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NAVFAC IGS-15949 (MAY 2002)  
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Preparing Activity: LANTNAVFACENGCOM Based on UFGS-15949N

ITALIAN GUIDE SPECIFICATIONS

Use for ITALIAN projects only

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SECTION 15949

HVAC TESTING/ADJUSTING/BALANCING FOR SMALL SYSTEMS  
05/02

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NOTE: This guide specification is issued by the  
Atlantic Division, Naval Facilities Engineering  
Command for regional use in Italy.

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NOTE: This guide specification covers requirements  
for testing, adjusting, and balancing (TAB) of small  
heating, ventilating and cooling (HVAC) air and water  
distribution systems.

This section is a version of guide NFGS-E-15950,  
"HVAC Testing/Adjusting/Balancing" in which the TAB  
work has been substantially reduced in order to make  
the project TAB effort more cost effective when  
applied to small HVAC systems.

Small HVAC Systems include:

1. Rooftop package A/C 35 kW or less (no more than two units on the project.)
2. Direct expansion, split system with air-handling units or fan coil units, constant volume/variable temperature system 17.5 kW or less (no more than three units on the project)
3. Hot water heating only, comprised of unit heaters, hot water pump and converter, fin tube radiation, convectors, and exhaust fans only.

Systems for industrial exhaust and those with large makeup air units, multizone units of any tonnage, or VAV systems are not considered small systems.

Duct Air Leakage Testing (DALT): Normally in the case of small HVAC systems, the cost of DALT work is not justified. However, a case might arise where in

the judgement of the HVAC system designer, DALT is considered necessary. An example of such a case may be a relatively long duct run in the small HVAC system.

The requirements for DALT work prior to system TAB work can be found in guide NFGS-E-15950, "HVAC Testing/Adjusting/Balancing". Use the guide NFGS-E-15950 to cover any small HVAC system requiring DALT work in lieu of using this specification section. NFGS-E-15950 requires qualified test personnel experienced in providing the complex DALT testing.

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NOTE: Following information shall be shown on project drawings:

1. A unique number or mark for each piece of equipment or terminal.
2. Air quantities at air terminals.
3. Air quantities and temperatures in air handling unit schedules.
4. Water quantities and temperatures in thermal energy transfer equipment schedules.
5. Water quantities and heads in pump schedules.
6. Water flow measurement fittings and balancing fittings.

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NOTE: Comments and suggestion on this specification are welcome and should be directed to the technical proponent of the specification. A listing of the technical proponents, including their organization designation and telephone number, is on the Internet.

Use of electronic communication is encouraged.

Brackets are used in the text to indicate designer choices or locations where text must be supplied by the designer.

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PART 1 GENERAL

1.1 DESCRIPTION OF WORK

The work includes and test, adjust, and balance (TAB) of new heating, ventilating, and cooling (HVAC) air and water distribution systems including equipment, ducts, and piping which are located within, on, under, between, and adjacent to buildings.

## 1.2 RELATED REQUIREMENTS

Perform work required by this section in accordance with the paragraph entitled "Subcontractor Special Requirements" in Section 01310, "Administrative Requirements."

Requirements for price breakdown of HVAC TAB work are specified in Section 01200, "Price and Payment Procedures."

Requirements for construction scheduling related to HVAC TAB work are specified in Section 01320, "Construction Progress Documentation".

Obtain Contracting Officer's written approval before applying insulation to exterior of air distribution systems under Section 15080, "Mechanical Insulation."

Obtain Contracting Officer's written approval before applying insulation to water distribution systems under Section 15080, "Mechanical Insulation." At Contractor's option and with Contracting Officer's written approval, the piping systems may be insulated, as specified below, before systems are TAB'd.

Piping insulation shall terminate immediately adjacent to each flow control valve, automatic control valve, or device. The ends of pipe insulation and the space between ends of pipe insulation and piping shall be sealed with waterproof vapor barrier coating. After completion of work under this section, the flow control valves and devices shall be insulated under Section 15080, "Mechanical Insulation."

## 1.3 DEFINITIONS

- a. TAB team supervisor: TAB team engineer.
- b. TAB team technician: TAB team assistant.
- c. TAB'd: HVAC Testing/Adjusting/Balancing procedures performed.
- d. Field check group: One or more systems of the same basic type; the subgroup of a "field check group" is a "system."
- f. Out-of-tolerance data: Pertains only to field checking of certified DALT or TAB report. The term is defined as a measurement taken during field checking which does not fall within the range of plus 5 to minus 5 percent of the original measurement reported on the certified DALT or TAB report for a specific parameter.
- g. Season of maximum heating load: Time of year when outdoor ambient

temperature at equipment installation site remains within following range throughout the period of data recording for TAB work. Indicated winter outdoor design dry bulb temperature plus 17.5 to minus 17.5 degrees Celcius plus 30 to minus 30 degrees Fahrenheit.

- h. Season of maximum cooling load: Time of year when outdoor ambient temperature at equipment installation site remains within following range throughout the period of data recording for TAB work. Indicated summer outdoor design dry bulb temperature plus 8, minus 3 degrees Celcius plus 15, minus 5 degrees Fahrenheit.

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**NOTE: In the case where the winter outdoor design dry bulb temperature and the summer outdoor design dry bulb temperature are within 19.4 degrees C 35 degrees F of each other, the above two seasons requiring TAB work are reduced to one season requiring TAB work. Therefore, in the following specification paragraphs, the phrase "the Season 1" shall be replaced with "the" and all requirements for "Season 2" TAB work shall be deleted.**  
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#### 1.4 TAB WORK SYNOPSIS

The following is an overview of the HVAC TAB work effort covered by this section. Detailed requirements are specified in other paragraphs of this section.

##### 1.4.1 Preliminary Work

- a. Contractor submits TAB agency and personnel qualifications.
- b. TAB agency submits design review report.
- c. TAB agency submits the Pre-Field TAB Engineering Report.

##### 1.4.2 Season 1 TAB Work

- a. Contractor submits advanced notice of commencement of Season 1 TAB field work.
- b. TAB agency accomplishes Season 1 TAB field work.
- c. TAB agency submits certified Season 1 TAB report.
- d. Contracting Officer conducts Season 1 field check.
- e. Contractor completes all TAB work except Season 2 TAB work.

##### [1.4.3 Season 2 TAB Work

- a. Contractor submits advanced notice of commencement of Season 2 TAB field work.
- b. TAB agency accomplishes Season 2 TAB field work.
- c. TAB agency submits certified Season 2 TAB report.
- d. Contracting Officer conducts Season 2 field check.
- e. Contractor completes all TAB work.]

1.5 SUBMITTALS

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NOTE:

Submittals must be limited to those necessary for adequate quality control. The importance of an item in the project should be one of the primary factors in determining if a submittal for the item is required.

A "G" following a submittal item indicates that the submittal requires Government approval. Some submittals are already marked with a "G". Only delete an existing "G" if the submittal item is not complex and can be reviewed through the Contractor's Quality Control system. Only add a "G" 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. Recommended codes for Army projects are "RE" for Resident Engineer approval, "ED" for Engineering approval, and "AE" for Architect-Engineer approval. Codes following the "G" typically are not used for Navy projects.

Submittal items not designated with a "G" are considered as being for information only for Army projects and for Contractor Quality Control approval for Navy projects.

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Submit the following in accordance with Section 01330, "Submittal Procedures."

SD-06 Test Reports

Certified TAB report for Season 1 G

Certified TAB report for Season 2 G

Submit certified reports in the specified format including the above data.

SD-07 Certificates

Independent TAB agency personnel qualifications G

Design review report G

Pre-field TAB engineering report G

Advance notice for Season 1 TAB field work G

[Advance notice for Season 2 TAB field work G]

#### 1.6 TAB SUBMITTAL AND WORK SCHEDULE

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**NOTE: The calendar day requirements specified should apply to many construction projects. However, the specifier, when preparing this paragraph for a specific contract shall review and modify this paragraph to suit the contract construction schedule. Season 1 may be the season of maximum heating load or maximum cooling load, depending upon construction schedule.**  
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Compliance with the following schedule is the Contractor's responsibility.

- a. Design Review Report: Within [60][\_\_\_\_\_] calendar days after the date of contract award, submit design review report.
- b. Pre-Field TAB Engineering Report: Within [75][\_\_\_\_\_] calendar days after the date of contract award, submit the Pre-Field TAB Engineering Report.
- c. Advance Notice For Season 1 TAB Field Work: At a minimum of [60][\_\_\_\_\_] calendar days prior to CCD, submit advance notice of commencement of [Season 1]TAB field work.
- d. [Season 1] TAB Field Work: At a minimum of [45][\_\_\_\_\_] calendar days prior to CCD, [and when the ambient temperature is within Season 1 limits,] accomplish [Season 1] TAB field work; submit [Season 1] certified TAB report; and conduct [Season 1] field check.
- e. Complete [Season 1] TAB Work: Prior to CCD, complete all TAB work [except Season 2 TAB work].
- [f. Advance Notice For Season 2 TAB Field Work: At a minimum of [15][\_\_\_\_\_]calendar days prior to CCD, submit advance notice of commencement of Season 2 TAB field work.
- g. Season 2 TAB Field Work: Within [180][\_\_\_\_\_] calendar days after date of commencement of the Season 1 TAB field work and when the ambient temperature is within Season 2 limits, accomplish [Season 2] TAB field work; submit [Season 2] certified TAB report; and conduct Season 2 field check.
- h. Complete Season 2 TAB Work: Within [15][\_\_\_\_\_] calendar days after the completion of Season 2 TAB field data check, complete all TAB work.]

#### 1.7 QUALITY ASSURANCE

### 1.7.1 Independent TAB agency personnel qualifications

#### 1.7.1.1 Independent Qualified TAB Agency

The contractor, as part of this contract, shall provide the services of a qualified testing organization to perform and manage the testing, adjusting and balancing (TAB) work on the HVAC system.

The testing agency shall have been in business, satisfactorily performing HVAC testing and balancing work, for not less than three (3) years immediately prior to this solicitation's bid opening date. The agency shall have acceptably completed testing and balancing work for a minimum of three (3) HVAC systems of equivalent design, capacity complexity, and size to the project's system. This TAB agency shall not be affiliated with any company participating in any other phase of this contract, including design, furnishing equipment, or construction.

#### 1.7.1.2 TAB Team Personnel

The TAB team approved to accomplish work on this contract shall be full-time employees of the TAB agency. No other personnel shall do TAB work on this contract.

- a. TAB Team Supervisor: Supervisor shall have satisfactorily performed full-time supervision of TAB work in the field for not less than 3 years immediately preceding this solicitation's bid opening date.
- b. TAB Team Field Technicians: Technicians shall have satisfactorily assisted a TAB team supervisor in performance of TAB work in the field for not less than one year immediately preceding this solicitation's bid opening date.

### 1.7.2 Responsibilities

The Contractor shall be responsible for ensuring compliance with the requirements of this section. The following delineation of specific work responsibilities is specified to facilitate execution of the various work efforts by personnel from separate organizations. This breakdown of specific duties is specified to facilitate adherence to the schedule listed in paragraph entitled "TAB Submittal and Work Schedule."

#### 1.7.2.1 Contractor

- a. Coordination of supporting personnel:

Provide the technical personnel, such as factory representatives or HVAC controls installer required by the TAB field team to support the TAB field measurement work.

Provide equipment mechanics to operate HVAC equipment and ductwork mechanics to provide the field designated test ports to enable TAB field team to accomplish the TAB field measurement work. Ensure

these support personnel are present at the times required by the TAB team, and cause no delay in the TAB field work.

Conversely, ensure that the HVAC controls installer has required support from the TAB team field leader to complete the controls check out.

- b. Prerequisite HVAC work: Complete checkout and debugging of HVAC equipment, ducts, and controls prior to the TAB engineer arriving at the project site to begin TAB work. Debugging includes searching for and eliminating malfunctioning elements in the HVAC system installations, and verifying all adjustable devices are functioning as designed. Include as prerequisite work items, the deficiencies pointed out by the TAB team supervisor in the design review report.
- c. Deficiencies: Ensure that the TAB Agency supervisor submits all Design/Construction deficiency notifications directly to the Contracting officer within 3 days after the deficiency is encountered. Further, the Contractor shall ensure that all such notification submittals are complete with explanation, including documentation, detailing deficiencies.
- d. Prior to the TAB field team's commencement of work, ensure completion of the applicable inspections and work items listed in the TAB team supervisor's pre-field engineering report; ensure correction of the deficiencies pointed out by the TAB team Supervisor in the design review report.
- e. Do not allow the TAB team to commence TAB field work until all of the HVAC system filters are clean for both Season 1 and Season 2 TAB field work.
- f. Advance notice: Furnish to the Contracting Officer with advance written notice for each event, the commencement of the TAB field work.
- g. Ensure that openings in duct and machinery insulation coverings for TAB test ports are marked, closed and sealed.

#### 1.7.2.2 TAB Agency

Provide the services of a TAB team which complies with the requirements of paragraph entitled "TAB Personnel Qualification Requirements."

#### 1.7.2.3 TAB Team Supervisor

- a. Field Manager: Manage, in the field, the accomplishment of the work specified in Part 3, "Execution."
- b. Full time: Be present at the contract site when TAB field work is being performed by the TAB team; ensure day-to-day TAB team work accomplishments are in compliance with this section.

- c. Design review report: Review project specifications and accompanying drawings to verify that the air systems and water systems are designed in such a way that the TAB engineer can accomplish the work in compliance with the requirements of this section. Verify the presence and location of permanently installed test ports and other devices needed, including gauge cocks, thermometer wells, flow control devices, circuit setters, balancing valves, and manual volume dampers.
- d. Support required: Specify the technical support personnel required from the Contractor other than the TAB team. Inform the Contractor in writing of the support personnel needed and when they are needed. Furnish the notice as soon as the need is anticipated.
- e. Pre-field engineering report: Utilizing the following HVAC-related documentation; contract drawings and specifications, approved submittal data for equipment, up-to-date revisions and change orders; prepare this report.
- f. Technical Assistance of TAB Work: Provide immediate technical assistance to the TAB field team for the TAB work.
- g. Certified TAB report: Certify the TAB report. This certification includes the following work:
  - (1) Review: Review the TAB field data report. From this field report, prepare the certified TAB report.
  - (2) Verification: Verify adherence, by the TAB field team, to the TAB plan prescribed by the pre-field engineering report and verify adherence to the procedures specified in this section.
- h. Design/Construction deficiencies: Within 3 working days after the TAB Agency has encountered any design or construction deficiencies, the TAB Supervisor shall submit written notification directly to the Contracting Officer, with a separate copy to the Contractor, of all such deficiencies.

Provide in this submittal a complete explanation, including supporting documentation, detailing deficiencies. Where deficiencies are encountered that are believed to adversely impact successful completion of TAB, the TAB field team shall issue notice and request direction in the notification submittal.
- i. TAB Field Check: The TAB team supervisor shall attend and supervise [Season 1][and Season 2] TAB field check.

#### 1.7.2.4 Design Review Report

Submit typed report describing omissions and deficiencies in the HVAC system's design that would preclude the TAB team from accomplishing the TAB work requirements of this section. Provide a complete explanation

including supporting documentation detailing the design deficiency. State that no deficiencies are evident if that is the case.

#### 1.7.2.5 Pre-Field TAB Engineering Report

Submit report containing the following information:

a. Step-by-step TAB procedure:

(1) Strategy: Describe the method of approach to the TAB field work from start to finish. Include in this description a complete methodology for accomplishing each seasonal TAB field work session.

(2) Procedural steps: Delineate fully the intended procedural steps to be taken by the TAB field team to accomplish the required TAB work of each air distribution system and each water distribution system. Include intended procedural steps for TAB work for subsystems and system components.

b. Pre-field data: Submit proposed TAB data reporting forms, with the pre-field information listed below, filled in. The TAB reporting forms submitted shall be based on the list of requirements presented in Table 15949, "Master List of TAB Data Reporting Requirements", included at the end of this section. Modify and supplement this master list to ensure this pre-field TAB engineering report applies to this particular contract.

(1) General Report Documents: Submit in accordance with Table 15950 requirements

(2) Design data obtained from system drawings, specifications, and approved submittals.

(3) Notations detailing additional data to be obtained from the contract site by the TAB field team.

(4) Designate the actual data to be measured in the TAB field work.

(5) Instrumentation: Comply with Table 15949, and the following: provide a list of the types of instruments which are anticipated to be used for measuring in the TAB field work. By means of a keying scheme, specify on each TAB data report form submitted, which instruments will be used for measuring each item of TAB data.

If the selection of which instrument to use, is to be made in the field, specify from which instruments the choice will be made. The instrument key number shall be placed in the blank space where the measured data would be entered.

#### 1.7.2.6 Certified TAB Reports

Submit Certified TAB Report for Season 1 and Certified TAB Report for

Season 2 in the following manner:

- a. Report format: Submit the completed pre-field data forms approved in the pre-field TAB Engineering Report completed by TAB field team, reviewed and certified by the TAB supervisor. Bind the report with a waterproof front and back cover. Include a table of contents identifying by page number the location of each report. Report forms and report data shall be typewritten. Handwritten report forms or report data are not acceptable.
- b. Temperatures: On each TAB report form reporting TAB work accomplished on HVAC thermal energy transfer equipment, include the indoor and outdoor dry bulb temperature range and indoor and outdoor wet bulb temperature range within which the TAB data was recorded. Include in the TAB report continuous time versus temperature recording data of wet and dry bulb temperatures for the rooms, or zones, as designated in the following list:

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**NOTE: The design engineer shall list, in the paragraph below, those rooms, or zones, for which indoor dry bulb and wet bulb temperatures shall be compiled for the specified time duration. Include a sufficient number of rooms, or zones, in the listing to ensure correct evaluation of performance for the installed HVAC systems.**

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(1) [Specifier: List desired rooms and/or zones here]. Data shall be measured and compiled on a continuous basis for the period in which TAB work affecting those rooms is being done.

(2) Data shall be measured/recorded only after the HVAC systems installations are complete, the systems fully balanced and the HVAC systems controls operating in fully automatic mode.

(3) Data may be compiled using direct digital controls trend logging where available. Otherwise, the Contractor shall temporarily install calibrated time versus temperature/humidity recorders for this purpose. The HVAC systems and controls shall have been fully operational a minimum of 24 hours in advance of commencing data compilation. The specified data shall be included in the [Season I TAB Report][Season I and Season 2 TAB Report].

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**NOTE: Paragraphs c., below apply to air distribution systems to be TAB'd. Delete the paragraph if no air distribution systems are in the project, or delete the paragraphs not applicable and edit the terminology of the remaining paragraphs to agree with the drawings.**

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[c. System Diagrams: Provide a system diagram in the TAB report showing the location of all terminal outlet supply, return, exhaust and transfer registers, grilles and diffusers. Use a key numbering system on the diagram which identifies each outlet contained in the outlet airflow report sheets.]

1.8 MINIMUM INSTRUMENTATION REQUIRED

1.8.1 Air Balance

- a. Inclined manometer calibrated in no less than 0.0005 in. of water 0.1 Pa divisions.
- b. Combination inclined and vertical manometer with minimum measuring range of 0 to 2490 Pa.
- c. Pitot tubes, a 457 mm tube and a 1219 mm long tube.
- d. A tachometer, high quality, direct contact, self-timing type.
- e. Clamp-on ampere meter with voltage scales.
- f. Deflecting vane anemometer.
- g. Rotating vane anemometer.
- h. Thermal-type (hot-wire) anemometer.
- i. Dial and glass stem thermometers.
- j. Direct reading flow hood.

1.8.2 Water Balance

- a. Water-over-mercury manometer or a recently calibrated differential pressure gauge.
- b. 100 mm pressure gauges of the appropriate ranges and recently calibrated.
- c. Clamp on Ampmeter with voltage scales.

PART 2 PRODUCTS - Not Used

PART 3 EXECUTION

3.1 TAB PROCEDURES

3.1.1 TAB Field Work

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**NOTE: For those projects having only a single certified TAB report, delete the last sentence of**

the following paragraph.

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Test, adjust, and balance the listed HVAC systems to the state of operation indicated on and specified in the contract design documents. Conduct TAB work, including maintenance and calibration of instruments, and and measurement accuracy. Provide instruments and consumables required to accomplish the TAB work.

Air systems and water systems shall be proportionately balanced and reported in the [Season 1] certified TAB report. [The only water flow and air flow reporting which can be deferred until the Season 2 will be that data which would be affected in terms of accuracy due to outside ambient conditions].

### 3.1.2 Preliminary Procedures

Use the approved pre-field engineering report as instructions and procedures for accomplishing TAB field work. Test ports required for testing by the TAB supervisor shall be located in the field by the TAB supervisor during TAB field work. It shall be the responsibility of the sheet metal contractor to provide and install test ports as required by the TAB engineer.

### [3.1.3 TAB Air Distribution Systems

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**NOTE: Specifier shall edit, delete, and add to the paragraphs below to ensure that air distribution systems indicated on project drawings are listed for TAB work. Specifier shall explicitly identify new and existing systems and components which are to be TAB'd. Particular care should be exercised in defining existing systems and components. Specify the systems identically to labeling and terminology used on project drawings.**

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#### 3.1.3.1 Air Handling Units

Air handling unit systems including fans (air handling unit fans, exhaust fans and winter ventilation fans), coils, ducts, plenums, mixing boxes, terminal units, variable air volume boxes, and air distribution devices for supply air, return air, outside air, mixed air relief air, and makeup air.

#### 3.1.3.2 Fan Coils

Fan coil unit systems including fans, coils, ducts, plenums, and air distribution devices for supply air, return air, and outside air.

#### 3.1.3.3 Rooftop Air Conditioning

Rooftop air conditioning systems including fans, coils, ducts, plenums, and air distribution devices for supply air, return air, and outside air.

3.1.3.4 Return Air Fans

Return air fan system including fan ducts, plenums, registers, diffusers, grilles, and louvers for supply air, return air, outside air, and mixed air.

3.1.3.5 Makeup Air Units

Makeup air unit systems including fans, coils, ducts, plenums, registers, diffusers, grilles, and louvers for supply air, return air, outside air, and mixed air.

3.1.3.6 Heating and Ventilating Units

Heating and ventilating unit systems including fans, coils, ducts, plenums, roof vents, registers, diffusers, grilles, and louvers for supply air, return air, outside air, and mixed air.

3.1.3.7 Door Heaters

Door heater systems, including fans, coils, and diffusers.

3.1.3.8 Exhaust Fans

Exhaust fan systems including fans, ducts, plenums, grilles, and hoods for exhaust air.

3.1.3.9 Cooling Units

[3.1.3.10 Unit Heaters

][3.1.3.11 Cabinet Heaters

]][3.1.4 TAB Water Distribution Systems

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NOTE: Specifier shall edit, delete, and add to the paragraphs below to ensure that water distribution systems indicated on project drawings are listed for TAB work. Specifier shall explicitly identify new and existing systems and components which are to be TAB'd. Particular care should be exercised in defining existing systems and components. Specify the systems identically to labeling and terminology used on project drawings.  
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3.1.4.1 Chilled Water

Chilled water systems including condensers, cooling towers, pumps, coils, system balance valves and flow measuring devices.

3.1.4.2 Heating Hot Water

Heating hot water systems including boilers, hot water converters (e.g., heat exchangers), pumps, coils, system balancing valves and flow measuring devices.

[3.1.4.3 Dual Temperature Water

Dual temperature water systems including boilers, converters, chillers, condensers, cooling towers, pumps, coils, and system balancing valves, and flow measuring devices.

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NOTE: Choose one of the following options; choose the text immediately below or the text below entitled "TAB work On Performance Tests Within Seasonal Limitations." Use the text immediately below in the case where the winter outdoor design dry bulb temperature and the summer outdoor design dry bulb temperature are within 19.4 degrees C of each other. This will reduce the number of trips to the contract site from two (one per person) to one for performance testing by the TAB field team. Use the second option, in the other cases.  
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[3.1.5 TAB Work on Performance Tests Without Seasonal Limitations

3.1.5.1 Performance Tests

In addition to the TAB proportionate balancing work on the air distribution systems and the water distribution systems, accomplish TAB work on the HVAC systems which directly transfer thermal energy. TAB the operational performance of the [heating systems] [and] [cooling systems].

3.1.5.2 Ambient Temperatures

On each tab report form used for recording data, record the outdoor and indoor ambient dry bulb temperature range and the outdoor and indoor ambient wet bulb temperature range within which the report form's data was recorded. That is, record these temperatures at beginning and at the end of data taking.

3.1.5.3 Refrigeration Units

For refrigeration compressors/condensers/condensing units, data required by Form 15949, "Master List of TAB Data Reporting Requirements", shall be reported, including refrigeration operational data.

3.1.5.4 Coils

Heating and cooling performance capacity tests shall be reported for [hot water], [chilled water], [DX] [and steam coils] for the purpose of verifying that the coils meet the indicated design capacity. Submit the

following data and calculations with the coil test reports: The apparent coil capacity shall be determined by calculations using single point measurement of entering and leaving wet and dry bulb temperatures; the calculations shall be submitted with the coil reports.

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NOTE: Choose the text immediately below, or the text above entitled "TAB Work On Performance Tests Without Seasonal Limitations." Refer to technical note immediately above. The text immediately below requires one trip each for Seasons 1 and 2.  
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] [3.1.6 TAB Work on Performance Tests With Seasonal Limitations

3.1.6.1 Performance Tests

Accomplish proportionate balancing TAB work on the air distribution systems and water distribution systems, in other words, accomplish adjusting and balancing of the air flows and water flows, any time during the duration of this contract, subject to the limitations specified elsewhere in this section. However, accomplish, within the following seasonal limitations, TAB work on HVAC systems which directly transfer thermal energy.

3.1.6.2 Season Of Maximum Load

Visit the contract site for at least two TAB work sessions for TAB field measurements. [Visit the contract site during the season of maximum heating load] [and] [visit the contract site during the season of maximum cooling load], the goal being to TAB the operational performance of the [heating systems] [and] [cooling systems] under their respective maximum outdoor environment-caused loading. During the seasonal limitations, TAB the operational performance of the [heating systems] [and] [cooling systems].

3.1.6.3 Ambient Temperatures

On each tab report form used for recording data, record the outdoor and indoor ambient dry bulb temperature range and the outdoor and indoor ambient wet bulb temperature range within which the report form's data was recorded. That is, record these temperatures at beginning and at the end of data taking.

3.1.6.4 Refrigeration Units

For refrigeration compressors/condensers/condensing units, data required by Table 15949, "Master List of TAB Data Reporting Requirements", shall be reported, including refrigeration operational data.

3.1.6.5 Coils

Heating and cooling performance capacity tests shall be reported for [hot water], [chilled water], [DX] [and steam coils] for the purpose of

verifying that the coils meet the indicated design capacity. Submit the following data and calculations with the coil test reports: The apparent coil capacity shall be determined by calculations using single point measurement of entering and leaving wet and dry bulb temperatures; the calculations shall be submitted with the coil reports.

#### 3.1.7 Workmanship

Conduct TAB work on specified HVAC systems until measured parameters are within plus or minus 10 percent of the design values, that is, the values specified or indicated on the contract documents.

#### 3.1.8 Deficiencies

Strive to meet the intent of this section to maximize the performance of the equipment as designed and installed. However, if deficiencies in equipment design or installation prevent TAB work from being accomplished within the range of design values specified in the paragraph entitled "Workmanship," provide written notice as soon as possible to the Contractor and the Contracting Officer describing the deficiency and recommended correction.

Responsibility for correction of installation deficiencies is the Contractor's. If a deficiency is in equipment design, call the TAB team supervisor for technical assistance. Responsibility for reporting design deficiencies to Contractor is the TAB team supervisor's.

### 3.2 DATA FROM TAB FIELD WORK

After completion of the TAB work, prepare a pre-final TAB report using the reporting forms approved in the pre-field engineering report. Data required by those approved data report forms shall be furnished by the TAB team. Except as approved otherwise in writing by the Contracting Officer, the TAB work and the TAB report shall be considered incomplete until the TAB work is accomplished to within the accuracy range specified in the paragraph entitled "Workmanship" of this section.

Prepare the report neatly and legibly; the pre-final TAB report shall be the final TAB report minus the TAB supervisor's review and certification. Obtain, at the contract site, the TAB supervisor's review and certification of the TAB report.

Verbally notify the Contracting Officer's TAB representative that the field check of the certified TAB report data can commence; give this verbal notice 48 hours in advance of when the field checking shall commence. Do not schedule field check of the certified TAB report until the specified workmanship requirements have been met or written approval of the deviations from the requirements have been received from the Contracting Officer.

### 3.3 QUALITY ASSURANCE FOR TAB FIELD WORK

#### 3.3.1 Field Check

Test shall be made to demonstrate that capacities and general performance of air and water systems comply with the contract requirements.

#### 3.3.1.1 Recheck

During field check, the Contractor shall recheck, in the presence of the Contracting Officer, random selections of data (water, air quantities, air motion) recorded in the certified report.

#### 3.3.1.2 Areas Of Recheck

Points and areas of recheck shall be selected by the Contracting Officer.

#### 3.3.1.3 Procedures

Measurement and test procedures shall be the same as approved for work forming basis of the certified report.

#### 3.3.1.4 Recheck Selections

Selections for recheck will not exceed 25 percent of the total number of reported data entries tabulated in the report.

#### 3.3.2 Retests

If random tests reveals a measured quantity which is out-of-tolerance, the report is subject to disapproval at the Contracting Officers discretion. In the event the report is disapproved, all systems shall be readjusted and tested, new data recorded, new certified reports submitted, and a new field check conducted at no additional cost to the Government.

#### 3.3.3 Prerequisite for Approval

Compliance with the field checking requirements of this section is a prerequisite for the final approval of the certified TAB report submitted.

#### 3.4 MARKING OF SETTINGS

Upon the final TAB work approval, permanently mark the settings of HVAC adjustment devices including valves, splitters, and dampers so that adjustment can be restored if disturbed at any time. The permanent markings shall indicate the settings on the adjustment devices which result in the data reported on the submitted certified TAB report.

#### 3.5 MARKING OF TEST PORTS

The TAB team shall permanently and legibly mark and identify the location points of the duct test ports. If the ducts have exterior insulation, these markings shall be made on the exterior side of the duct insulation. The location of test ports shall be shown on the as-built mechanical drawings with dimensions given where the test port is covered by exterior insulation.



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MASTER LIST OF TAB DATA REPORTING REQUIREMENTS

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(1) General TAB Report Documentation

- a. Title page
- b. Certification page: including name, address, and telephone number of TAB agency; project name and location; government contract number; statement of system performance; TAB supervisor's printed name and certifying signature; report date.
- c. Table of contents
- d. System diagrams

(2) Air Handling Unit Data

- a. Unit Data
  1. Make/Model No.
  2. Type/Size
  3. Serial Number
  4. Arrangement/Class
  5. Discharge
  6. Make Sheave
  7. Sheave Diameter/Bore
  8. Number Belts/make/size
  9. Number Filters/type/size
- b. Motor Data
  1. Make/Frame
  2. W/RPM
  3. Volts/Phase/Hertz
  4. Full load (F.L.) Amps
  5. Make sheave
  6. Sheave Diameter/Bore
- c. Test Data (Design and Actual)
  1. Total l/s
  2. Total static pressure (S.P.)
  3. Fan RPM
  4. External S.P.
  5. Motor Volts (each phase)
  6. Motor Amps (each phase)
  7. Outside Air l/s
  8. Return Air l/s
  9. Discharge S.P.
  10. Suction S.P.
  11. Reheat Coil S.P. drop
  12. Cooling Coil S.P. drop
  13. Preheat Coil S.P. drop
  14. Filters S.P. drop

TABLE 15949

MASTER LIST OF TAB DATA REPORTING REQUIREMENTS

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15. Outside Air Damper Position
16. Return Air Damper Position

**(3) Coil Data**

a. Coil Data

1. System Number
2. Location
3. Coil Type
4. No. Rows-Fins/in.
5. Manufacturer
6. Model Number
7. Face Area, m<sup>2</sup>

b. Test Data (Design and Actual)

1. Air Quantity, l/s
2. Air velocity, m/s
3. Pressure Drop, Pa
4. Outside Air, DB/WB
5. Return Air, DB/WB
6. Entering Air, DB/WB
7. Leaving Air, DB/WB
8. Air T change
9. Water Flow, l/s
10. Pressure Drop, kPa
11. Entering Water Temp.
12. Leaving Water Temp.
13. Water T change
14. Expansion Valve/ Refrig.
15. Refrig. Suction Pressure
16. Refrig. Suction Temp.
17. Inlet Steam Pressure

**(4) Fan Data**

a. Fan Data

1. Fan Number
2. Location
3. Service
4. Manufacturer
5. Model Number
6. Serial Number
7. Type Class
8. Motor Make/Style
9. Motor H.P./RPM/Frame
10. Volts/Phase/Hertz
11. F.L. Amps

**TABLE 15949**

**MASTER LIST OF TAB DATA REPORTING REQUIREMENTS**

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- 12. Motor Sheave Make/Model
- 13. Motor Sheave Diameter/Bore
- 14. Fan Sheave Make
- 15. Fan Sheave Diameter/Bore
- 16. No. Belts/Size

TABLE 15949

MASTER LIST OF TAB DATA REPORTING REQUIREMENTS

---

**(4) Fan Data (Continued)**

- b. Test Data (Continued)
  - 1. L/s
  - 2. Fan RPM
  - 3. S.P. in/out
  - 4. Total S.P.
  - 5. Voltage (each phase)
  - 6. Amps (each phase)

**(5) Traverse Data**

- a. Static pressure
- b. Duct Size
- c. Duct Area
- d. All velocity readings
- e. Measured Average Velocity, m/s
- f. Measured Flow Rate, l/s
- g. Design Flow Rate, l/s
- h. System/Zone
- i. Location
- j. Static Pressure

**(6) Gas/Oil Fired Heating Units Data**

- a. Unit Data
  - 1. Unit number
  - 2. System
  - 3. Location
  - 4. Make/Model
  - 5. Type/Size
  - 6. Serial Number
  - 7. Type Fuel/Input
  - 8. Output
  - 9. Ignition type
  - 10. Burner control
  - 11. Volts/Phase/Hertz
  - 12. Watts/RPM
  - 13. F.L. amps
  - 14. Drive data
  
- b. Test Data (Design and Actual)
  - 1. L/s
  - 2. Entering/Leaving air temperature
  - 3. Air temperature change T
  - 4. Entering/Leaving air pressure
  - 5. Air pressure drop P
  - 6. Low fire input

TABLE 15949

MASTER LIST OF TAB DATA REPORTING REQUIREMENTS

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7. High fire input
8. High limit setting
9. Operating set point

TABLE 15949

MASTER LIST OF TAB DATA REPORTING REQUIREMENTS

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**(7) Electric Coil Duct Heater Data**

a. Coil Data

1. Coil number
2. System number
3. Location
4. Coil type
5. Stages
6. Manufacturer
7. Model number
8. Face area, m<sup>2</sup>

b. Test Data (Design and Actual)

1. Air flow rate, l/s
2. Minimum air velocity, m/s
3. Pressure drop, Pa
4. kW
5. Phase
6. Entering air DB/WB
7. Leaving air DB/WB
8. Air temp. change T
9. Volts, each phase
10. Amps, each phase
11. Limit-Cutout time
12. Limit-Cutout temperature
13. Flow Switch Check

**(8) Package Rooftop, Heat Pump and Air Conditioning Unit Data**

a. Unit Data

1. System / Unit
2. Location
3. Make/Model number
4. Type/Size
5. Serial number
6. Type filters/Size
7. Fan sheave make
8. Fan sheave diameter/bore
9. Type heating section (Use section 3.3.1.8 or 3.3.1.9)

b. Motor Data

1. Make/Frame
2. Power, W / RPM
3. Volts/Phase/Hertz

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MASTER LIST OF TAB DATA REPORTING REQUIREMENTS

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b. Motor Data (Continued)

4. F.L. amperage
5. Make sheave
6. Sheave diameter/bore

c. Evaporator Data (Design and Actual)

1. Total flow, l/s
2. Total static pressure, S.P.
3. Discharge S.P.
4. Suction S.P.
5. Outside air, l/s
6. Outside air temperature, DB/WB
7. Return air, l/s
8. Return air temperature, DB/WB
9. Entering air temperature, DB/WB
10. Leaving air temperature, DB/WB
11. Fan RPM
12. Voltage, each phase
13. Amperage, each phase

d. Condenser Data (Design and Actual)

1. Refrigerant type/kg
2. Compressor manufacturer/number
3. Compressor model/serial number
4. Low ambient control
5. Suction pressure and temperature
6. Condenser pressure and temperature
7. Crankcase heater amperage
8. Compressor voltage, each phase
9. Compressor amperage, each phase
10. Low and High pressure cutout settings
11. Number of fans and fan RPM
12. Condenser fan, W / l/s
13. Condenser fan voltage and amperage

**(9) Compressor and Condenser Data**

a. Unit Data

1. Unit number
2. Location
3. Manufacturer
4. Model/Serial number
5. Compressor manufacturer
6. Compressor model/serial number
7. Refrigerant type/kg
8. Low ambient control

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MASTER LIST OF TAB DATA REPORTING REQUIREMENTS

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b. Test Data (Design and Actual)

1. Suction pressure and temperature
2. Condenser pressure and temperature
3. Oil pressure and temperature
4. Voltage, each phase
5. Amperage, each phase
6. kW input
7. Crankcase heater amperage
8. Number of fans, fan RPM, and fan l/s
9. Fan motor make, frame, fan W
10. Fan motor voltage and amperage
11. Duct inlet and outlet static pressure
12. Entering and leaving air temperature, D.B.
13. Entering and leaving condenser water temperature
14. Entering and leaving condenser water pressure
15. Control setting
16. Unloader set points
17. High and Low pressure cutout setting

**(10) Heat Exchanger and Converter Data**

a. Unit Data

1. Unit number
2. Location
3. Service
4. Rating, W
5. Manufacturer
6. Model number and serial number

b. Test Data (Design and Actual)

1. Steam

- a) Pressure , kPa
- b) Flow, kg/s

2. Primary Water

- a) Entering and Leaving temperature
- b) Temperature T
- c) Entering and Leaving pressure
- d) Pressure P
- e) Flow, l/s

3. Secondary Water

- a) Entering and Leaving temperature
- b) Temperature T
- c) Entering and Leaving pressure
- d) Pressure P
- e) Flow, l/s
- f) Control set point
- g) Exchanger Circuiting

TABLE 15949

MASTER LIST OF TAB DATA REPORTING REQUIREMENTS

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TABLE 15949

MASTER LIST OF TAB DATA REPORTING REQUIREMENTS

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**(11) Pump Data**

a. Design Data

1. Pump number
2. Location
3. Service
4. Manufacturer
5. Model and Serial number
6. Flow, l/s and Head, m
7. Required NPSH
8. Pump RPM
9. Impeller Diameter
10. Motor manufacturer/frame
11. Motor, W/RPM
12. Volts/Phase/Hertz
13. F.L. amperage
14. Seal type

b. Actual Data

1. Discharge pressure at full flow
2. Discharge pressure at no flow
3. Suction pressure at full flow
4. Suction pressure at no flow
5. Differential pressure at full flow
6. Differential pressure at no flow
7. Circuit setter size, P, l/s
8. Circuit setter type and set point
9. Voltage, each phase
10. Amperage, each phase

**(12) Balance Valve and Flow Meter Data**

- a. System/Unit
- b. Location
- c. Service
- d. Size
- e. Model
- f. Design flow, l/s
- g. Actual valve set point
- h. Actual valve pressure drop
- i. Actual flow, l/s

**(13) Boiler Data**

a. Unit Data

1. Unit number
2. Location
3. Manufacturer

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MASTER LIST OF TAB DATA REPORTING REQUIREMENTS

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4. Model and Serial number
5. Type/Size
6. Fuel/Input

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MASTER LIST OF TAB DATA REPORTING REQUIREMENTS

---

a. Unit Data (Continued)

7. Number of passes
8. Ignition type
9. Burner control
10. Volts/Phase/Hertz

b. Test Data (Design and Actual)

1. Operating pressure and temperature
2. Entering and Leaving temperature
3. Number of safety valves/size
4. Safety valve setting
5. High limit setting
6. Operating control setting
7. High and Low fire set point
8. Voltage, each phase
9. Amperage, each phase
10. Draft fan, voltage and amperage
11. Manifold pressure
12. Output, kW
13. Safety controls check

**(14) Instrumentation Calibration Report**

- a. Instrument identification and serial number and key
  - b. Measuring range
  - c. Application
  - d. Dates of use
  - e. Calibration test date
- 

-- End of Section --