

SECTION 23 3600 - AIR TERMINAL DEVICES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Fan-powered air terminal units/devices.
2. Shut off air terminal units/devices.
3. Dual duct terminal units/devices.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

B. [LEED Submittal:

- 1. Product Data for Prerequisite EQ 1: Documentation indicating that units comply with ASHRAE 62.1-2007, Section 5 - "Systems and Equipment."]**

C. Shop Drawings: For air terminal units. Include plans, elevations, sections, details, and attachments to other work.

D. Field quality-control reports.

E. Operation and maintenance data.

F. Northwestern University Maintenance Requirement Forms, see Division 01.

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1-2007, Section 5 - "Systems and Equipment" and Section 7 - "Construction and System Start-Up."

1.4 SPECIAL WARRANTIES

A. Five (5) years, see Division 01.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Subject to compliance with requirements, provide products by one of the following (see schedules for Basis of Design):

1. Nailor
2. Price
3. Titus
4. Tuttle and Bailey

2.2 TERMINAL UNIT WALL CONSTRUCTION FOR CRITICAL AREAS/AIR AND NON-CRITICAL AREAS/AIR

- A. For critical areas/air, all units to be double wall. For high humidity areas/air (which are also considered critical, units to be stainless steel (and this requirement for stainless steel for critical areas/air overrides any conflicting material requirements that may exist below). For non-critical areas/air, units can be double wall or single wall fiber free lined.

2.3 SERIES FAN-POWERED AIR TERMINAL UNITS

- A. Configuration: Volume-damper assembly and fan in series arrangement inside unit casing with control components inside a protective metal shroud for installation above a ceiling and in areas without a ceiling.

- B. Casing: **minimum 22 gauge** steel, single wall or double wall for non-critical areas/air, double wall for critical areas/air.

1. Casing Lining:

- a. Adhesive attached, 3/4" foil faced fibrous-glass insulation complying with ASTM C 1071, with a reinforced foil facing on the airstream side, and having a maximum flame/smoke index of 25/50, for both insulation and adhesive, when tested according to ASTM E 84.
- b. Elastomeric Closed Cell Foam Insulation is an acceptable alternate. Insulation must meet 25/50 flame/smoke index, and comply with antimicrobial performance of no observed growth per ASTM G-21

2. Air Inlets: Round stub connections or S-slip and drive connections for duct attachment.

3. Air Outlet: S-slip and drive connections.

4. Access: Removable top and bottom panels for access to parts requiring service, adjustment, or maintenance; with airtight gasket and quarter-turn latches.

5. Fan: Forward-curved centrifugal.

6. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1-2007.

- C. Volume Damper: Minimum 22 gauge steel with shaft rotating in self-lubricating bearings. Shaft shall be clearly marked on the end to indicate damper position.

1. Mechanical stop to prevent overstroking of damper.

2. The air valve leakage shall not exceed 1% of maximum inlet rated airflow at 3" W.G. inlet pressure.
- D. Velocity Sensors: Single axis sensor shall not be acceptable for duct diameters 6" or larger. Multiple pressure sensing points shall be utilized. The total pressure inputs shall be averaged using a pressure chamber located at the center of the sensor. Sensor shall have an error of plus or minus 5% or better.
- E. Motor:
1. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Division 23 Section "Common Motor Requirements for HVAC Equipment."
 2. Type: Electronically commutated motor.
 3. Fan-Motor Assembly Isolation: Rubber isolators.
 4. Efficiency: Premium efficient.
 5. Motor Speed: Variable, SCR controlled.
 6. Electrical Characteristics: as scheduled on drawings.
- F. Filters: Terminals shall include a 1" thick disposable MERV 7 polyester filter (spun fiberglass is not acceptable). Filter shall be secured with quick release clips, allowing removal without horizontal sliding.
- G. Hydronic Coils: Copper tube, with mechanically bonded aluminum fins spaced no closer than 0.1 inch, and rated for a minimum working pressure of 300 psig and a maximum entering-water temperature of 200 deg F. Include manual air vent and drain valve.**
- H. Control Panel Enclosure: Electrical components mounted in control box with removable cover and mounted on side of unit. Incorporate single-point electrical connection to power source.
1. Control Transformer: Factory mounted for control voltage on electric and electronic control units with terminal strip in control box for field wiring of thermostat and power source.
 2. Wiring Terminations: Fan and controls to terminal strip. Terminal lugs to match quantities, sizes, and materials of branch-circuit conductors. Enclose terminal lugs in terminal box that is sized according to NFPA 70.
 3. Disconnect Switch: Factory-mounted, fuse type.
- I. Direct Digital Controls : Single phase unitary controller and actuator as specified in Division 25.
- J. All boxes shall have a maximum NC (Rad.) as scheduled on drawings. If required provide attenuation to meet the NC level as scheduled.
- 2.4 PARALLEL FAN-POWERED AIR TERMINAL UNITS
- A. Configuration: Volume-damper assembly and fan in parallel arrangement inside unit casing with control components inside a protective metal shroud.
- B. Casing: [0.034-inch (0.85-mm) steel] [0.032-inch (0.8-mm) aluminum], single or double wall for non-critical areas/air, double wall for critical areas/air.**
1. **Casing Lining: Adhesive attached, [1/2-inch- (13-mm-)] [3/4-inch- (19-mm-)] [1-inch- (25-mm-)] thick, coated, fibrous-glass duct liner complying with**

ASTM C 1071, and having a maximum flame-spread index of 25 and a maximum smoke-developed index of 50, for both insulation and adhesive, when tested according to ASTM E 84.

- a. **Cover liner with nonporous foil.**
- b. **Cover liner with nonporous foil and perforated metal.**

- 2. Air Inlets: Round stub connections or S-slip and drive connections for duct attachment.
 - 3. Air Outlet: S-slip and drive connections.
 - 4. Access: Removable panels for access to parts requiring service, adjustment, or maintenance; with airtight gasket and quarter-turn latches.
 - 5. Fan: Forward-curved centrifugal, located at plenum air inlet.
 - 6. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1-2004.
- C. Volume Damper: Galvanized steel with flow-sensing ring and peripheral gasket and self-lubricating bearings.
- 1. Maximum Damper Leakage: ARI 880 rated, [2] [3] percent of nominal airflow at [**3-inch wg (750-Pa)**] [**6-inch wg (1500-Pa)**] inlet static pressure.
 - 2. Damper Position: Normally [**open**] [**closed**].
- D. Velocity Sensors: Multipoint array with velocity sensors in cold- and hot-deck air inlets and air outlets.
- E. Motor:
- 1. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Division 23 Section "Common Motor Requirements for HVAC Equipment."
 - 2. Type: [**Permanent-split capacitor with SCR for speed adjustment**] [**Electronically commutated motor**].
 - 3. Fan-Motor Assembly Isolation: Rubber isolators.
 - 4. Enclosure: [**Open dripproof**] [**Totally enclosed, fan cooled**] [**Totally enclosed, air over**] [**Open, externally ventilated**] [**Totally enclosed, nonventilated**] [**Severe duty**] [**Explosion proof**] [**Dust-ignition-proof machine**].
 - 5. Enclosure Materials: [**Cast iron**] [**Cast aluminum**] [**Rolled steel**].
 - 6. Motor Bearings: <Insert special requirements>.
 - 7. Unusual Service Conditions:
 - a. Ambient Temperature: <Insert deg F (deg C)>.
 - b. Altitude: <Insert feet (m)> above sea level.
 - c. High humidity.
 - d. <Insert conditions>.
 - 8. Efficiency: Premium efficient.
 - 9. NEMA Design: <Insert designation>.
 - 10. Service Factor: <Insert value>.
 - 11. Motor Speed: [**Single speed**] [**Multispeed**].
 - a. Speed Control: Infinitely adjustable with electronic controls.
 - 12. Electrical Characteristics: See schedules.

- F. Filters: Minimum arrestance according to ASHRAE 52.1 and a minimum efficiency reporting value (MERV) according to ASHRAE 52.2.
1. **Material: Polyurethane foam having 70 percent arrestance and 3 MERV.**
 2. **Material: Glass fiber treated with adhesive; having 80 percent arrestance and 5 MERV.**
 3. **Material: Pleated cotton-polyester media having 90 percent arrestance and 7 MERV.**
 4. **Thickness: [2 inches (50 mm)] [1 inch (25 mm)].**
- G. Attenuator Section: [0.034-inch (0.85-mm) steel] [0.032-inch (0.8-mm) aluminum] sheet.
1. **Lining: Adhesive attached, [1/2-inch- (13-mm-)] [3/4-inch- (19-mm-)] [1-inch- (25-mm-)] thick, coated, fibrous-glass duct liner complying with ASTM C 1071, and having a maximum flame-spread index of 25 and a maximum smoke-developed index of 50, for both insulation and adhesive, when tested according to ASTM E 84.**
 - a. **Cover liner with nonporous foil.**
 - b. **Cover liner with nonporous foil and perforated metal.**
 2. **Lining: Adhesive attached, 3/4-inch- (19-mm-) thick, polyurethane foam insulation complying with UL 181 erosion requirements, and having a maximum flame-spread index of 25 and a maximum smoke-developed index of 50, for both insulation and adhesive, when tested according to ASTM E 84.**
 3. **Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1-2004.**
- H. **Hydronic Coils: Copper tube, with mechanically bonded aluminum fins spaced no closer than 0.1 inch (2.5 mm), and rated for a minimum working pressure of 200 psig (1380 kPa) and a maximum entering-water temperature of 220 deg F (104 deg C). Include manual air vent and drain valve.**
1. **Location: Plenum air inlet.**
- I. **Electric-Resistance Heating Coils: Nickel-chromium heating wire, free of expansion noise and hum, mounted in ceramic inserts in a galvanized-steel housing; with primary automatic, and secondary manual, reset thermal cutouts. Terminate elements in stainless-steel, machine-staked terminals secured with stainless-steel hardware.**
1. **Location: Plenum air inlet.**
 2. **Stage(s): [1] [2] [3].**
 3. **Access door interlocked disconnect switch.**
 4. **Downstream air temperature sensor with local connection to override discharge-air temperature to not exceed a maximum temperature set point (adjustable.)**
 5. **Nickel chrome 80/20 heating elements.**
 6. **Airflow switch for proof of airflow.**
 7. **Fan interlock contacts.**
 8. **Fuses in terminal box for overcurrent protection (for coils more than 48 A).**
 9. **Mercury contactors.**
 10. **Magnetic contactor for each step of control (for three-phase coils).**
- J. **Factory-Mounted and -Wired Controls: Electrical components mounted in control box with removable cover. Incorporate single-point electrical connection to power source.**

1. **Control Transformer:** *Factory mounted for control voltage on electric and electronic control units with terminal strip in control box for field wiring of thermostat and power source.*
 2. **Wiring Terminations:** *Fan and controls to terminal strip. Terminal lugs to match quantities, sizes, and materials of branch-circuit conductors. Enclose terminal lugs in terminal box that is sized according to NFPA 70.*
 3. **Disconnect Switch:** *Factory-mounted, fuse type.*
- K. Control Panel Enclosure: NEMA 250, Type 1, with access panel sealed from airflow and mounted on side of unit.
- L. **Electric Controls:** *24-V damper actuator with wall-mounted electric thermostat and appropriate mounting hardware.*
- M. **Electronic Controls:** *Bidirectional damper operator and microprocessor-based controller with integral airflow transducer and room sensor. Control devices shall be compatible with temperature controls specified in Division 23 Section "Instrumentation and Control for HVAC" and shall have the following features:*
1. **Occupied and unoccupied operating mode.**
 2. **Remote reset of airflow or temperature set points.**
 3. **Adjusting and monitoring with portable terminal.**
 4. **Communication with temperature-control system specified in Division 25.**
- 2.5 SHUTOFF, SINGLE-DUCT AIR TERMINAL UNITS
- A. Configuration: Volume-damper assembly inside unit casing with control components inside a protective metal shroud.
- B. Casing: **minimum 22 gauge** steel, single wall or double wall for non-critical areas/air, double wall for critical areas/air.
1. Casing Lining:
 - a. Adhesive attached, 3/4" foil faced fibrous-glass insulation complying with ASTM C 1071, with a reinforced foil facing on the airstream side, and having a maximum flame/smoke index of 25/50, for both insulation and adhesive, when tested according to ASTM E 84.
 - b. Elastomeric Closed Cell Foam Insulation is an acceptable alternate. Insulation must meet 25/50 flame/smoke index, and comply with antimicrobial performance of no observed growth per ASTM G-21
 2. Air Inlet: Round stub connection or S-slip and drive connections for duct attachment.
 3. Air Outlet: S-slip and drive connections.
 4. Access: Removable panels for access to parts requiring service, adjustment, or maintenance; with airtight gasket.
 5. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1-2007.
- C. Velocity Sensors: Single axis sensor shall not be acceptable for duct diameters 6" or larger. Multiple pressure sensing points shall be utilized. The total pressure inputs shall be averaged using a pressure chamber located at the center of the sensor. Sensor shall have an error of plus or minus 5% or better.

- D. Volume Damper: Minimum 22 gauge steel with shaft rotating in self-lubricating bearings. Shaft shall be clearly marked on the end to indicate damper position.
1. Mechanical stop to prevent overstroking of damper.
 2. The air valve leakage shall not exceed 1% of maximum inlet rated airflow at 3" W.G. inlet pressure.
- E. Attenuator Section: **[0.034-inch (0.85-mm) steel] [0.032-inch (0.8-mm) aluminum]** sheet.
1. **Lining: Adhesive attached, [1/2-inch- (13-mm-)] [3/4-inch- (19-mm-)] [1-inch- (25-mm-)] thick, coated, fibrous-glass duct liner complying with ASTM C 1071, and having a maximum flame-spread index of 25 and a maximum smoke-developed index of 50, for both insulation and adhesive, when tested according to ASTM E 84.**
 - a. **Cover liner with nonporous foil.**
 - b. **Cover liner with nonporous foil and perforated metal.**
 2. **Lining: Adhesive attached, 3/4-inch- (19-mm-) thick, polyurethane foam insulation complying with UL 181 erosion requirements, and having a maximum flame-spread index of 25 and a maximum smoke-developed index of 50, for both insulation and adhesive, when tested according to ASTM E 84.**
 3. **Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1-2004.**
- F. **Hydronic Coils: Copper tube, with mechanically bonded aluminum fins spaced no closer than 0.1 inch, and rated for a minimum working pressure of 300 psig and a maximum entering-water temperature of 200 deg F. Include manual air vent and drain valve.**
- G. **Electric-Resistance Heating Coils: Nickel-chromium heating wire, free of expansion noise and hum, mounted in ceramic inserts in a galvanized-steel housing; with primary automatic, and secondary manual, reset thermal cutouts. Terminate elements in stainless-steel, machine-staked terminals secured with stainless-steel hardware.**
1. **Access door interlocked disconnect switch.**
 2. **Downstream air temperature sensor with local connection to override discharge-air temperature to not exceed a maximum temperature set point (adjustable.)**
 3. **Nickel chrome 80/20 heating elements.**
 4. **Airflow switch for proof of airflow.**
 5. **Fan interlock contacts.**
 6. **Fuses in terminal box for overcurrent protection (for coils more than 48 A).**
 7. **Mercury contactors.**
 8. **Magnetic contactor for each step of control (for three-phase coils).**
- H. **Electric Controls: Damper actuator and thermostat.**
1. **Damper Actuator: 24 V, powered closed, [spring return open] [powered open].**
 2. **Thermostat: Wall-mounted electronic type with clock display, temperature display in Fahrenheit and Celsius, and space temperature set point.**
- I. **Electronic Controls: Bidirectional damper operator and microprocessor-based thermostat with integral airflow transducer and room sensor. Control devices shall be compatible with temperature controls specified in Division 23 Section "Instrumentation and Control for HVAC" and shall have the following features:**

1. **Damper Actuator: 24 V, powered closed, [spring return open] [powered open].**
2. **Velocity Controller: Factory calibrated and field adjustable to minimum and maximum air volumes; shall maintain constant airflow dictated by thermostat within 5 percent of set point while compensating for inlet static-pressure variations up to 4-inch wg (1000 Pa); and shall have a multipoint velocity sensor at air inlet.**
3. **Thermostat: Wall-mounted electronic type with temperature set-point display in Fahrenheit and Celsius.**

2.6 DUAL DUCT AIR TERMINAL UNITS

- A. Configuration: **[Mixing] [and] [non-mixing]** with two volume dampers inside unit casing with mixing attenuator section and control components inside a protective metal shroud **[with a third primary air inlet with volume damper]**.
- B. Casing: **[0.040-inch- (1.0-mm-)] [0.034-inch- (0.85-mm-)]** <Insert dimension> thick galvanized steel, single wall or double wall for non-critical areas/air, double wall for critical areas/air.
1. **Casing Liner: Comply with requirements in "Casing Liner" Article for [fibrous-glass] [flexible elastomeric] duct liner.**
 2. Air Inlets: Round stub connections or S-slip and drive connections for duct attachment.
 3. Air Outlet: S-slip and drive connections.
 4. Access: Removable panels for access to parts requiring service, adjustment, or maintenance; with airtight gasket.
 5. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.
- C. Volume Damper: Galvanized steel with peripheral gasket and self-lubricating bearings.
1. Maximum Damper Leakage: AHRI 880 rated, 3 percent of nominal airflow at **[3-inch wg (750-Pa)] [6-inch wg (1500-Pa)]** inlet static pressure.
 2. Damper Position: Normally **[open] [closed]**.
- D. Velocity Sensors: Multipoint array with velocity sensors in air inlets and air outlets.
- E. Attenuator Section: **[0.034-inch (0.85-mm)]** galvanized steel **[0.032-inch (0.8-mm)]** aluminum sheet.
1. Attenuator Section Liner: Comply with requirements in "Casing Liner" Article for **[fibrous-glass] [flexible elastomeric]** duct liner.
 2. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.
- F. Multioutlet Attenuator Section: With **[two] [three] [four]** <Insert number> **[6-inch- (150-mm-)] [8-inch- (200-mm-)] [10-inch- (250-mm-)] [12-inch- (300-mm-)]** diameter collars, each with locking butterfly balancing damper.
1. Attenuator Section Liner: Comply with requirements in "Casing Liner" Article for **[fibrous-glass] [flexible elastomeric]** duct liner.
- G. **Control devices shall be compatible with temperature controls system specified in Division 25.**
1. **Electric Damper Actuator: 24 V, powered open, [spring] [capacitous] return.**

2. ***Pneumatic Damper Operator: [0- to 13-psig (0- to 90-kPa)] <Insert range> spring range.***
3. ***Electronic Damper Actuator: 24 V, powered open, [spring] [capacitous] return.***
4. ***Electric Thermostat: Wall-mounted electronic type with clock display, temperature display in Fahrenheit and Celsius, and space temperature set point.***
5. ***Pneumatic Thermostat: Wall-mounted pneumatic type with appropriate mounting hardware.***
6. ***Electronic Thermostat: Wall-mounted electronic type with temperature set-point display in Fahrenheit and Celsius.***
7. ***Pneumatic Velocity Controller: Factory calibrated and field adjustable to minimum and maximum air volumes; shall maintain constant airflow dictated by thermostat within 5 percent of set point while compensating for inlet static-pressure variations up to 4-inch wg (1000 Pa); and shall have a multipoint velocity sensor at air inlet.***
8. ***Electronic Velocity Controller: Factory calibrated and field adjustable to minimum and maximum air volumes; shall maintain constant airflow dictated by thermostat within 5 percent of set point while compensating for inlet static-pressure variations up to 4-inch wg (1000 Pa); and shall have a multipoint velocity sensor at air inlet.***
9. ***Terminal Unit Controller: Pressure-independent, VAV controller with electronic airflow transducer with multipoint velocity sensor at air inlet, factory calibrated to minimum and maximum air volumes, and having the following features:***

H. Control Sequence:

1. ***[System] [Room thermostat] modulates VAV damper and dual-duct damper.[Room sensor reports temperature.]***
2. ***When Space Temperature Is below Set Point: Close VAV damper, open hot-deck dampers and close cold-deck dampers, then open VAV damper.***
3. ***When Space Temperature Is above Set Point: Close VAV damper, close hot-deck dampers and open cold-deck dampers, then open VAV damper.***
4. ***Occupancy sensor reports occupancy and enables occupied temperature set point.***
5. ***Occupancy sensor switches set point from occupied setting to unoccupied setting.***

2.7 HANGERS AND SUPPORTS

- A. Hanger Rods for Noncorrosive Environments: Steel rods and nuts.
- B. Steel Cables: Galvanized steel complying with ASTM A 603.
- C. Steel Cable End Connections: Steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.
- D. Air Terminal Unit Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.
- E. Trapeze and Riser Supports: Steel shapes and plates for units with steel casings; aluminum for units with aluminum casings.

2.8 SOURCE QUALITY CONTROL

- A. Factory Tests: Test assembled air terminal units according to ARI 880.

1. Label each air terminal unit with plan number, nominal airflow, maximum and minimum factory-set airflows, and ARI certification seal.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install air terminal units according to NFPA 90A, "Standard for the Installation of Air Conditioning and Ventilating Systems."
- B. Install air terminal units level and plumb. Maintain sufficient clearance for normal service and maintenance.
- C. If boxes have coils, install duct access doors downstream of same per Section 23 3314.
- D. *Install boxes per the installation details on drawing XXXXX.***

3.2 HANGER AND SUPPORT INSTALLATION

- A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "Hangers and Supports."
- B. Building Attachments: Concrete inserts, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.
 1. Where practical, install concrete inserts before placing concrete.
 2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
 3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes and for slabs more than 4 inches (100 mm) thick.
 4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes and for slabs less than 4 inches (100 mm) thick.
- C. Hangers Exposed to View: Threaded rod and angle or channel supports.
- D. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.3 CONNECTIONS

- A. Install piping adjacent to air terminal unit to allow service and maintenance.
- B. Connect ducts to air terminal units according to Division 23 Section "Ductwork."
- C. Make connections to inlets of air terminal units with flexible connectors complying with requirements in Division 23 Section "Ductwork Specialties."

3.4 IDENTIFICATION

- A. Label each air terminal unit with plan number, nominal airflow, and maximum and minimum factory-set airflows. Comply with requirements in Division 23 Section "Mechanical Systems Identification" for equipment labels and warning signs and labels.

3.5 FIELD QUALITY CONTROL

- A. Perform Tests and Inspections:
1. After installing air terminal units and after electrical circuitry has been energized, test for compliance with requirements.
 2. **Leak Test: After installation, fill water coils and test for leaks. Repair leaks and retest until no leaks exist.**
 3. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
 4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- B. Air terminal unit will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.

3.6 STARTUP 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 inlet duct connections are as recommended by air terminal unit manufacturer to achieve proper performance.
 3. Verify that controls and control enclosure are accessible.
 4. Verify that control connections are complete.
 5. Verify that nameplate and identification tag are visible.
 6. Verify that controls respond to inputs as specified.

3.7 DEMONSTRATION

- A. Train Owner's maintenance personnel to adjust, operate, and maintain air terminal units.

END OF SECTION 23 3600

NORTHWESTERN UNIVERSITY
PROJECT NAME _____
JOB # _____

FOR: _____
ISSUED: 03/29/2017

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