APPENDIX T
ROOF INSPECTION FORMS AND PROCEDURES

SECTION T.1 – THE ROOF INSPECTOR

The minimum qualifications below serve as criteria for the University when selecting a third-party outside, full-time roofing inspector:

T.1.1 Inspector Knowledge and Background

The Inspector should have a thorough knowledge of roofing details, flashing, and systems employing single-ply, built-up, metal, shingle, slate, or other membranes as the main weatherproof barrier.

T.1.2 Roofing Specific Continuing Education Requirements

The Inspector should have attended at least three formal schools / seminars (for example: AIA, BURSI, RCI, CSI, NRCA or RIEI seminars) providing no less than a total of four (4) continuing education units, have a registered roof observer registration from RCI (or a Quality Assurance Observer Certificate from RIEI for the roof system to be observed) or have equivalent training as approved by the University.

T.1.3 NRCA Roofing and Waterproofing Manual

The Inspector should be thoroughly familiar with the NRCA Roofing & Waterproofing Manual, latest edition.

T.1.4 Inspector Experience

The Inspector should have a minimum of five years of full-time, practical roofing experience or approved equivalent experience.

T.1.5 Project Experience and References

The Inspector should identify, in writing, at least three projects where he/she has been the full-time roofing inspector. The Inspector should provide names, addresses, and telephone numbers of roof owners and A/Es for the roof projects.

T.1.6 Training and Competency

The Inspector should be trained and competent in the services he/she is providing.

T.1.7 Roof Inspector's Scope of Work

Roof Inspector's Scope of Work shall include the following:

T.1.7.1 The Inspector shall monitor the work continuously during installation of the roof.

T.1.7.2 The Inspector shall monitor the work for compliance with the contract documents and the W&M Technical Standards.

T.1.7.3 The Inspector shall immediately report any deviations from the contract documents, the University's Policy, or good roofing practice to the Architect and University. A written report shall follow an oral report.

T.1.7.4 The Inspector may recommend suspension of work or rejection of non-complying work to the A/E and University.

T.1.7.5 The Inspector shall not:

T.1.7.5.1 - Allow roofing materials to be installed until the manufacturer's certification that the roofing materials comply with specified ASTM or other approved standards are received. The Inspector shall notify the University so that appropriate action can be taken.

T.1.7.5.2 - Authorize deviations from the contract documents.

T.1.7.5.3 - Enter the area of responsibility of the Contractor's superintendent.

T.1.7.5.4 - Issue orders on any aspect of construction means, methods, techniques, sequences, procedures, or safety in connection with the work.

T.1.7.5.5 - The Inspector shall keep a daily log (refer to the form at end of this appendix) for each project and shall give a copy of the log to the roofing Contractor. The Inspector shall record all pertinent information such as weather, daily progress, workers on the job, material storage, deck condition, bitumen temperature, installation procedures, quality of workmanship, job-related visitors, and so forth.

SECTION T.2 – THE ROOF CONSULTANT

The Consultant should have the following qualifications:

T.2.1 Full-Time Occupation Requirement

Roof consulting and testing services should be the Consultant's full-time occupation.

T.2.2 Required Experience

The Consultant should have a minimum of five years of field experience in providing the service.

T.2.3 Service Project Experience

The Consultant should have completed at least three service contracts in the recent past. Work for each of the completed contracts should be roughly equivalent in size and complexity to the proposed work.

T.2.4 Surveys of Repaired Roofs

The Consultant should be required to submit three complete surveys of roofs that were repaired, recovered, or replaced; names, addresses and telephone numbers of roof owners; and A/Es responsible for preparing the drawings and specifications.

T.2.5 Roofing Specific Continuing Education Requirements

The Consultant should have attended at least three formal roofing schools / seminars (RIEI, BURSI, RCI, NRCA, AIA, CSI Seminars, for example). The seminars should be the type that gives CEU (Continuing Education Unit) credits. A minimum total of four (4) CEU credits should have been received.

T.2.6 Training and Competency

The Consultant should be trained, experienced and competent in performing required services.

T.2.7 Training for Testing Procedures

If testing is required, the Consultant shall be appropriately trained, certified, licensed in the testing procedures (infrared, nuclear, electrical capacitance surveys; core sampling; ASTM procedures; gravimetric analysis; and so forth) required for the service.

T.2.8 Employee Backgrounds and Resumes

The Consultant should submit resumes of his firm and all employees participating in the service.

T.2.8.1 The Consultant's resume should describe other related services and contributions, such as writing, lecturing, and serving as an expert witness that he has provided. He should list any professional qualifications or licenses.

T.2.8.2 The resume form must be submitted with the roof Consultant's response to the University's RFP. It will be used with other requested items to evaluate the applicant.

SECTION T.3 – NON-DESTRUCTIVE (NDE) ROOFING SURVEYS

A non-destructive (NDE) Survey uses infrared or nuclear and electric capacitance moisture detection equipment to locate unacceptable moisture within a roofing system. An infrared or nuclear survey may be used alone; electric capacitance is acceptable only if it is issued with infrared or nuclear surveys.

An NDE survey is mandatory before a newly constructed roof may be accepted. Depending on the size and condition of an existing roof, a survey may or may not be required before an Agency may repair or replace the roof. The following outlines requirements for NDE surveys:

T.3.1 Equipment Requirements

Equipment, subject to the University's approval, shall be equal to the following:

T.3.1.1 Infrared: A camera designed for the intended application and capable of taking thermograms. Instrument sensitivity shall permit recognition of areas of wet insulation as small as 6 inches on a side.

T.3.1.2 Nuclear: A nuclear hydrogen detection (NHD) meter used for the measurements of reflected neutrons that can be linked to the presence of water in the roofing system

T.3.1.3 Impedance Moisture Survey: Scanner designed to detect and evaluate non-destructively comparative moisture conditions within roofing and waterproofing.

T.3.1.4 Electronic Field Vector Mapping (EFVM) or Electronic Leak Detection: Generator and receiver designed for the intended membrane leak detection used for roofing and waterproofing.

T.3.2 Operators of equipment shall be certified in the equipment used and licensed as required for by the survey protocol.

T.3.3 Surveys

Requirements for surveying are as follows:

T.3.3.1 Infrared: Provide a complete survey of the roof or roofs. Outline all anomalies on the roof. Provide a thermogram showing the outlines and daylight photographs of all anomalies. Survey inspection procedures, reports, etc. shall be conducted in accordance with the requirements and procedures in ASTM C1153, "Standard Practice for Location of Wet Insulation in Roofing Systems Using Infrared Imaging," except as otherwise noted in this Appendix.

T.3.3.2 Nuclear: Provide a grid, comprising 5' x 5' grid unit, to completely cover the roof or roofs. Mark each grid intersection with spray paint. Take readings at the inter-sections and record them on a roof plan. Provide daylight photographs of area of anomalies. Survey inspection procedure, reports, etc. shall be conducted in accordance with the requirements and procedures of ANSI/SPRI/RCI NT-1, "Detection and Location of Latent Moisture in Building Systems by Nuclear Radioisotopic Thermalization" except as otherwise noted in this Appendix.

T.3.3.3 Impedance Moisture Survey: Provide a complete survey of all roof or waterproofing areas. Mark, number, and photograph all anomalies on the membrane surface. After field testing is complete submit a report with all anomalies located on a roof plan. Photographs of each anomaly shall be included in the report. Mapping shall be done in accordance with standard practices over the entire roof surface. Survey inspection procedures, reports, etc. shall be conducted in accordance with the requirements and procedures of ASTM D7954, "Practice for Moisture Surveying of Roofing and Waterproofing Systems using Non-destructive, Electrical Impedance Scan" except as otherwise noted in this Appendix.

T.3.3.4 Special Surveys using electrical conductance measurement methods to locate leaks in roofing systems - Electronic Leak Detection or Electronic Field Vector Mapping (EFVM): This system may be used on roof areas where full time roof inspector has noted that there is no detrimental moisture observed in the roof system during the daily observations. Provide a complete survey of roof or waterproofing areas as directed. Mark, number, and photograph all anomalies on the membrane surface. After field testing is complete submit a report with all anomalies located on a roof plan. Photographs of each anomaly shall be included in the report. Survey inspection procedures, reports, etc. shall be conducted in accordance with the requirements and procedures of ASTM D7877 "Standard Guide for Electronic Leak Detection methods for Detecting and Locating Leaks in Waterproof Membranes" except as otherwise noted in this Appendix. Roof cores shall be taken at all leaks to determine the extent of damage by the leak if roof insulation is below the roof membrane and above the deck. Roof cores may be omitted if the roof inspector is to be present to observe the roof Contractor's repair of the roof leak by opening roof and removing wet insulation. Wet insulation is determined in the field by the roof inspector. Fees for the roof inspector and retesting shall be paid by the Contractor by change order to the contract. Note: for Electronic Leak Detection test the roof area on an area by area basis not to exceed 5,000 SF. Readings taken with the receiver shall be done on a 24" x 24" grid pattern.

T.3.4 Core Samples

Since NDE surveys are not able to measure moisture in roofs directly - nuclear equipment responds to hydrogen emissions, infrared to heat changes - core samples to measure actual moisture content must be taken from

surveyed roofs and correlated with NDE readings (See Exception below for roofs with no anomalies). The samples shall be taken as follows:

T.3.4.1 One is required on roofs showing no anomalies.

T.3.4.2 On all other roofs a minimum of one dry and one wet core shall be taken from each roof surveyed where anomalies are present. Additional cores are not required if the Consultant can show that moisture is not causing detected anomalies. The Consultant shall identify such anomalies and explain their cause in a written report to the Owner.

T.3.4.3 As many cores as needed should be taken to verify non-destructive testing data results, but no more than five cores shall be taken from any roof area except as noted in the test protocol.

T.3.4.4 Exception: If no anomalies are shown by the survey equipment and the owner's full time roof inspector was present on the site during all roofing applications and had not noted any roofing applications where moisture was present in the form of rain, dew, mist or entrapped moisture the requirement for a minimum of one roof core into a newly installed assembly may be waived by the owner.

T.3.5 Gravimetric Analysis

As soon as possible after samples are taken, core should be sealed in air tight containers and taken to a laboratory for analysis.

T.3.5.1 Analyze samples gravimetrically per ASTM D1864 to determine percent of moisture in any required core sample taken from new roofs and, unless waived for justifiable reasons, from existing roofs.

T.3.5.2 Identify all materials - surfacing, membrane (and number of plies), insulation, vapor barriers, adhesives, etc. - in the cores.

T.3.6 Moisture Conditions

The Surveyor shall correlate survey reading results with actual moisture conditions determined by core samples gravimetrically analyzed. The correlation shall be shown or tabulated on the drawings.

T.3.7 Report

The Consultant shall submit a written report explaining the problems.

T.3.7.1 Reports for existing roofs shall

- Identify and describe all anomalies.
- Identify and describe any visual survey defects that may be harmful to the roof.
- Give the causes for each anomaly and defect.
- Recommend alternates for corrective action for defects and anomalies harmful to the roof.
- Provide the cost estimate for correcting the defects and anomalies.

T.3.7.2 Reports for new roofs where a design professional provides construction administration services shall:

- Identify and describe all anomalies.
- Identify and describe any visual survey defects that may be harmful to the roof.
- Give the causes for each anomaly and defect.

T.3.8 Drawings

The Consultant shall prepare drawings that include the following as a minimum:

T.3.8.1 Plans shall show all roofs surveyed.

T.3.8.2 State identification, title, date, and use of the building.

T.3.8.3 Name, address and phone number of agency representative.

T.3.8.4 Make, model and serial number of equipment used.

T.3.8.5 Name of operator and data analyst.

T.3.8.6 The survey technique used.

T.3.8.7 Condition of the roof surface at the time of the survey.

T.3.8.8 Date, time and weather conditions at the time of the survey.

T.3.8.9 Description of the roofing and waterproofing assembly.

T.3.8.10 Provide an orientation north arrow and drawing scale

T.3.8.11 Indicate the area of each roof and approximate overall dimensions.

T.3.8.12 Indicate all existing features, equipment, and roof penetrations of whatever nature (such as vents, stacks, drains, hatches, skylights, screens, railings, mechanical equipment, etc.) shall be accurately indicated and identified.

T.3.8.13 Show and explain all roofing defects and anomalies.

T.3.8.14 Delineate, for an infrared survey, moisture anomalies with contour lines; for a nuclear survey, show all grid point readings and define areas having unacceptable moisture by contour lines. Indicate where core samples were taken. Correlate nuclear grid point readings and infrared contour changes to percent of moisture. Dimension areas recommended for removal and locate them with respect to fixed identify-able features (such as parapets).

T.3.8.15 Provide at least one detail section showing roof construction where core samples were taken; more if there are differences in construction from core to core. Identify surfacing material, membrane product, insulation type and thickness, vapor barrier if used, and deck construction.

T.3.8.16 A statement shall be made of the basis for the unacceptable moisture content levels

established for each material present. See survey protocols.

T.3.8.17 Other information as required or listed in the survey protocol.

SECTION T.4 – ROOFING FORMS

Standard DGS forms and formats are available for download from the DGS Forms Center.

FORM NUMBER	DESCRIPTION	FILE TYPE
DGS-30-328	Roofing – Installation History	Word
DGS-30-332	Roofing – Built-Up Roofing Data	Word
DGS-30-336	Roofing – Metal Roofing Data	Word
DGS-30-340	Roofing – Shingle Roofing Data	Word
DGS-30-344	Roofing – Single Ply Roofing Data	Word
DGS-30-348	Roofing – Inspection Checklist	Word
DGS-30-352	Roofing – Daily Inspection Log	Word
DGS-30-356	Roofing Consultant / Inspector Resume	Word

To view / download the latest version of a form, visit the website listed above and enter the Form Number (e.g., “DGS-30-328”) in the search box on the Forms Center.