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PART 1 GENERAL

1.1 SYSTEM DESCRIPTION

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NOTE: This guide specification is not intended to limit the inspection and acceptance process to the use of Predictive Testing & Inspection (PT&I) techniques. This guide is intended to supplement comprehensive and detailed commissioning and quality control specifications.

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This guide specification establishes acceptance requirements to ensure building envelope systems installed by the Contractor have been installed properly and contain no identifiable defects that waste energy or will shorten the useable design life of the facility, including facility wall and opening systems, (windows, doors, hatches, etc.) as well as facility roofing systems. These requirements utilize Predictive Testing & Inspection (PT&I) technologies and are essential elements in the Government's Reliability Centered Building and Equipment Acceptance Program.

1.2 REFERENCES

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NOTE: This paragraph is used to list the publications cited in the text of the guide specification. The publications are referred to in the text by basic designation only and listed in this paragraph by organization, designation, date, and title.

Use the Reference Wizard's Check Reference feature when you add a RID outside of the Section's Reference Article to automatically place the reference in the Reference Article. Also use the Reference Wizard's Check Reference feature to update the issue dates.

References not used in the text will automatically be deleted from this section of the project specification when you choose to reconcile references in the publish print process.

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The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION (NASA)

RCBEA GUIDE

(2004) NASA Reliability Centered Building and Equipment Acceptance Guide

1.3 SUBMITTALS

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NOTE: Review Submittal Description (SD) definitions in Section 01 33 00 SUBMITTAL PROCEDURES and edit the following list to reflect only the submittals required for the project.

The Guide Specification technical editors have designated those items that require Government approval, due to their complexity or criticality, with a "G." Generally, other submittal items can be reviewed by the Contractor's Quality Control System. Only add a "G" to an item, if the submittal is sufficiently important or complex in context of the project.

For submittals requiring Government approval on Army projects, a code of up to three characters within the submittal tags may be used following the "G" designation to indicate the approving authority. Codes for Army projects using the Resident Management System (RMS) are: "AE" for Architect-Engineer; "DO" for District Office (Engineering Division or other organization in the District Office); "AO" for Area Office; "RO" for Resident Office; and "PO" for Project Office. Codes following the "G" typically are not used for Navy, Air Force, and NASA projects.

Choose the first bracketed item for Navy, Air Force and NASA projects, or choose the second bracketed item for Army projects.

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Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for [Contractor Quality Control approval.] [information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

#### SD-01 Preconstruction Submittals

Material, Equipment, and Fixture Lists[; G][; G, [\_\_\_\_]]

Quality Control Plan[; G][; G, [\_\_\_\_]]

#### SD-02 Shop Drawings

Fabrication Drawings[; G][; G, [\_\_\_\_]]

Layout Drawings[; G][; G, [\_\_\_\_]]

#### SD-03 Product Data

Manufacturer's Catalog Data[; G][; G, [\_\_\_\_]]

Specific Equipment Data[; G][; G, [\_\_\_\_]]

Spare Parts List[; G][; G, [\_\_\_\_]]

Warranty[; G][; G, [\_\_\_\_\_]]

#### SD-04 Samples

Samples[; G][; G, [\_\_\_\_\_]]

#### SD-06 Test Reports

Infrared Thermography Test[; G][; G, [\_\_\_\_\_]]

Ultrasonic (Airborne) Test[; G][; G, [\_\_\_\_\_]]

Visual Inspection[; G][; G, [\_\_\_\_\_]]

#### SD-07 Certificates

Certificates[; G][; G, [\_\_\_\_\_]]

#### SD-08 Manufacturer's Instructions

Manufacturer's Instructions[; G][; G, [\_\_\_\_\_]]

#### SD-10 Operation and Maintenance Data

Operations and Maintenance Manuals[; G][; G, [\_\_\_\_\_]]

#### SD-11 Closeout Submittals

Acceptance Documentation[; G][; G, [\_\_\_\_\_]]

Baseline Data Report[; G][; G, [\_\_\_\_\_]]

### 1.4 QUALITY ASSURANCE

Submit a Quality Control plan outlining the intended methods of receiving, testing, and installing equipment and structural components. The **RCBEA GUIDE** specifies minimum test equipment requirements. Use trained, certified personnel in the application of appropriate acceptance testing PT&I technologies to ensure that the results are accurate and consistent. Submit the following as part of the **quality control plan** for all required acceptance testing:

- a. List of all test equipment used, including its manufacturer, model number, calibration date, certificate of calibration, and serial number.
- b. Certificates of test personnel qualifications and certifications.

### 1.5 WARRANTY

Furnish workmanship and performance **warranty** for the work performed for a period not less than [1][\_\_\_\_\_] year[s] from the date of Government acceptance of the work; issued directly to the Government. Perform corrective action that becomes necessary because of defective materials and workmanship while system is under warranty within [7][\_\_\_\_\_] days after notification, unless additional time is approved by the Contracting Officer. Failure to perform repairs within the specified period of time constitutes grounds for having the corrective action and repairs performed by others and the cost billed to the Contractor. Provide a [1][\_\_\_\_\_] year minimum contractor installation warranty.

## PART 2 PRODUCTS

### 2.1 PRODUCT DATA

Submit [material, equipment, and fixture lists](#) for all equipment, structural components, materials, and fixtures planned for use to complete the job before commencing work. Include at a minimum, the item's description, quantity, manufacturer's style or catalog numbers, and specification and drawing reference numbers. Provide a complete list of construction equipment to be used.

Provide product [samples](#) for roof, wall, and insulation system components, at a minimum include roof membrane materials, underlayment, flashing, insulation, roof and wall penetrations, fasteners, and finish color swatches for Contracting Officer approval prior to commencing work or ordering materials. Size samples to clearly illustrate product features and characteristics.

#### 2.1.1 Manufacturer's Product Data

Include manufacturer's standard catalog data, at least [5 weeks] [\_\_\_\_\_] prior to the purchase or installation of a particular component, highlighted to show material, size, options, equipment performance data charts and curves, etc. in adequate detail to demonstrate compliance with contract requirements. Include manufacturer's recommended installation instructions and procedures. [ If vibration isolation is specified for a unit, include vibration isolator literature containing catalog cuts and certification that the isolation characteristics of the isolators provided meet the manufacturer's recommendations.] Submit for each specified component.

Submit [fabrication drawings](#) for equipment and structural components consisting of fabrication and assembly details to be performed in the factory.

Submit [manufacturer's catalog data](#) (as applicable) for the following equipment and structural components:

- a. Roofs, Walls, and Insulation
- b. Automated Openings Operation and Closure
- c. Sound Attenuation Systems
- d. Acoustical Performance
- e. Facility Air Quality Evaluation

#### 2.1.2 Certification Data

Submit applicable [certificates](#) for the equipment and structural components listed below showing conformance with test requirements, laboratory certifications, etc. as instructed by the project specification.

- a. Roofs, Walls, and Insulation
- b. Acoustical Performance

- c. Facility Air Quality Evaluation
- d. Openings (infiltration, energy transmission)

#### 2.1.1.3 Specific Equipment Data

Submit the following information for all equipment and structural components listed below: location of installation, [AIR FORCE ARMY NASA NAVY](#) Identification number, date of installation (required or actual acceptance date), and applicable [AIR FORCE ARMY NASA NAVY](#) reference drawing number. Unless explicitly stated in submitted manufacturer's literature, provide and submit the following [specific equipment data](#):

- a. Roofs, Walls, and Insulation
  - (1) Type of roofing system and insulation system installed (type)
- b. Acoustical Performance
  - (1) Finishes Rating (type)
  - (2) Volume levels tested
- c. Facility Air Quality Evaluation
  - (1) Completed Facility, furnished and equipped
  - (2) Simulated Occupancy Levels
- d. Openings
  - (1) Check doors, windows, hatches for infiltration and energy transmission levels.

#### 2.1.1.4 Extra Materials

Submit [spare parts list](#) data for each different item of material and equipment specified, after approval of detail drawings and not later than [\_\_\_\_\_] months prior to the date of beneficial occupancy. Include in the data a complete list of parts and supplies, with current unit prices and source of supply, a recommended spare parts list for 12 months operation, and a list of the parts recommended by the manufacturer to be replaced after [1] [and] [\_\_\_\_\_] year(s) of service.

### PART 3 EXECUTION

#### 3.1 INSTALLATION

Submit [layout drawings](#) for all installed equipment and structural components consisting of equipment layouts including assembly, applicable [manufacturer's instructions](#), installation details and connection diagrams.

#### 3.2 EXAMINATION

Perform [visual inspection](#) on the equipment and structural components listed below. Correct all abnormalities or defects as directed by the Contracting Officer.

- a. Roofs, Walls, and Insulation

b. Automated Openings Operation and Closure

3.3 FIELD QUALITY CONTROL AND ACCEPTANCE TESTING

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NOTE: The acceptance criteria, as defined in this specification, may also be used to establish the required baselines for future maintenance.

At the Government's option, Government may elect not to have the Contractor perform acceptance testing, but instead the acceptance testing may be performed either by Government personnel or other designated third party personnel. This option can be exercised on a case-by-case basis. Regardless of who performs the acceptance testing, Contractor compliance with the requirements of acceptance is still mandatory.

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Deliver completed facility, fixtures, furnishings, equipment and services that meet the contract requirements and specifications. Ensure that all materials, furnishings, fixtures and equipment be free of latent manufacturing and installation defects. Perform acceptance testing as defined in this specification and the **RCBEA GUIDE**, using both traditional and PT&I technologies. The Government will observe and monitor the acceptance testing, analysis and documentation as part of the Government's Quality Assurance Program. Satisfactory completion of all acceptance requirements is required to obtain Government approval and acceptance of the Contractor's work.

3.3.1 Predictive Testing and Inspection Tests

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NOTE: Predictive Testing and Inspection (PT&I) involves the use of acceptance and inspection techniques that are non-intrusive and non-destructive in order to avoid introducing problems. It also involves the use of data collection devices, data analysis and computer databases to store and trend information. Typical PT&I technologies used during equipment and structural component acceptance includes, but is not limited to: infrared thermography, airborne ultrasonics, integrity testing, and verification of liquid levels and relief devices.

The PT&I tests prescribed in this section are MANDATORY for all **AIR FORCE ARMY NASA NAVY** assets and systems identified as Critical, Configured, or Mission Essential. Do not remove the requirement from this specification. If the system is non-critical, non-configured, and not mission essential, use sound engineering discretion to assess the value of adding these additional test and acceptance requirements.

Enhanced acceptance criteria may have an impact on contractor cost. It is not the intent of these



acceptance criteria to unnecessarily drive up the cost of equipment installations and contractor work. If the cost of the added inspections and the cost of enhanced equipment designs outweigh their performance and life-cycle value, then do not use overly restrictive acceptance criteria. The acceptance criteria should define the "minimum" limits essential for a high quality installation. See the RCBEA Guide for additional information regarding cost feasibility of PT&I.

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Perform the following PT&I Tests in accordance with the requirements and criteria established in the **RCBEA GUIDE**. Include test point locations in all submitted reports.

a. Perform **Infrared Thermography Test** for:

(1) Roofs, Walls, Insulation and Openings

Perform a thermographic survey of the building envelope using infrared thermography as part of the prebeneficial occupancy to check for voids in insulation or the presence of wetted insulation. In addition, check for the presence of air gaps in building joints such as seams, door frames, window frames, etc., using an appropriate procedures specified in the **RCBEA GUIDE**.

The Government may elect to perform a thermographic survey on the installed structural components after a minimum [90] [\_\_\_\_\_] days of operation or [90] [\_\_\_\_\_] days from the installation acceptance date, but no later than one year from this date. If deficiencies are identified within the construction contract warranty period, correct all defects at no additional cost to the Government.

b. Perform Facility Air Quality Evaluation [\_\_\_\_\_] for:

(1) [\_\_\_\_\_]

(2) [\_\_\_\_\_]

(3) [\_\_\_\_\_]

c. Perform **Ultrasonic (Airborne) Test** for:

(1) Roofs, walls, and insulation

(2) Openings, seals, and joints

### 3.3.2 Baseline Data from Verification Testing

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**NOTE:** PT&I data allows for effective planning and scheduling of maintenance or repairs so that consequences from failure can be minimized or eliminated. For PT&I data to be effective, initial baseline data, normally taken at inception, is needed for comparisons and trending. From an equipment acceptance perspective, PT&I tests have become one of the most effective methods for testing

new and in-service equipment for hidden defects.

Ensuring that facilities and equipment meet acceptance criteria and obtaining and documenting critical baseline data is extremely important during the construction phase. As RCM decisions are made later in the life cycle, it becomes more difficult to achieve the maximum possible benefit from Reliability Centered Maintenance programs.

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Upon completion of all PT&I tests submit [baseline data report](#) to the Contracting Officer. Include a summary of all performance data, set points, operating parameters and PT&I test results obtained for equipment and building systems. Provide reports with a cover letter/sheet clearly marked with the System name, Date, and the words "[Preliminary] [Final] Test Report Data - Forward to the [Systems Engineer] [Condition Monitoring Office] [Predictive Testing Group] [\_\_\_\_\_] for inclusion in the Maintenance Information Database."

### 3.4 OPERATIONS AND MAINTENANCE

Submit manufacturer's [operations and maintenance manuals](#) for the following equipment:

- a. Roofs, Walls, and Insulation
- b. Tanks and Storage Tank Pressurized
- c. Tanks and Storage Tank Unpressurized

Submit [six] [\_\_\_\_\_] complete copies of operations and maintenance manuals in bound [216 by 279 8-1/2 by 11 inch](#) booklets listing step-by-step procedures required for system startup, operation, abnormal shutdown, emergency shutdown, and normal shutdown. Include the manufacturer's name, model number, parts list, routine maintenance procedures, possible breakdowns and repairs, trouble shooting guide, and a brief description of all equipment and their basic operating features. Include piping and equipment layouts and simplified wiring and control diagrams of the system as installed. Where available, provide technical manuals in electronic format with Standard Graphics Markup Language. When electronic format publications are provided, only two copies of the document are required. Submit operations and maintenance manuals [30] [\_\_\_\_\_] calendar days prior to testing any equipment.

### 3.5 ACCEPTANCE DOCUMENTATION

Upon completion of the project and acceptance testing the Contracting Officer will provide [acceptance documentation](#) to the Contractor. Complete, sign and date this documentation and submit back to the Contracting Officer for processing and approval.

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