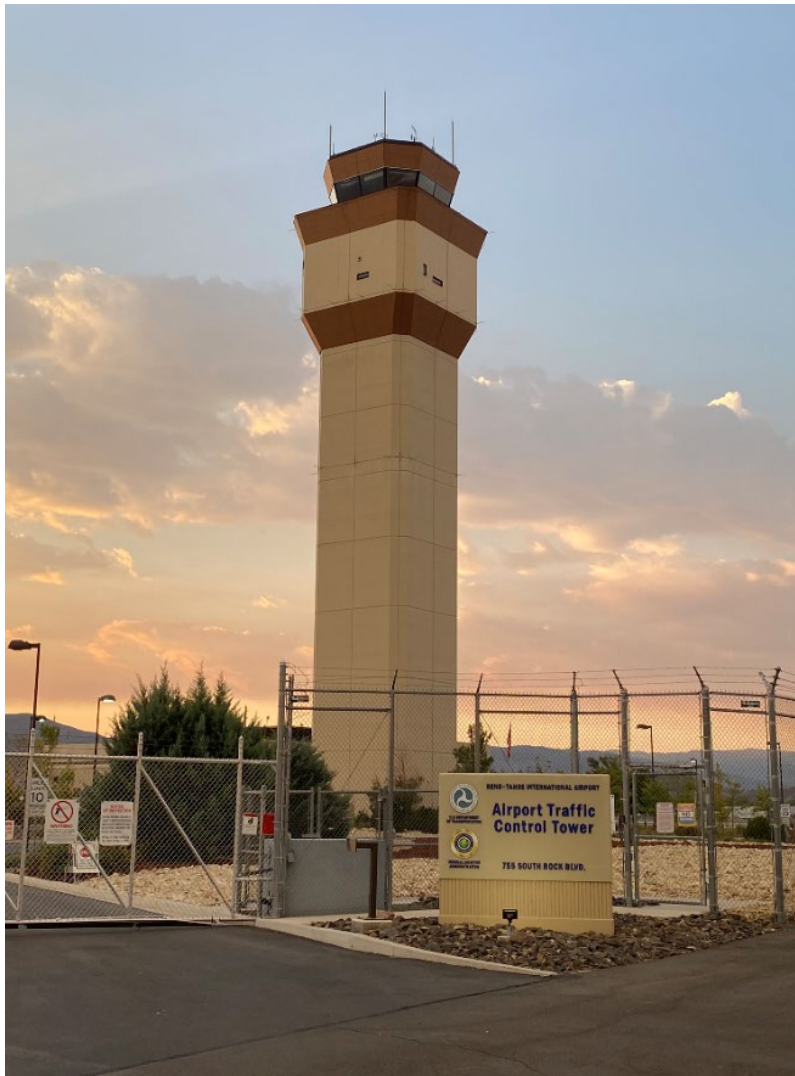


Specifications

United States Department of Transportation
Federal Aviation Administration

RNO ATCT Chiller Replacement Project
Air Traffic Control Tower
Reno, Nevada

Prepared by: Matthew Taeubel, PE
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Reno-Tahoe Air Traffic Control Tower
Reno, Nevada

Chiller Replacement Project

Division 1
General Requirements

1-1.0 General

1-1.1 Scope of Work:

Contractor shall furnish all necessary labor, material, equipment and transportation for the installation of the “RNO ATCT Chiller Replacement Project” consists of two of 70 ton air cooled chillers, corresponding mechanical, water piping, electrical and controls. The air conditioning systems specified herein or shown on the contract drawings shall be completed, functional and operational in all respects.

- Air cooled chiller shall be removed and replaced one a time to ensure facility one chiller is operational at all times.
- Provide rigging services to remove the existing chiller and install the new chiller to and from the mechanical yard.
- Furnish and install two (2) Carrier model or equal 30RB 70-ton air cooled scroll chillers or equal
- Set each air cooled chiller on equipment pad with seismic spring isolator.
- Provide labor, equipment and materials to pipe the new chiller to the existing chilled-water system.
- Provide labor, equipment and materials to replace all piping, devices, accessories and connections from both supply and return isolation valves to new chiller.
- Install tags on all valves and controls devices in piping system
- Furnish and install disconnect switches, electrical conduit, liquidtight flex and fittings for all devices, accessories and from outside stubs serving chillers.
- Furnish and install new safety switch, fuses and load side conductor.
- Reuse existing line side conductors to the chiller.
- Reuse existing control wire as needed.
- Reuse existing grounding conductor to chiller chassis.
- Furnish and install new (size to match existing) rigid elastomeric pipe insulation with jacketing.
- Provide a factory certified startup with a written report.
- Provide a NEBB-certified test-and-balance agent to measure, set, and adjust flows with a written report.
- Provide materials and labor to add the new chiller to the existing Building Automation System, including hardware and software changes. The new chiller shall mirror the data and control points currently used on existing Chillers 1 and 2 in a seamless integration.
- Provide factory representation during start up. Factory representative shall provide a report for each air cooled chiller.
- Provide owner/operator training by Carrier or equal service technician.
- Provide labor and new equipment warranty.

1-1.2 Project Location:

Reno-Tahoe Air Traffic Control Tower
755 South Rock Blvd
Reno, Nevada 89502

1-1.3 Site Visits:

All site visits shall be arranged and coordinated on all secured FAA property. Pre-bid site visits shall be arranged by the Contracting Officer (CO). Contractors are encouraged to attend.

1-1.4 Work Schedule:

Air traffic operations are 24 hours a day, 7 days a week at this facility.

The contractor shall schedule and perform all work between the hours of 7:00 AM and 5:00 PM, Monday through Friday except for scheduled outages. Any outage shall take place at night during minimal impact to the facility between the hours of 12:00 AM and 6:00 AM. Exact time for outages shall be determined by the FAA and must be coordinated at least one week in advanced. Any work in the cab must also be coordinated at least one week in advanced. No work shall be performed on federal holidays, Saturdays and Sundays without approval from the Resident Engineer (RE). Alternate work schedules such as 10 hour shifts for 4 consecutive days are acceptable such that the total work week does not exceed 40 hours. Any work day exceeding 8 hours must be approved by the RE in advanced. Approved overtime by the RE shall not be construed as an agreement for payment of overtime work. In the event the contractor requests to work overtime, holidays and/or weekends, there must be a written request for approval at least 48 hours prior to the RE.

1-1.7 Maximum Allowable Preparation Time:

The contractor shall be allowed one hundred and twenty (120) calendar day starting from date of awarded contract to Notice to Proceed Date (NTP). This is to provide adequate time to procure, fabricate and ship all necessary equipment and materials that will be installed under this contract.

1-1.8 Maximum Allowable On Site Duration:

The contractor shall be required to commence work under this contract within five (5) calendar days after the NTP date. The NTP date shall be negotiated by the Contracting Officer (CO) and contractor. The contractor has a maximum timeframe of thirty (30) calendar days for the project to be completed starting from the day after the Notice to Proceed Date. This period of performance is mandatory. Work shall be done diligently and to be completed ready for use within this period of performance. Final clean up on site is included in this time frame.

1-1.9 Security Requirements:

The contractor must follow all security requirements governed by the Reno Air Traffic Control Tower and Administration Building. Daily badging and escorting is required. Coordinate with the RE for proper parking and staging arrangements.

1-1.10 On Site Storage and Cleanliness:

The contractor shall be required to take full responsibility for the safekeeping of products, materials and tools stored on site.

The contractor and subcontractors shall maintain the job site in a neat and orderly condition. Daily removal of rubbish, waste, and material not required for the work in progress shall be required. Work area shall be clean and free of any debris prior to installation of any new equipment.

1-1.11 Availability of Utilities:

The contractor may use necessary facility water, electricity and keep clean rest rooms. Public telephone services are not permitted. The government will not be responsible to receive any message or telephone call to the contractor. Coordinate with RE for which receptacles are acceptable for usage. During outage contractor may need to provide temporary lighting. Escorting to rest room is required.

1-1.12 Waste Management:

The contractor is fully responsible for all waste management pertaining to this project and must comply with all federal, state and local waste regulations of the disposal of all waste. Any material or equipment removed shall become property of the contractor and be transported from the site. Contractor shall provide documents all material and equipment that is removed. Contractor shall not use any FAA existing waste containment on site. A waste disposal plan must be prepared for any transporting, storing and/or location. It is encouraged that any recyclable material be handled appropriately.

1-1.13 Shop Vacuum Cleaners:

The contractor shall supply a new in box shop vacuum cleaner specifically for this project. This vacuum cleaner must stay on site until project is completed. No other previously used vacuum cleaners will not be accepted and allowed on site.

1-1.14 Damage to the Site:

Any damage or defect to anything on site shall be replaced and repaired with all costs paid by the contractor. This shall apply to existing equipment, utilities, vegetation, structures and improvements.

1-1.15 Protection and Clean Up:

The contractor is fully responsible for the protection and enforcement against the weather of all material and equipment on site. Damaged material and equipment as a result of inadequate protection shall be replaced and at the cost of the contractor.

1-2.0 Meetings and Submittals:

1-2.1 Preconstruction Meeting:

Prior to the start of construction, it is required the contractor and FAA personnel conduct a preconstruction meeting at the construction site or at a designated FAA office location to discuss project implementation. A teleconference call may be in lieu of a meeting at the discretion of the FAA. The Prime Contractor's Project Manager must be in attendance as well as any personnel who will be involved in decision making and accident prevention for the duration of project. This shall include project superintendent, site safety and health officer, quality control supervisor and any other assigned

safety and health professional. All main subcontractors shall be represented during this meeting. Safety requirements will be reviewed to discuss site specific health and safety procedures. All potential hazards and mitigation information will be clarified. The government representatives will comment on submittals and project plans to then proceed for approval.

The contractor shall discuss in detail the submitted site specific Accident Prevention Plan and any necessary Activity Hazard Analysis.

1-2.2 Safety Meetings:

Daily safety meetings shall be conducted prior to every work shift and documented. Minutes showing contract title, signatures of attendees and a list of topics discussed shall be attached to the Contractors' daily quality control report. All contractors, REs and relevant FAA personnel that will be on the job site must be present. This is to give reminders about proper work and health safety to who is involved with the project.

1-2.3 Submittals:

All submittals must be submitted to Project Engineer or COTR in a timely manner within fourteen (14) calendar days from the awarded contract date. Contractor must supply submittals to be reviewed containing product and material data for items used throughout the project. This list must include a brief description of the materials or equipment, the name of the manufacturer and the model or type number. Correct material and quantity must meet minimum specification requirements.

The use of brand name with, or without, an or approved equal statement following the purchase description in this specification or on the project drawings is intended to promote competition by encouraging the offering of products that are equal in all material respects to the brand name products cited in such descriptions. The reference by brand name does not indicate a preference for the products mentioned but identifies a product known to furnish the quality and characteristics that meet the requirements of this specification. All characteristics of a specified brand name product which are essential to the Government are described in this specification or on the project drawings. The Contractor must obtain product literature from the manufacturer of the specified brand name product to determine its general quality and functional characteristics and must use that information in making any desired substitutions.

Where the Contractor elects to use the manufacturer and model number specified herein, no further technical information or shop drawings need to be submitted. Where the Contractor desires to utilize the products of another manufacturer or where no make or model is specified, a complete set of shop drawings and descriptive literature must be submitted, including selected performance data, electrical data including MCA and any required changes to electrical sizing or requirements, internal controls diagrams and external control connection diagrams, clearance requirements, and any other information required to determine whether the new equipment will meet the FAA's requirements. Any new work required as a result of acceptance of materials by another manufacturer will be the responsibility of the contractor, and no additional compensation will be made. Prior to construction, the contractor must submit an electronic copy of the descriptive literature, shop drawings, and/or samples to the Project Engineer or the COTR for approval for any item he wishes to submit as equal to the brand name(s) as specified. Items will be returned stamped. Any submittals that are necessary after construction starts may be submitted in hard copy or electronic copy at the discretion of the COTR.

Information must be submitted within fourteen (14) calendar days after the date of contract award and must include, but not be limited to the following, where applicable:

- (1) Chiller equipment
- (2) Isolators
- (3) Insulation and jacketing
- (5) Controls
- (6) Electrical equipment
- (7) Piping, devices and accessories
- (8) MSDS
- (9) Site Specific Health and Safety Plan
- (10) Crane Lift Plan and Certifications/Qualifications of operating personnel
- (11) Start up reports, Operations and Maintenance Data

Shop drawings must include manufacturer's catalog data and certified capacity data. Information submitted must be complete to enable the item to be evaluated from an engineering viewpoint and must be sufficient to show compliance with this specification.

The project drawings are designed for the particular manufacturer and model specified. However, where required to show specific details of equipment interface, attachment, support, wiring, etc., the Contractor must provide any additional shop drawings or descriptive literature for any equipment, including that specified, as required by the COTR.

The Contractor must carefully select equipment and materials, furnish shop drawings and other documentation required above, place and confirm orders for equipment and materials, and schedule all delivery dates in a manner which conforms with the performance time and advance acquisition time allotted by this contract.

Notice-To-Proceed with on-site work will not be granted until the Contractor certifies to the Contracting Officer that all required materials and equipment, as approved by the Government, are in his possession and ready for installation.

1-2.4 Government Furnished Materials (GFM):

None.

1-3.0 Health and Safety

1-3.1 Asbestos Free Requirements:

There shall not be any use of asbestos containing material (ACM) during construction of this project at any time. The general construction contractor shall verify that all material used is asbestos free material. The prime contractor shall provide to the CO a signed document stating no ACM were used on this project during the construction, renovation and/or modernization of this facility.

1-3.2 MSDS:

The contractor shall submit to the CO Material Safety Data Sheets (MSDS) for all materials and products that will be used for this work to be completed. The RE and contractor shall routinely inspect the

products used on site are only the products which have an approved MSDS. All copies of MSDS shall be given to the FAA for records.

1-3.3 Site Specific Health and Safety Plan:

The contractor is fully responsible for the construction site and construction work safety and health for all those on site and general public. Comply with the regulations of the Occupational Safety and Health Standards (OSHA) 29 CFR Part 1926. The contractor shall use a qualified person to perform a written site specific health and safety plan. This plan shall be site specific to address any unusual or unique aspects of the project or activity for which it is written. It shall interface with the overall health and safety program. The government considers the prime contractor the overall controlling authority for all work site health and safety for all subcontractors. It is up to the prime contractor to communicate and inform all subcontractors of the safety provisions under the contract and all penalties for noncompliance. Coordinate the work such that one craft shall not interfere with another or create hazardous working conditions and inspecting subcontractor operations to ensure that that accident prevention responsibilities are carried out. This site specific health and safety plan shall be signed by the person and firm preparing, the contractor, on site superintendent and the designated site safety and health officer.

Work will not proceed without an approved site specific health and safety plan. Disregarding the provisions of this contract or the accepted plan will cause stoppage of all work, at the authority of the CO, until the matter has been resolved. Once work begins, any changes to the site specific health and safety plan shall be made known to the CO, project superintendent and site safety and health officer. In the event any hazard becomes evident then all work shall stop in the area, secure the area and develop a plan to mitigate specific hazard.

A copy of this accepted plan shall maintained with both the Resident Engineer (RE) and at the job site. The site specific health and safety plan shall be reviewed and amended as necessary throughout the duration of the contract. All new activities discovered that were not originally identified in this plan shall be updated accordingly.

1-3.4 Hot Work:

Any required hot work must have an approved and signed hot work permit by the FAA. Every day requires a new signed permit.

All welding, cutting, brazing, soldering, grinding or other work that may generate a flame or spark is considered to be hot work. Before any hot work shall be performed, a permit shall be requested to the RE. This permit shall be signed and approved at a minimum twenty four (24) hours in advanced and requires a new permit for each day of hot work being performed. A designed fire watch for all hot work is required and to remain on site for a minimum of 30 minutes after task is completed. All fire extinguishers shall be provided by the contractor. Extinguishers shall contain current inspection tag, approved safety pin and tamper resistant seal. Contractors shall require all personnel to locate nearest fire alarm. Any fire shall be reported immediately to the RE and building manager.

1-3.5 Conduct of Electrical Work:

Any required outage must be scheduled with FAA at least one week in advanced. All work in electrical any distribution panel shall have a scheduled outage. Contractor shall complete any work inside panels during one scheduled outage. Planned start time will be authorized of the FAA.

No energized circuits will be work on this project. Proper lock out tag out procedures must be performed prior to any work on the equipment and corresponding circuits, breakers, disconnects, panels, etc. Qualified FAA personnel shall deenergize the equipment. The RE shall be present when testing any equipment and circuits to verify deenergization. Coordinate all power panel work with the RE at least one week in advanced for approval.

1-4.0 Warranty:

Contractor and all subcontractors must provide warranty and manufacturer documentation on all material and labor conducted for this project. All work performed under this contract is to meet contract requirements and does not have any defects in products or workmanship performed. Any defects of the equipment and all corresponding components must be repaired or replaced under this warranty. This warranty is valid for one year starting from the completion of the date if final work acceptance.

1-5.0 List of Project Drawings:

Drawings contain the number RNO-D-ATCT

<u>Suffix</u>	<u>Drawing Title</u>
-G012	Title Sheet, Drawing Index and Vicinity Map
-D001	Demolition Chiller Site Plan
-M046	Equipment Schedule
-M047	Chiller Site Plan
-M048	Chiller Piping Detail and Section
-M049	Existing Controls Diagram and Sequence of Operation
-E085	Electrical Single Line

Reno-Tahoe Air Traffic Control Tower
Reno, Nevada

Chiller Replacement Project

Division 2
Air Conditioning

2-1.0 Statement of Work:

The contractor shall furnish all necessary labor, material, equipment and transportation for the installation of the RNO ATCT Chiller Replacement Project. Work is to include but is not necessarily limited to the following:

- Air cooled chiller shall be removed and replaced one a time to ensure facility has one chiller operational at all times.
- Provide rigging services to remove the existing chiller and install the new chiller to and from the mechanical room. Exchanging chillers shall include deliver offload, reload, and removal. Contractor shall provide crane and rigging services. A FAA approved lift plan is required.
- Furnish and install two (2) Carrier model or equal 30RB 70-ton air cooled scroll chillers or equal per RNO-D-ATCT-M046 Equipment Schedule drawing.
- Set each air cooled chiller on equipment pad with seismic spring isolator: selected and located per manufacturer's specifications.
- Provide labor, equipment and materials to pipe the new chiller to the existing chilled-water system.
- Provide labor, equipment and materials to replace all piping, devices, accessories and connections from both supply and return isolation valves to new chiller:
 - Thermometer: with thermowell (0-100 °F); Weiss Instruments or equal
 - Pressure Gauge: with cock (0-100 PSI); Weiss Instruments or equal
 - Test plug: brass body with core insert, gasket and threaded cap; Weiss Instruments or equal
 - Flexible pipe connection: Flange, with straightening vanes; Metraflex VF or equal
 - Automatic shutoff valve: quantity of 1 Belimo SY4-110, Non Spring Return, On/Off Floating Point, 110V and corresponding temperature sensor or equal
 - Check valve: inline swing, cast iron, metal seats
 - Circuit setting balance valve: quantity of 1; Bell & Gossett CB-1-1/4 or equal
 - Flow switch: Factory furnished for field installation
 - Abandon existing flow meter up stream of valve and install new downstream of valve: Badger Meter SDI1D1N10-0200, brass and corresponding temperature sensor or equal
 - Strainer: Y- Pattern, cast iron, flange, bolt cover with ball valve and bottom drain connection
 - Low point drain: ball valve with hose adaptor and capped
 - Air vent: with ball valve
- Install tags on all valves and controls devices in piping system.

- Furnish and install new safety switch: heavy duty, NEMA 3R, 200A, 600V, 3 phase; Square D H364RB or equal.
- Furnish and install new time delay, class RK5 fuses for each disconnect switch.
- Furnish and install new load side conductor sized per manufacturer's specifications and NEC
- Furnish and install electrical conduit, unistrut, liquidtight flex and fittings for all devices, accessories and from outside stubs serving chillers.
- Reuse existing line side conductors to the chiller.
- Reuse existing control wire as needed.
- Reuse existing and extended as needed grounding conductor to chiller chassis.
- Furnish and Install new (size to match existing) rigid elastomeric pipe insulation with .016" thickness galvanized jacketing.
- Provide a factory certified startup with a written report.
- Provide a NEBB-certified test-and-balance agent to measure, set, and adjust flows with a written report.
- Provide materials and labor to add the new chiller to the existing Building Automation System, including hardware and software changes. The new chiller shall mirror the data and control points currently used on existing Chillers 1 and 2 in a seamless integration.
- Provide factory representation during start up. Factory representative shall provide a report for each air cooled chiller.
- Provide owner/operator training by Carrier or equal service technician.
- Provide labor and new equipment warranty

2-2.0 Codes and Standards:

All labor and material shall be in strict conformance with the rules and regulations of the Air Conditioning and Refrigeration Institute (ARI), National Fire Protection Association (NFPA), American Society for Testing and Materials (ASTM), and American Society of Mechanical Engineers (ASME), where such standards have been established for the particular item of equipment used.

All equipment and materials installed must be installed according to the manufacturer's instructions. Copies of installation instructions from the manufacturer shall be on site and available to the RE at anytime. The RE shall review installation instructions before any equipment and material is installed.

2-3.0 Applicable Documents:

The following standard publications, of the issues currently in force, form a part of this specification. The contractor shall perform all work not included in this specification in accordance with these specifications:

International Conference of Building Officials

National Fire Protection Association
International Mechanical Code, 2015 Edition

International Conference of Building Officials

International Plumbing Code, 2015 Edition

SMACNA

HVAC Duct Construction Standards, Metal and Flexible, Most Recent Edition

National Electric Code, 2020 Edition

Interior Electrical

FAA Standard: FAA-C-1217H

Lighting Protection, Grounding and Bonding

FAA Standard: FAA-STD-019F

Equipment Installation Instructions, Specified or
Applicable Edition for Model Number Approved

Manufacturer of Install Equipment

2-4.0 Air Conditioning Equipment:

The equipment make, model and all performance data must be in accordance with the data table on the project drawings. The minimum and maximum performance data specified must not be below the minimum or above the maximum by more than 5% of the specified value.

2-4.1 Air Cooled Chiller:

Size Range: 70 tons Nominal

Carrier Model Number: 30RBX0706—GGG34 or equal

2-5.0 Air Distribution:

Any item that is not shown in detail or covered in detailed specifications shall be set forth in the SMACNA HVAC Duct Construction Standards, Metal and Flexible. The project drawings show the general location, orientation, and alignment of duct, registers, grilles and other devices. The contractor shall be responsible for the field verification of the system layout and shall determine the exact location of all components to avoid interference with building structure, light fixtures, ceiling grid, other mechanical systems, etc.

2-6.0 Piping

The Contractor must check all dimensions and must establish all lines and levels affecting piping and other work specified herein. Such lines, grades, and levels must be checked with the work of other trades to assure proper clearance of piping and equipment. The Contractor must be held responsible for correctness of lines, grades, and levels so established and must provide all fittings and accessories required to satisfy field conditions affecting pipe installation.

Pipe must be cut accurately to measurements established at the site by the Contractor and must be worked into place without springing or forcing. Piping must be run parallel with the lines of the building unless otherwise indicated. A clearance of not less than one inch must be kept between pipe, or finished covering, and other work or the different piping services. Branch connections and changes in pipe size must be made with standard pipe fittings. Change in direction must be made with fittings.

Allowance must be made throughout for expansion and contraction of piping. Flexibility must be provided by use of one or more turns to allow piping to spring without straining.

Pipes in exposed locations must be grouped and be neatly aligned. Vertical pipes must be accurately plumbed. Horizontal pipes must be installed parallel to structural members and level or at a uniform slope when a pitch is required. Groups of vertical pipes must be aligned parallel to a wall whenever

practicable, otherwise, they must be aligned 90 degrees to a wall. Groups of horizontal pipes must be aligned either horizontally or vertically.

2-6.1 Pipe Hangers and Supports:

All piping must be supported, anchored, and guided in a manner such that expansion and contraction will take place in the direction desired and vibration and undue strain on equipment will be prevented. Hangers must have means of vertical adjustment after piping is in place. Supports on flat surfaces must be with "Unistrut" P-2558 pipe strap bolted to P-1000 channel, or approved equal. Location of hangers must be coordinated with the structural work to assure that structural members will support the load under operating conditions.

Hangers and clamps applied to bare copper must be electrolytically coated or padded with felt. Hangers applied to piping specified to be insulated must be sized for the outside diameter of the insulation. Furnish a rigid non-compressible urethane or calcium silicate block (Dow Corning Trymer, or approved equal) insulation insert of 1" minimum thickness or of equal thickness to the adjoining insulation, whichever is greater, and 12" maximum length at each hanger. Spacing between supports must be not more than 6 feet for tubing up to 1-1/2 inches in diameter and 10 feet for tubing 2 inches and larger. Also, support at each change of direction. Where concentrated loads, such as valves, flanges, and accessories occur, the above spacing does not apply and each location must be supported.

Where necessary to maintain support spacing, structural members must be bridged to suit hanger locations.

2-6.2 Water Piping:

All chilled water and heating water circulating piping materials and installation must be as specified herein.

2-6.2.1 Water Piping Materials:

Furnish piping materials in accordance with the following tables:

<u>STEEL WATER PIPING</u>		
Item	Size	Description
Pipe Fittings	All 2-1/2" & smaller	Carbon steel, standard weight Black malleable iron, 150-pound, screwed
	3" & larger	Carbon steel, butt-welding type long radius, standard weight
Unions	2-1/2" & smaller	Black malleable iron, 300-pound brass or bronze seats
Flanges	3" & larger	Forged steel, 150-pound, weld neck
Branch Connections	All	Straight tees, reducing tees or forged steel branch outlet fittings

Plugs	2-1/2" & smaller	Steel, screwed hex head
Bolting	All	Hex head machine bolts, with one hex nut each
Gaskets	All	1/16 inch thick non-metallic composition
Thread	All	Non-hardening, lead free, thread
Lubricant		seal compound
Pipe Nipples	2" & smaller	Black steel, Schedule 80 minimum, seamless, threaded pipe for installation between main headers and first block valve for drains, vents and pressure connections

COPPER WATER PIPING

Item	Size	Description (model, or equal)
Pipe	All	Copper, Type L
Fittings	All	Copper, Class 150, threaded or sweat connections, long radius
Ball Valves	2" & smaller	Nibco T/S-585-70, bronze 2-piece body, full port, threaded or sweat.
	2-1/2"	Nibco T/S-595-Y, bronze 3-piece body, full port, threaded or sweat.
	3" & larger	Nibco T/S-590-Y, bronze 3-piece body, conventional port, threaded or sweat.
Unions	2-1/2" & smaller	Nibco 733 series, or approved equal
Dielectric Unions	All	Piping Products Plus Type DUFC
Flanges	3" & larger	Cast copper Alloy, Class 150, Nibco 771 - Companion Flange C, or approved equal.
Branch Connections	All	Cast Copper Alloy, Straight tees, Reducing tees must be Nibco 711 - Tee, or approved equal.
Plugs	2-1/2" & smaller	Cast Copper Alloy, Nibco 716, or approved equal

Bolting	All	Hex head machine bolts, with one hex nut each
Gaskets	All	1/16 inch thick non-metallic composition
Thread Lubricant	All	Non-hardening, lead free, thread seal compound

2-6.2.2 Threaded Water Pipe Joint Fabrication:

Threaded joints in ferrous piping must have American National taper screw threads conforming to ANSI Standard B2.1. After cutting and before threading, pipe must be reamed and burrs must be removed. Screw joints must be made with thread seal compound applied to the male thread only. Caulking of threaded joints to stop or prevent leak will not be permitted. All short connections such as valved vents, drains, pressure connections and small instrument connections must have a minimum of Schedule 80 nipple between the header and the first block valve.

2-6.2.3 Soldered Water Pipe Joint Fabrication:

Water piping must be fabricated from Type L, hard drawn copper tubing and standard weight wrought copper fittings. Swaged joints must not be used. Ells must be long radius type. Tubing cuts must be made square, using a sharp wheel cutter or fine tooth hacksaw, reamed after cutting to remove burrs. Soldered joints must be made in the following manner: (1) Cut tube end square; ream, de-burr and size. (2) Use sand cloth or steel wire brush to clean tube and cup to a bright metal finish. (3) Apply solder flux to outside of tube and inside of cup of fitting carefully so that surfaces to be joined are completely covered. Select flux in accordance with solder manufacturer's instructions. Use flux sparingly. (4) Apply flame to the fitting to heat tube and solder cup of fitting until solder melts when placed at joint of tube and fitting. (5) Remove flame and feed solder into the joint at one or two points until a ring of solder appears at the end of the fitting (The correct amount of solder is approximately equal to the diameter of the fitting...5/8" solder for 5/8" fitting, etc.). (6) Remove excess solder with a small brush or wiping cloth while plastic.

For domestic water systems (under 100 psi) and drainage piping use 95-5 solder (95% Tin/5% Antimony) with a 4800 psi joint strength and a liquidus temperature of 464°F.

For chilled and heating water hydronic systems and any high pressure (at or above 100 psi) fluid systems use 6% silver/94% tin solder (Harris Stay-Brite 8, or equal) with a 15,000 psi joint strength and a liquidus temperature of no greater than 535°F to prevent annealing of the base material.

2-6.2.4 Steel Pipe Joint Fabrication:

Standard weight steel pipe, wrought-steel fittings and wrought-cast or forged-steel flanges and flange fittings, and welded and flanged joints.

- A. Join pipe and fittings according to the following requirements and Division 23 Sections specifying piping systems.
- B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.
- F. Flanged Joints: Select appropriate gasket material, size, type, and

thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.

F. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.

2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

G. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.

H. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

2-6.3 Valves:

Valves must be provided at locations shown and where required for proper function of the systems. Unless otherwise indicated or approved, all valves must be installed with stems horizontal or above. All manual valves, control valves, and accessories must be placed in accessible areas to provide operation and maintenance.

2-6.4 Piping Devices:

All piping devices such as shut off valves, flow control valves, flexible connectors, etc., must be as specified on the project drawings. All such devices must have a pressure and temperature rating no less than that of the adjoining pipe and must be installed and adjusted in accordance with the manufacturer's instructions.

2-6.4.1 Dielectric Unions:

All connections between ferrous (steel) and non-ferrous (copper or bronze) piping must be made with dielectric unions designed to prevent corrosion by insulating against electrical conductivity between dissimilar metals. Bronze fittings are not acceptable alternatives to dielectric unions and must not be used for this purpose. The means of connection between the pipe and the respective half of the union must be the same as for the type and size of pipe to be connected (ie; solder or thread).

2-6.5 Water Pipe Testing:

Piping must be tested hydrostatically at 200 pounds per square inch (psi) using clean potable water and must be held for not less than 30 minutes during which time all joints must be inspected for leaks.

If inspection and tests show defects, such defective work or material must be replaced and test repeated. All repairs must be made with new material. No caulking of screwed joints or holes will be acceptable.

2-6.6 Pipe Cleaning:

Prior to the cutover of the new to the existing piping, new piping must be thoroughly cleaned. All equipment, piping, valves, and strainers must be cleaned inside and outside of oil, grease, metal cuttings and sludge which may have accumulated during construction. Water systems must be cleaned by

flushing, during which each valve must be operated several times. All strainer baskets must be removed, cleaned, and replaced.

2-6.7 Insulation:

After tests have been successfully completed and pipe surfaces have been cleaned and dried, insulation must be installed on pipe, valves and equipment of all new and modified piping systems.

2-6.7.1 Cold Surface Insulation:

All chilled water supply, return and makeup piping as well as any cold surfaces such as on pumps, tanks, chiller evaporators or any other surface subject to condensation must be insulated. These piping systems, both indoor and outdoor, must be covered with a flexible, elastomeric thermal insulation with a minimum nominal wall thickness of 2" or to match existing insulation thickness. Polyethylene or fiberglass insulations are not acceptable. Maximum thermal conductivity must be .27 BTU-In. per sq. ft.-hour-°F at 75°F mean temperature. Water vapor permeability must not exceed 0.20 perm-inch per ASTM test procedure E96, procedure B. Water absorption must not exceed 5% by weight per ASTM test procedure D1056. Flame spread rating must not exceed 25 and smoke developed rating must not exceed 50 per ASTM test procedure E84. Insulation must be capable of preventing condensation on piping with a surface temperature of 35°F in ambient air temperature of 85°F dry bulb, 70% relative humidity. Pipe insulation must be either unslit for installation as pipe is being assembled or must have factory longitudinal slit with tape or mastic sealed joint. Field cutting of insulation length to allow installation over installed pipe must not be acceptable. Pipe insulation must be Armstrong AP Armaflex SS, or equal. Sheet and roll insulation must be Armstrong Armaflex II, or equal.

2-6.7.2 Insulation Installation:

Insulation must be applied on clean dry surface after all tests are completed and must be continuous through walls and equipment openings. Insulation on all cold surfaces where vapor barrier jackets are used must be applied with a continuous, unbroken vapor seal. Piping at supports must rest upon 1" thick rigid insulation inserts as specified above. Metal shield must be applied between hangers or supports and the pipe insulation. Shield must be formed 18 gauge sheet metal to fit rigid insulation insert and must be in two halves.

Fittings at all locations must be insulated with miter-cut pipe insulation, with insulation sheet cut to size or with insulation tape of the same material as straight pipe insulation. All butt joints and seams must be sealed with insulation adhesive. All outdoor insulation must be covered with 0.016 inch thick aluminum with longitudinal Z-joint and secured with 2-inch side locking straps at butt joints. The aluminum must be carefully cut and mitered around elbows and fittings for a smooth jacket which totally conceals all insulation. All indoor insulation exposed to view must be finished with polyvinyl chloride (PVC) insulated fitting covers on all pipe fittings, flanges, valves and pipe terminations. Finish all straight pipe sections with 20 mil thick PVC jacketing. Solvent welding adhesive must be used to permanently seal all the PVC circumferential lap joints and longitudinal overlap joints in the system. Bands, straps or mechanical clamps for securing the PVC insulation jacketing will not be acceptable. Apply adhesive with strict adherence to the manufacturer's application instructions. Fitting covers and straight pipe jacketing must be white in color and be ultra violet resistant. They must also not exceed flame spread 25 and smoke developed 50, as rated by Underwriter's Laboratories. A PVC insulation

fitting cover and jacketing brand name known to meet the requirements of this specification is Zeston 2000 PVC, as manufactured by Johns-Manville, Inc.

2-7.0 Controls:

The contractor shall supply and install all automatic temperature controls as specified. All controls shall be electric or electronic. Control device make and model numbers, or approved equal, must be as shown in the specifications.

Provide materials and labor to add the new chiller to the existing Direct Digital Control System, including hardware and software changes. The new chiller shall mirror the data and control points currently used on existing Chillers 1 and 2 in a seamless integration. See drawing RNO-D-ATCT-M049 for chiller sequence of operation.

After all contractual work has been completed, the contractor shall demonstrate to the RE that all controls are properly calibrated and provide a sequence of operation specified. This shall be done notified to the RE at a minimum of three (3) working days prior this demonstration.

2-8.0 Electrical:

Items not shown in detail or covered by detailed specifications shall be as set forth in the National Electric Code (Most Recent Edition), FAA Standard: FAA-C-1217H and FAA-STD-019F

2-8.1 Electrical Conduit:

All conduit inside the building shall be electric metallic tubing (EMT) with compression ring type fittings. All conduit outside the building shall be rigid steel with threaded fittings. Support on flat surfaces must be with "Unistrut" P-2558 pipe strap bolted to P-1000 channel, or approved equal. Location of hangers must be coordinated with the structural work to assure that structural members will support the load under operating conditions. Support with slotted standard strut channel, pipe clamps and anchors. All flexible conduit, inside and outside, shall be metallic, liquid tight. Spacing between supports must be not more than 6 feet for tubing up to 1-1/2 inches in diameter and 10 feet for tubing 2 inches and larger. Also, support at each change of direction.

2-8.2 Electrical Conduit Installation:

All conduit shall be installed parallel or at right angles to the building. Conduits shall be securely supported and fastened in place at intervals of no more than 5 feet and each change in direction. Support from building structural steel, walls or other structural components at discretion of the RE. Fasteners shall be conduit hangers or one hole malleable iron pipe straps with appropriate screws or bolts for the surface material. Conduits shall not be supported from metal roof decking. Suspended ceiling supports wires shall not be used to support conduit. Any change in direction shall be symmetrical bends or cast metal fittings. Each conduit entrance to outlet boxes, panel boards and equipment cabinets shall be fitted with a lock nut and insulated throat connector.

2-8.3 Electrical Conduit Fittings:

All EMT connectors and fittings shall be compression type fitting. All rigid steel conduit connectors and couplings shall be threaded type fittings.

2-8.4 Knockout Seals:

Knockout seals shall be the three piece variety. No snap in KO seals are allowed.

2-8.5 Wire:

All wire shall have copper conductors. Size shall be American Wire Gauge (AWG) with size for power circuits as shown on the project drawings, or as required per the National Electric Code if not indicated. Wire size for all control circuits shall be #16 AWG. Power wire #12 AWG and smaller shall be stranded or solid; #10 AWG and larger wire, and control wire, shall be stranded. Insulation shall be THW or THWN for power wire and type MTW for controls wire and shall be color coded as follows:

<u>Single Phase</u>	<u>120 Volts</u>	<u>208/240 Volts</u>
	Line – Black Neutral – White	Line 1 – Black Line 2 – Red Neutral – White
<u>Three Phase</u>	<u>120/208 or 240 Volts</u>	<u>277/480 Volts</u>
	Phase A – Black Phase B – Red Phase C – Blue Neutral – White	Phase A – Yellow Phase B – Orange Phase C – Brown Neutral – White

All Circuits: Ground - Green

2-8.6 Control Wire Insulation:

All power wire #6 AWG and smaller shall have continuous colored insulation. Wire #4 AWG and larger may utilize continuous colored insulation and colored tape. Where conductors are color coded with tape, they shall be taped with a minimum length of 3 inches in all junction and pull boxes, raceways, panelboards, outlets, switches and equipment cabinets.

2-8.7 Wire Identification:

All feeder and branch circuits, including neutral conductors, shall be identified at both ends of the conductor with panel and circuit number indicated. Labels are to be heat shrink embossed labels only, no vinyl tape labels.

2-8.8 Wire Splices:

All wire shall be continuous; no splices will be permitted unless specified on the project drawings. Where permitted, splices shall be accomplished with compression type connectors bonded to the wire with a crimping tool and procedure by the connector manufacturer.

2-8.9 Pulling Wire:

Wire shall not be installed until all conduit and fittings are in place. All wire shall be drawn into conduit simultaneously and with adequate lubricating compound to prevent damage to insulation. Terminate all control wire with spade type, crimped terminals.

2-8.10 Control Wire Installation:

Control wire installed within control panels shall be neatly routed between the control components and shall run parallel and perpendicular to the sides of the panel. Wires which run diagonally from component to component will not be accepted. Wiring shall have sufficient slack to prevent tension on the termination connector. Route wires between components in the most direct path possible without overshoots and loopbacks. Bundles of wires shall be neatly secured with nylon self locking cable ties. All wires exiting the control panel shall terminate on a screw terminal block with each terminal marked the same as on the control schematic on the project drawings.

2-8.11 Grounding and Bonding:

All noncurrent carrying metallic parts of the electrical system shall be grounded with an insulated wire sized and install in accordance with Article 250 of the National Electric Code. Ground wire shall be connected to ground bus in each power panel, to ground lug on receptacles, and to enclosure or frame of major electrical devices such as safety switches, motor, motor starters, terminal cabinets, light fixtures, etc. Connection of ground wire to these devices shall be with properly sized lug and a separate screw which bonds to a clean bare metal surface. Screws which are used for support of the enclosure shall not be used for this purpose.

Grounding bushings shall be installed where conduits enter any device, enclosure or raceway. Each grounding bushing shall be bonded to the enclosure and the bonding conductor shall continue to the next. Handy boxes are exempt, but shall be equipped with plastic bushings.

The FAA has additional grounding and bonding requirements specified in FAA-STD-019F. All equipment, conduits and enclosures shall be bonded the existing earth electrode (EES) system. The outside heat pump units located on the 8th floor shall be externally bonded to the EES using bare copper #2 AWG stranded. Connections to the EES shall be made using exothermic welding (Cad-weld).

2-8.12 Insulation Resistance:

After installation, all power wire shall be tested to demonstrate a minimum of thirty (30) megohms resistance from each conductor to ground when tested at not less than 500 volts DC. The contractor shall provide the necessary test equipment and conduct the test in the presence of the RE.

2-8.13 Safety Switches:

Safety switches shall be NEMA rated as heavy duty. Enclosures indoors shall be NEMA 1 and NEMA 3R for outdoors. Switches must be if the number of poles, voltage and amperage ratings shown on the project drawings. Furnish fuse clips to receive cartridge type dual element fuses in all piles if fusible switches are required on the project drawings. Switches shall be the quick make, quick type with visible blades. Switch handles shall be the extended arm type for easy identification of position. Switches that contain rocker arm handles or have concealed blades will not be accepted. Switch handles must be

capable of being secured in both the on and off positions by the use of the Government owned and installed padlock with a 5/16" diameter shackle. The switch cover must also be capable of being secured in the closed position with a separate Government owned and installed padlock with a 5/16" diameter shackle. The contractor must modify the switch as required to achieve these locking requirements. The switch must be grounded with a separate lug secured to the enclosure bare metal with a bolt and nut. The use of the switch neutral bus with or without a grounding electrode screw bonding to the enclosure is no acceptable.

2-9.0 Fire Protection:

All indoor insulating and acoustical materials, vapor barrier, covering and wrapping materials permanently attached or insulated separately shall not exceed flame spread 25 and smoke developed 50, as rated Underwriter's Laboratories.

All conduits and pipes which penetrate floors (except ground floor) of multistory buildings and which penetrate fire barrier walls as designated in the Uniform Mechanical Code shall have the excess void or cavity sealed with firestop compound. Compound shall be Underwriters Laboratories, Inc. listed for use in through penetration firestop system. Firestop shall be "Flamesafe" Ca. No. FS 900 as manufactured by International Protective Coatings, Inc. or approved equal.

2-10.0 Demolition:

Any existing furniture, cabinets, equipment racks or other items which obstruct the Contractor's access to the work area must either be temporarily relocated by the Contractor to a storage area designated by the R.E. or be covered in a manner as to provide suitable access while protecting the Government property from construction damage. At the completion of all work, the Contractor must return all such items to their original location.

Any unused conduit, wire, duct, pipe, structural supports or other fittings associated with equipment or devices to be removed under this contract must also be removed.

All conduit must be totally removed unless approved by the R.E to only remove it back to the first existing junction box or electrical fitting. Remove all unused wire back to the source power panel. Any circuit which must continue to operate must be rewired for continuity. Seal all unused conduit with electrical plugs.

All refrigerant which is either a "CFC" or an "HCFC", as classified by the Environmental Protection Agency (EPA), must be recovered, decontaminated and recycled in accordance with "The National Recycling And Emissions Reduction Program" of the EPA. Intentional venting of covered refrigerant gasses is subject to criminal penalties.

Remove unused structural support angles, channels, bolts, and similar hardware. Patch any holes resulting from removed equipment, hardware, conduit or pipe with the same material as that of the penetrated surface (ie: concrete floor openings must be filled with concrete). Paint patch to match adjacent undisturbed surface.

After removal of floor supported equipment, clean and/or replace any floor finish or covering to match adjacent undisturbed floor covering. Acoustical ceiling tiles or T-bar grid members which have holes

resulting from removed duct or diffusers must be removed and replaced with new components of equal quality and appearance to the adjacent undamaged ceiling.

Any equipment or material to be removed, unless shown to be given to the RE, must become the property of the Contractor and must be transported from the site.

2-11.0 Paint Finishes:

Any painting must consist of one coat of latex primer and one coat of exterior latex semi-gloss enamel. Paint galvanized surfaces with one coat of "Speedhide Interior/Exterior Galvanized Steel Primer", No. 6-209 white, as manufactured by Pittsburgh Paint Company. Paints must be certified by their manufacturer for use on the intended surface materials and must be applied in accordance with his instructions. Finish coat paint must be "Acry-Sheen" acrylic semi-gloss as manufactured by Evr-Gard Coatings, Paramount, CA, or approved equal.

2-12.0 Identification:

All air conditioning equipment shall be identified to show designator. Identify safety switch disconnects, power panels, cabinets, etc to show equipment served, voltage, phase and fuse amperage rating. Identify control panel and controls to show its function.

Identification must be by plastic engraved nameplates with white letters and black background. Letter size must be 1/4" for controls, 3/16" for devices on control panel covers and 3/8" for safety switches, air conditioning equipment and other equipment devices. Chiller name plates shall be accordingly sized with FAA approval prior to manufacturing. Nameplates must be secured to equipment, cabinets and to controls with adhesive backing. In addition, nameplates installed outdoors must be secured with two screws.

Identify all new and modified pipes to show contents (i.e.: Chilled Water Supply, Refrigerant Suction, etc.) and flow direction. Identification must be with color coded, printed plastic bands secured around the entire circumference of pipe insulation. Bands must be "Setmark" as manufactured by Seton Nameplate Corp., or approved equal. Install bands on maximum 10 foot intervals and at each change of pipe direction.

2-13.0 Cleaning:

Equipment shall be wiped clean, with all traces of debris, dirt, dust and oil inside and out. Safety switch disconnects, enclosures, cabinets, etc. shall be clean inside and out.

2-14.0 Start Up Service:

A. Engage a factory-authorized service representative to perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.
2. Verify that refrigerant charge is sufficient and chiller has been leak tested.
3. Verify that pumps are installed and functional.
4. Verify that thermometers and gages are installed.
5. Operate chiller for run-in period.
6. Check bearing lubrication and oil levels.
7. Verify that refrigerant pressure relief device is vented outside.
8. Verify proper motor rotation.

9. Verify static deflection of vibration isolators, including deflection during chiller startup and shutdown.
 10. Verify and record performance of fluid flow and low-temperature interlocks for evaporator and condenser.
 11. Verify and record performance of chiller protection devices.
 12. Test and adjust controls and safeties. Replace damaged or malfunctioning controls and equipment.
- B. Inspect field-assembled components, equipment installation, and piping and electrical connections for proper assembly, installation, and connection.
- C. Prepare test and inspection startup reports.

2-15.0 Testing and Balancing and Documentation:

The organization performing the air and water balance shall be NEBB or TABB certified. Furnish a standard typewritten TAB report to the Resident Engineer for approval.

Procedures for Hydronic Systems:

A. Motors, 1/2 HP and Larger: Test at final balanced conditions and record the following data:

1. Manufacturer's name, model number, and serial number.
2. Motor horsepower rating.
3. Motor rpm.
4. Efficiency rating.
5. Nameplate and measured voltage, each phase.
6. Nameplate and measured amperage, each phase.
7. Starter thermal-protection-element rating.

B. Balance water flow through each evaporator and condenser to within specified tolerances of indicated flow with all pumps operating. With only one chiller operating in a multiple chiller installation, do not exceed the flow for the maximum tube velocity recommended by the chiller manufacturer.

Measure and record the following data with each chiller operating at design conditions:

1. Evaporator-water entering and leaving temperatures, pressure drop, and water flow.
2. For water-cooled chillers, condenser-water entering and leaving temperatures, pressure drop, and water flow.
3. Evaporator and condenser refrigerant temperatures and pressures, using instruments furnished by chiller manufacturer.
4. Power factor if factory-installed instrumentation is furnished for measuring kilowatts.
5. Kilowatt input if factory-installed instrumentation is furnished for measuring kilowatts.
6. Capacity: Calculate in tons of cooling.

Furnish a typewritten report documenting TAB data which must include the following:

A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.

1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing engineer.
2. Include a list of instruments used for procedures, along with proof of calibration.

B. Final Report Contents: In addition to certified field-report data, include the following:

1. Manufacturers' test data.
2. Field test reports prepared by system and equipment installers.
3. Other information relative to equipment performance; do not include Shop Drawings and product data.

C. General Report Data: In addition to form titles and entries, include the following data:

1. Title page.
2. Name and address of the TAB contractor.
3. Project name.
4. Project location.
5. Engineer's name and address.
6. Contractor's name and address.
7. Report date.
8. Signature of TAB supervisor who certifies the report.
9. Table of Contents with the total number of pages defined for each section of the report.
number each page in the report.
10. Summary of contents including the following:
 - a. Indicated versus final performance.
 - b. Notable characteristics of systems.
 - c. Description of system operation sequence if it varies from the Contract Documents.
11. Nomenclature sheets for each item of equipment.
12. Data for terminal units, including manufacturer's name, type, size, and fittings.
13. Notes to explain why certain final data in the body of reports vary from indicated values.

D. System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present each system with single-line diagram and include the following:

1. Water and steam flow rates.
2. Outlet and inlet sizes.
3. Pipe and valve sizes and locations.
4. Balancing stations.
5. Position of balancing devices.

2-16.0 Maintenance Equipment:

Supply the following equipment to the FAA for continued maintenance of the R-410A air conditioning equipment:

- Valve Manifold – Fieldpiece SM480V or an approved equal
- One R-410A 25lb cylinder – New and unused
- Spare fuses – one spare set consisting of the quantity and type of fuse in each safety switch

2-17.0 Instruction Manuals:

The contractor shall submit to the RE two (2) bounded copies of an instruction manual. This is to contain, but not limited to, installation instructions, operations and maintenance, replacement parts lists, sequence of operations descriptions, sizing and capacity data and guarantee information from the manufacturers. All supplied and installed equipment by the contractor shall contain the above.