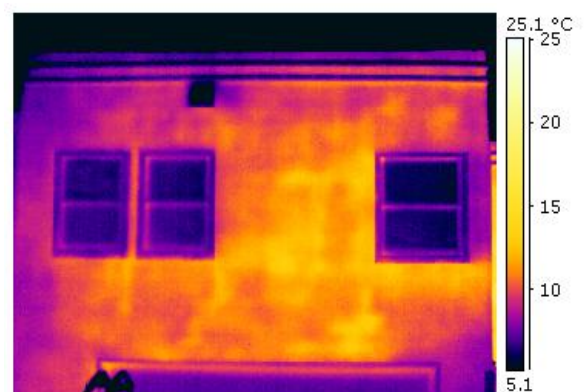


1.5 The images above are of the overall surface material installed on the low slope roof systems (left image) and of coverage of the parapet wall (right image). Any lighter portions of the image are a result of solar loading of the materials and not of any concern at this time. With this type of material and roof installation, it is important that the homeowner retain a qualified roofing contractor to inspect all seams periodically for needed repairs. Our recommendation would be minimally inspect the surface materials every 3-5 years in the first 10 years and yearly thereafter. Drainage which is through the parapet walls and exits into scupper and downspouts should be cleared of debris prior to the local rain season and inspected monthly through the rain season.

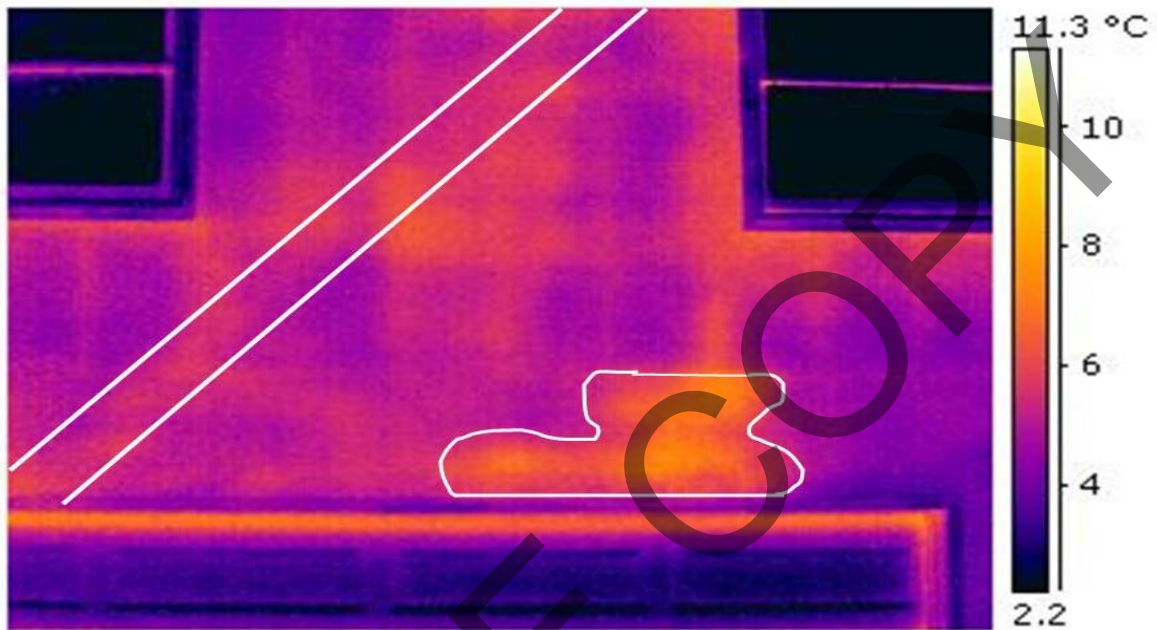


Post Sunset

2.1 Once the sun had set the inspection was begun using thermal imaging to investigate the area above the garage vehicle entry door to observe for potential pockets that could allow moisture to collect behind the cladding. In the following thermal images refer to the site map above for location identification.

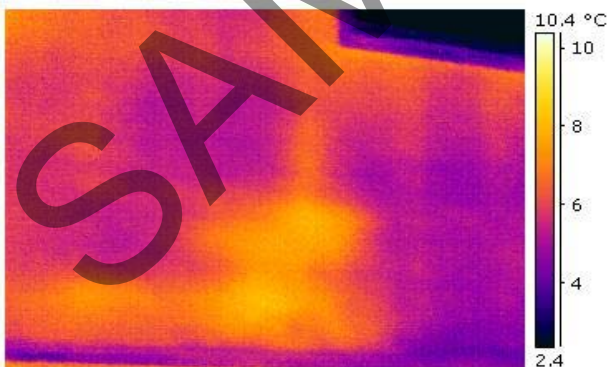


Initially imaging in the above left image of areas **A1** and **B1** would indicate no evidence of areas of concern. This image was taken at approximately 16:45. The image on the right is of the full area above the garage vehicle door which was taken at approximately 17:00 and areas identified as **B-3&4** and **C-3&4** as identified on the exterior map photo do indicate areas of concern.



2.2 The infrared image above which was taken at approximately 18:00, diagrams an area as identified by the two straight white lines that in the opinion of the inspector indicates a cross brace within the wall. The cross brace which is a standard timber and would be of denser materials would be less likely to dissipate heat easily. For this reason it would tend to conduct a higher level of temperature to the exterior wall cladding. This is the same cause for the lighter regularly shaped vertical areas in the image as well. It would be possible for moisture to travel this diagonal timber. This could only be verified by destructive testing.

2.3 In the same image above in location **C-4** as identified on the exterior map photo, the irregular pattern in our opinion is an area that exhibits an elevated level of infrared energy. Either an air pocket or moisture trapped behind the stucco could easily cause this unusual pattern.



The image to the left is close up of area **C-4** in which the irregular pattern is more observable.

Interior

3.1 Inspection of the interior related to this part of the structure was made from bedroom areas located directly above the garage.



3.2 The image at the left is taken from the interior of the right bedroom if viewed from the exterior of the home. This is behind the area identified as A-5 on the exterior map photo and is just above the window. Although the darker shading would indicate cooler surface temperature, verification with a surface moisture meter did not indicate elevated levels of moisture. Lack of insulation or some form of void connecting to the attic may be a possible cause.



3.3 The image at the right is taken from the left bedroom if viewed from the exterior and identified as A-3 on the exterior map photo. This cooler or darker area is associated with a vent on the exterior. See the digital image of the exterior. Since this would vent the cavity between the interior ceiling and roof deck, no concern is to be raised by this image.

Summaries and Recommendations

4.1 Visual inspection of the exterior wall cladding and window installation above the garage vehicle door discovered moisture draining from the trim above the door in area C-4 as identified on the exterior map photo. Block trim around the window locations at B-2, B-3 and B-5, as identified on the exterior map photo, discovered softness in the wood materials and when a Delmhorst BD-10 penetrating moisture meter was employed, readings in excess of 25% were observed. Readings of this level indicate an unacceptable level of moisture. Investigation of the stucco materials discovered no cracking that could be associated with the entry of water to the wall system.



4.2 Our recommendation would be first to remove the window block trim boards and inspect the attachment and flashing detail of the installation. It is our belief that damage has occurred at the attachment flange or the installation of window flashing or that the flashings were not sealed/installed in accordance with accepted trade/code standards.

4.3 **Recommended Method.** The following is a method commonly used. Install self-adhered membrane sill flashing pans at both flanged and non-flanged windows, complete with interior upturned legs and permanently watertight end dams. Do not penetrate the horizontal surface of the sill pan and do not use sealants to form the end dams. Install continuous metal angles along the rough opening to serve as backing for membrane strip flashing and as attachment for non-flanged windows. At the jambs, turn the strip flashing into the rough opening and extend to the tip of the angle; shingle jamb flashing into the sill flashing pan.

Install metal head flashings with integral flashing flanges at both flanged and non-flanged windows. Head flashings are of particular importance over ganged windows. The flashing flanges must extend over the weather resistant barrier or WRB at window head corners to prevent water on the head flashing from draining behind the WRB.

4.4 Upon the removal of the block trim the WRB should be investigated to determine if liquid water is being transferred behind the barrier materials. It is also our recommendation that the area in area C-4 as identified on the exterior map photo should have a test opening of approximately 12" x 12" be created to discover if as suspected, liquid water is draining into this area from the window components and repairs dependent upon those findings should follow accepted trade/code standards.

4.5 Upon completion of the repairs, testing such as the ASTM E1105¹ should be considered to verify that all areas associated with the liquid water intrusion have been correctly repaired.

Possible Additional Contacts

Below is a local company which the client may contact with regard to making further investigation visits and repairs. Eagle One Services by furnishing these names is not endorsing any one contractor, contractor company or individual. As with any repair or remodeling project, it is recommended that you verify the company's qualifications such as State Required Licensing or Certification and necessary Liability or Workmen's Compensation Insurance necessary to comply with the requirements of the state in which the repairs are to be made.



References

1. ⁱ ASTM Standard E1105, Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors and Curtain Walls. American Society for Testing and Materials, 1000 Bar Harbor Dr. W. Conshohocken, Pa 19428
2. ASTM Standard E 1186, Standard Practices for Air Leakage Site Detection in Buildings
3. ⁱⁱⁱ ASTM Standard C 1153, Standard Practice for the Location of Wet Insulation in Roofing Systems Using Infrared Imaging.
4. ISO Standard 6781 Thermal Insulation-Qualitative Detection of Thermal Irregularities in Building Envelopes-Infrared Method. American National Standards Institute, 11 West 42nd St. New York City, NY 10036
5. ACI 530 and ACI 530.1, Design Standard and Specifications, American Concrete Institute.

SAMPLE COPY