

Direct Gas Fired [Make-Up Air / Displacement Ventilation / Space Heating] System

Note: Optional items and/or items requiring a choice, are shown between brackets and/or parentheses with selections separated by a forward slash, i.e.[a / b / c].

Part 1: GENERAL

1.1 Section Includes:

- A. Direct Gas-Fired Heaters
- B. Controls
- C. Equipment Schedule

1.2 Related Sections:

- A. Section 01655: Starting up mechanical systems
- B. Section 15070: Pipe and pipe fittings
- C. Section 15100: Valves
- D. Section 15120: Piping Specialties
- E. Section 15400: Plumbing System
- F. Section 15990: Testing, adjusting and balancing
- G. Section 16050: Basic electrical materials and methods

1.3 References:

- A. **American National Standards Institute (ANSI):** Establishes requirements applicable to certifying direct gas-fired heaters.
- B. **ETL Testing Laboratories:** Independent testing facility certifies standards conformance.
- C. **American Conference of Governmental Hygienists (ACGIH):** Establishes air quality standards.
- D. **Environmental Protection Agency (EPA):** Enforces outdoor air quality standards.
- E. **Occupational Safety & Health Administration (OSHA):** Enforces air quality standards and safety in the work place.
- F. **National Electric Code (NEC):** Establishes electrical standards.
- G. **Underwriters Laboratory (UL):** Independent testing facility certifies component conformance to appropriate standards.

- H. **National Fire Protection Agency (NFPA):** Establishes fire prevention standards.
- I. **Factory Mutual Insurance (FM):** Certifies gas manifold to owners insurance carrier.
- J. **Industrial Risk Insurance (IRI):** Certifies gas manifold to owners insurance carrier.
- K. **Sheet Metal & Air Conditioning Contractors National Association (SMACNA):** Covers sheet metal fabrication and insulation standards.

1.4 Quality Assurance:

Manufacturer shall:

- A. Provide direct gas-fired heater built in conformance to NFPA-54 and ETL/AGA design certified and listed to the [ANSI Z83.4b-2006 and CSA 3.7b-2006 standards (non-recirculating)] [Z83.18-2008b standards (recirculating)].
- B. Provide direct gas-fired heating equipment that does not exceed contaminant threshold limits for safe environment, as established by the ACGIH.
- C. Furnish proof, satisfactory to the owner (or its representative), of having manufactured temperature modulating direct gas-fired space heating systems for a minimum of 10 years.
- D. Make its facility available to owner or his representative for quality control audit without prior notification.

1.5 Submittals:

- A. Manufacturer shall submit product data, including dimensions, duct & service connections, accessories, controls with schematics and sequence of operation, electrical nameplate data, wiring diagrams, fan curves and burner & filter data.
- B. Manufacturer shall furnish rigging, assembly, and installation instructions.
- C. Manufacturer shall furnish Operation & Maintenance Manuals, including descriptive literature, operation instructions, maintenance and repair data, and parts listing.

2.1 Acceptable Manufacturer's:

AbsolutAire, Inc. (Kalamazoo, MI) (800) 804-4000

2.2 **Direct Gas-Fired Heaters:**

Manufacturer shall:

- A. Provide a direct gas-fired [Rooftop / Horizontal / Suspended / Upright] heater with [80%/20% Recirculation with variable OA/RA feature for building pressurization] [100% Outside Air {constant volume / variable volume / 2-speed}].
- B. Provide self-contained packaged heaters that shall include the casing, modulating burner, DWDI FC scrolled centrifugal fan, fan motor & drives, [mixing chamber; positive position variable outdoor air/return-air dampers]; [variable frequency drive capable of XX% supply air reduction] and automatic controls for temperature [and pressure].
- C. Provide a casing, which shall be a minimum 18-gauge, aluminized steel, (16-gauge on AA7 & AA8) welded to structural steel framing. Both interior and exterior structural steel shall be red-oxide primed. All exterior casing seams shall be weather resistant. All interior and exterior surfaces will be cleaned of all oil and grease. Painted exterior will consist of a high-quality prime coat and a finish coat of machine enamel with rust inhibitors. Color is selected by the owner. [All interior surfaces will be lined with 1-inch thick, 1-1/2 pound density, coated fiberglass when specified. The insulation shall comply with UL standard 181 for erosion and NFPA 90A for fire resistance. All exposed edges will be coated to eliminate erosion. Fiberglass will be held in place with both adhesive and welded pins, per SMACNA standards.] Provide a minimum of (2) hinged access doors with positive latching, watertight handles (not available on AA1700 or AA3000). All weather enclosure doors shall be painted on the interior as well as the exterior and shall include braces that lock the door open during servicing.
- D. **Burner:** shall be a direct-fired type gas burner which shall be [Maxon Model NP1LE or NP2LE / Midco Model HMA2 / Eclipse Model Ah-MA] specifically designed to burn natural or propane gas below the maximum non-contaminating levels required by OSHA and the ACGIH. Burner shall have non-clogging, stainless steel baffles attached to a cast aluminum gas supply section with no moving parts. The burner shall be capable of a 30-to-1 turndown ratio and be designed for 100% thermal efficiency for the life of the equipment. The outdoor air velocity across the burner shall be constant and at an air velocity required for ANSI certification. The burner air velocity shall be constant at all times throughout the operation of the heater. No air from the indoor space shall be allowed to recirculate across the burner at any time. Service of and access to the burner igniter and flame rod shall be accomplished through an access door or panel.
- E. **Burner Profile Adjustment System:** shall consist of a means to monitor and

adjust the pressure differential across the burner profile while the fan is running. The burner profile will remain fixed while in service and use.

F. **Pilot:** the direct fired burner will consist of a direct spark ignition system, including an ignition module, spark igniter, and flame rod to verify burner low fire (pilot) ignition before allowing the main gas valve to fully open.

G. **Supply fan:** shall be a double-width, double-inlet, centrifugal design, belt driven for the required air capacity. The motor shall be 1750 rpm, standard NEMA frame, [Open Drip Proof (ODP) / Totally Enclosed Fan Cooled (TEFC) / EPACT compliant / Premium Efficient] mounted on an adjustable pivot base. The motor shall have a 1.15 service factor, suitable for continuous service at 120° F ambient temperature, and shall be wired for the specified voltage. The fan, motor, and drive shall be factory tested to ensure the specified air delivery (per ANSI standards) at the design total static pressure. The fan shaft shall be connected to the motor by a V-belt drive, capacity designed for 30% over the motor nameplate horsepower. The fan shaft shall be a turned, ground and polished solid shaft. A protective coating shall be applied to the shaft to minimize oxidation. Fan shall have ball bearings, and shall be designed for a minimum L10 life of 100,000.

H. **Controls:**

(Choose “1” Analog, “2” UC-3 or “3” LX-4)

1) Analog Controls

1. **Main Control Panel:** shall be similar to NEMA 3R and contain all standard electrical components, such as [non] fused disconnect switch; motor starter; 120-volt and 24-volt transformers; control circuit fuses; flame control relay and a number-coded terminal strip. The control panel shall have a burner flame relay to lockout the flame in abnormal conditions. A remote flame reset button shall allow personnel to reset the burner at the remote control panel. The complete control and safety system as well as the burner and gas manifold shall be factory tested.

2. Temperature Controls:

i. Discharge Temperature Control:

A solid state temperature control system, located inside the control panel includes a sensing thermistor located in the supply fan discharge opening. The thermistor senses and controls discharge temperature. The temperature control for adjusting the discharge air temperature is located at [the main unit] [the remote panel].

ii. **Space Temperature Control:**

A solid-state temperature control system, located inside the control panel, shall have a sensing thermistor located in the space as shown on the plans. The thermistor senses and controls the room temperature in the occupied mode. A second thermistor, mounted in the heater discharge, controls the allowable maximum and minimum discharge temperature in response to the actual discharge temperature being sensed.

3. **Automatic Building Pressure Control [with Manual Override]:
(80% / 20% Recirculating Units)**

The heater shall incorporate a separate outdoor-air / return-air mixing chamber, containing two (2) sets of 16-gauge galvanized multi-blade dampers, interlinked to work opposite each other. Each damper shall control up to 80% of the total heater fan volume. These dampers shall provide a total outdoor air turndown ratio of 5- to-1 by a proportional control means as outlined herein. This damper control shall be through a manual (potentiometer control) or an automatic (building pressure sensitivity control) outdoor-air/return-air proportional adjustment control. An automatic pressure control, linked to the outdoor-air/return-air dampers, is used to sense the room pressure. This [diaphragm / photohelic] switch is mounted on the heater. The pressure sensing range shall be 0.01 to 0.20 with a null span of 0.02 to 0.03 inches water column. A manual/automatic selector override switch shall be provided to allow personnel to select manual or automatic control. A potentiometer shall be located inside the remote control panel for manual control.

4. **Remote Control Panel:** shall be provided and includes all necessary remote operating switches and circuit analyzer lights. The remote control panel shall be painted mild steel. Wiring to remote panel from the main control panel shall be accomplished with 120/1/60 and/or 24 volt wiring circuits.

The remote control panel shall provide each heater with the following (choose):

- i. a manual pressure-control potentiometer,
- ii. an occupied room temperature stat. (The stat room sensor shall be remote mounted where noted on the plan),
- iii. a room-temperature unoccupied cycle stat (the stat sensor remote shall be mounted where noted on the plan),
- iv. a programmable 7-Day time clock with a minimum of four (4) programmable on/off schedules per day, with battery back-up reserve.

- v. a burner alarm horn with silence switch,
- vi. a [tamper proof, key operated] Summer/Off/Winter switch,
- vii. a [tamper proof, key operated] remote burner-flame reset switch,
- viii. a [tamper proof, key operated] manual/auto building pressure selector switch and,
- ix. These system circuit analyzer lights:
 - 1. Power On
 - 2. Fan On
 - 3. Burner On
 - 4. Low Temperature Alarm

5. **Low-Temperature Limit Switch:** turns the fan motor off when cold air is being discharged from the heater. The minimum discharge temperature may be selected from 0°F to 70°F. An integral timer shall by-pass this switch for five (5) minutes on initial start-up.

2) DIRECT DIGITAL CONTROLS (DDC) {UC-3}

The DDC Control System will be a factory installed and tested open protocol Distech ECB Series Controller consisting of system compatible control boards, sensors and program logic necessary to provide the features described as follows.

- a. I/O Modules: Each I/O module shall have an LED status indication and be individually fused and replaceable.
- b. External Control Interface: Via a Building Management System (BMS), the equipment can be monitored or controlled remotely through the BACnet {MS/TP} {IP} connection.
- c. Information and Control Functions: Individual unit controllers shall be capable of communicating information to and receiving control instructions from a BMS. The following control functions and instructions shall be available:
 - i. Space Temperature set point for occupied and unoccupied periods
 - ii. Occupied and unoccupied 7-day scheduling with 5 special events per H&V unit.
 - iii. Building pressure set point, status, and control
 - iv. OA and RA damper set point, status and control {mixed air units only}
 - v. Variable Frequency Drive set point, status and control {variable volume units only}
 - vi. Humidity control enable/disable, set point and status (optional)
 - vii. Low temperature limit set point and shut down temperature and delay time
 - viii. Maximum and minimum discharge air set point
 - ix. Current discharge air temperature

- x. Current return air temperature {mixed air units only}
- xi. Current outside air temperature
- xii. Current mixed air temperature {mixed air units only}
- xiii. Error reporting display of the following system alarms:
 - 1) Outside Temperature Sensor Alarm
 - 2) Return Temperature Sensor Alarm {mixed air units only}
 - 3) Discharge Temperature Sensor Alarm
 - 4) Space Temperature Sensor Alarm
 - 5) Cooling Coil Temperature Sensor Alarm {cooling units only}
 - 6) Humidity Sensor Alarms {humidification control units only}
 - 7) OA/RA damper failure
 - 8) Low temperature limit shut down
 - 9) Digital I/O check
 - 10) Fan start up failure
 - 11) Clogged filter alarm
 - 12) Burner Lockout Alarm
 - 13) Burner Not Responding Alarm
 - 14) Burner Watchdog Alarm

- xiv. Human Machine Interface: When the unit controller(s) are connected with a CAT-5 communication cable per the manufacturer's instructions the following visual display and control features are available:
 - 1) Fan Status and Enable
 - 2) Burner Status
 - 3) Burner Demand Percentage
 - 4) Occupied/Unoccupied Status and Set Point
 - 5) Heat/Vent{/Cool} Mode(s)
 - 6) Space Temperature Set Point and Status
 - 7) Building Pressure Set Point and Status
 - 8) Manual Damper Set Point and Status
 - 9) VFD Speed Set Point and Status
 - 10) Outdoor air temperature
 - 11) Return air temperature {mixed air units only}
 - 12) Mixed air temperature {mixed air units only}
 - 13) Discharge temperature
 - 14) Cooling Coil temperature {cooling units only}
 - 15) Space temperature
 - 16) OA/RA damper position
 - 17) VFD command
 - 18) Filter status (clear/clogged)
 - 19) Optional customer designated points
 - 20) Flame relay reset

- 21) Low Temperature limit reset
- 22) System Alarms
- 23) Minimum discharge temperature
- 24) Maximum discharge temperature
- 25) Minimum economizer position
- 26) Maximum economizer position

The DDC controls shall be housed in a control enclosure that is lighted with a minimum 25-watt incandescent light bulb.

2. Temperature Control

{Space Temperature Control. A solid-state temperature control system, located inside the control panel, shall have a sensing RTD located in the space as shown on the plans. The RTD senses and controls the room temperature in the occupied mode. One RTD, mounted in the heater discharge, controls the maximum and minimum discharge air temperature in response to burner modulation}.

{Discharge Temperature Control. A solid-state temperature control system, located inside the control panel, shall have a sensing RTD located in the heater discharge. The RTD senses and controls the minimum and maximum discharge temperature based on the setting of the discharge temperature selector located at the remote-control panel}.

(Choose “3” for Mixed Air Units or “3a” for 100% OA Units)

3. {Automatic Building Pressure Control {with Manual Override}}

The heater shall incorporate a separate outdoor-air/return-air mixing chamber, containing two (2) sets of 16-gauge galvanized multi-blade dampers, interlinked to work opposite each other. Each damper shall control up to 85% of the total heater fan volume. These dampers shall provide a total outdoor air turndown ratio of 6.67 to 1 by proportional control means as outlined herein. Outdoor air {and return air} damper(s) will be controlled with a {manual potentiometer control} {automatic building pressure control}. {An automatic pressure transmitter, linked to the {outdoor air} {and return air} damper(s), is used to sense the difference between outdoor ambient and room pressure. The pressure transmitter is mounted in a control cabinet at the heater. The pressure-sensing range shall be - 0.10 to +0.10 in./wc. (Factory set at +0.02 in./wc.). {A manual/auto selection is provided to allow selection of manual or automatic pressure control. This manual control function is an option item at the remote-control panel.}}

3a. {Automatic Building Pressure Control {with Manual Override}}

The heater shall incorporate a Variable Frequency Drive (VFD) to control the speed of the supply fan motor. The supply fan motor will be controlled with a {manual potentiometer control} {automatic building pressure control}. {An automatic pressure transmitter, linked to the variable frequency drive is used to sense the difference between outdoor ambient and room pressure. The pressure transmitter is mounted in a control cabinet at the heater. The pressure sensing range shall be -0.10 to +0.10 in./wc. (Factory set at +0.02 in./wc.). {A manual/auto selection is provided to allow selection of manual or automatic pressure control. This manual control function is an option item at the remote-control panel.}}

3) DIRECT DIGITAL CONTROLS (DDC) {LX-4}

The DDC Control System will be a factory installed and tested open protocol Lynxpring EDGE534 Niagara Based Controller consisting of system compatible control boards, sensors and program logic necessary to provide the features described as follows.

- a. I/O Modules: Each I/O module shall have an LED status indication and be individually fused and replaceable.
- b. External Control Interface: Via a Building Management System (BMS), the equipment can be monitored or controlled remotely through the BACnet {MS/TP} {IP}, Modbus {TCP} {IP}, a Windows™ based computer via a CAT-5 cable or Touch Screen connection
- c. Information and Control Functions: Individual unit controllers shall be capable of communicating information to and receiving control instructions from a BMS/Computer/Touchscreen. The following control functions and instructions shall be available:
 - i. Space Temperature set point for occupied and unoccupied periods
 - ii. Occupied and unoccupied scheduling with up to 21 occupied periods per week, per H&V unit
 - iii. Building pressure set point, status, control and history
 - iv. OA and RA damper set point, status, control and history {mixed air units only}
 - v. Variable Frequency Drive set point, status, control and history {variable volume units only}
 - vi. Humidity control enable/disable, set point, status and history (optional)
 - vii. Low temperature limit set point and shut down temperature and delay time
 - viii. Maximum and minimum discharge air set point
 - ix. Current discharge air temperature and history
 - x. Current return air temperature and history {mixed air units only}
 - xi. Current outside air temperature and history

- xii. Current mixed air temperature and history {mixed air units only}
- xiii. Error reporting display of the following system alarms:
 - 1) Outside Temperature Sensor Alarm
 - 2) Return Temperature Sensor Alarm {mixed air units only}
 - 3) Discharge Temperature Sensor Alarm
 - 4) Space Temperature Sensor Alarm
 - 5) Cooling Coil Temperature Sensor Alarm {cooling units only}
 - 6) Humidity Sensor Alarms {humidification control units only}
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- xiv. Human Machine Interface: When the unit controller(s) are connected with a CAT-5 communication cable per the manufacturer's instructions the following visual display and control features are available:
 - 1) Fan Status and Enable
 - 2) Burner Status
 - 3) Burner Demand Percentage
 - 4) Occupied/Unoccupied Status and Set Point
 - 5) Heat/Vent{/Cool} Mode(s)
 - 6) Space Temperature Set Point and Status
 - 7) Building Pressure Set Point and Status
 - 8) Manual Damper Set Point and Status
 - 9) VFD Speed Set Point and Status
 - 10) Outdoor air temperature
 - 11) Return air temperature {mixed air units only}
 - 12) Mixed air temperature {mixed air units only}
 - 13) Discharge temperature
 - 14) Cooling Coil temperature {cooling units only}
 - 15) Space temperature
 - 16) OA/RA damper position
 - 17) VFD command
 - 18) Filter status (clear/clogged)
 - 19) Optional customer designated points
 - 20) Flame relay reset
 - 21) Low Temperature limit reset

- 22) System Alarms
- 23) Minimum discharge temperature
- 24) Maximum discharge temperature
- 25) Minimum economizer position
- 26) Maximum economizer position

The DDC controls shall be housed in a control enclosure that is lighted with a minimum 25-watt incandescent light bulb.

2. Temperature Control

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{Discharge Temperature Control. A solid-state temperature control system, located inside the control panel, shall have a sensing RTD located in the heater discharge. The RTD senses and controls the minimum and maximum discharge temperature based on the setting of the discharge temperature selector located at the remote-control panel}.

(Choose “3” for Mixed Air Units or “3a” for 100% OA Units)

3. {Automatic Building Pressure Control {with Manual Override}}

The heater shall incorporate a separate outdoor-air/return-air mixing chamber, containing two (2) sets of 16-gauge galvanized multi-blade dampers, interlinked to work opposite each other. Each damper shall control up to 85% of the total heater fan volume. These dampers shall provide a total outdoor air turndown ratio of 6.67 to 1 by proportional control means as outlined herein. Outdoor air {and return air} damper(s) will be controlled with a {manual potentiometer control} {automatic building pressure control}. {An automatic pressure transmitter, linked to the {outdoor air} {and return air} damper(s), is used to sense the difference between outdoor ambient and room pressure. The pressure transmitter is mounted in a control cabinet at the heater. The pressure-sensing range shall be -0.10 to +0.10 in./wc. (Factory set at +0.02 in./wc.). {A manual/auto selection is provided to allow selection of manual or automatic pressure control. This manual control function is an option item at the remote-control panel.}}

3a. {Automatic Building Pressure Control {with Manual Override}}

The heater shall incorporate a Variable Frequency Drive (VFD) to control the

speed of the supply fan motor. The supply fan motor will be controlled with a {manual potentiometer control} {automatic building pressure control}. {An automatic pressure transmitter, linked to the variable frequency drive is used to sense the difference between outdoor ambient and room pressure. The pressure transmitter is mounted in a control cabinet at the heater. The pressure sensing range shall be -0.10 to +0.10 in./wc. (Factory set at +0.02 in./wc.). {A manual/auto selection is provided to allow selection of manual or automatic pressure control. This manual control function is an option item at the remote-control panel.}

4. Optional DDC Items

5. **High-Temperature Limit Switch:** turns the burner off when the discharge air temperature exceeds 130°F. The switch must then be manually reset at the heater.
6. **Gas manifold:** shall be sized for the rated BTU (MBH) capacity as scheduled on the drawings. The gas manifold will be constructed in conformance to ANSI Standards [and Factory Mutual (FM) / Industrial Risk Insurers (IRI) insurance requirements].

2.3 **Accessories (select each optional accessory needed):**

Manufacturer shall (provide the following accessories):

- A. **High and Low Gas Pressure Switches:** this option includes a high gas-pressure switch located on the burner end of the gas manifold and shall turn the burner off when the gas pressure is too high. The maximum gas-pressure range will be from 3" to 21" W.C. This is factory set at 1.5" W.C. above the high fire gas pressure. Also included with this option is a low gas-pressure switch located on the inlet end of the manifold. The low gas switch shall turn the burner off when the gas pressure is too low. The minimum gas pressure range will be from 3" to 21" W.C. This switch shall be factory set at 3.0" W.C.
- B. **Filtered Inlet Hood:** this option includes filters accessible from the inlet hood face. Filters are a [1" / 2"] aluminum mesh washable filter. [Provide a clogged filter warning (light / alarm / photohelic gauge) at the main (remote) control panel].
- C. **Inlet Hood with Bird Screen:** manufactured using the same gauge and metal type as the base unit and includes ½" x ½" galv. bird screen.
- D. **Side Access Filter Section:** manufactured using the same gauge and metal type as the base unit and is field attached at the unit inlet (entering air) end. [All interior surfaces will be lined with 1-inch thick, 1-1/2 pound density, coated

fiberglass when specified. The insulation shall comply with UL standard 181 for erosion and NFPA 90A for fire resistance. All exposed edges will be coated to eliminate erosion. Fiberglass will be held in place with both adhesive and welded pins, per SMACNA standards.] Filters are to be [{"1" / 2"}] aluminum mesh washable / 2" 30% pleated/disposable / 1-1/2" polyester media filter with and internal galvanized frame]. [Provide a clogged filter warning (light / alarm / photohelic gauge) at the main (remote) control panel]. Filters are UL Class 2.

- E. **Variable Frequency Drive:** variable volume 100% OA models includes an automatic building pressure control, a variable frequency drive (VFD) for supply fan speed control and a burner profile damper with a pressure differential switch to control and maintain the proper burner airflow across the burner profile. Includes a building pressure differential switch to signal the VFD to vary fan speed as needed in response to the building negative or positive conditions. This diaphragm [photohelic] switch is mounted in the heater main control panel. The pressure sensing range shall be 0.01 to 0.20" W.C. with a null span of 0.01 to 0.03 inches water column.

- F. **Roof Curb (horizontal units):** provide a [full-perimeter curb / duct supply-air curb], 20" high [flat, pitched] curb, formed of heavy-gauge aluminized steel. Contractor shall shim the curb so that it is level and shall install a cant strip and wood nailer per detail on the plans. [Manufacturer to provide {1" foil face fiberglass} {1" therma-fiber} insulation on curb interior, glued and pinned as required.] [Manufacturer to provide 1" wood-nailer and cant strip.]

- G. **Motorized [Inlet / Discharge] Damper:** a parallel blade [low leak] [spring return] damper is provided in a flange assembly shipped loose for field installation by others. Includes a 24-volt direct coupled actuator with a pre-wired cable.

- H. **Gravity [Inlet / Discharge] Damper:** a parallel blade damper is provided in a flange assembly which is shipped loose for field installation by others. Damper blades are constructed of fabricated aluminum and have adjustable weights for balancing.

- I. **Service Platform:** unit shall be furnished with a service platform, running the full length (width) of the heater, which shall be constructed of corrosion resistant 16-gauge multi-grip floor plate with an OSHA-approved handrail and steel safety chains at each end.

- J. **Vibration Isolators:** shall consist of a steel housing and an isolation element, molded entirely of a colored oil-resistant neoprene stock for easy identification of capacity. The hangers shall have a deflection of 1/4" or less and will be supplied by the heater manufacturer.

- K. **Discharge Splash Plate (where noted on plans):** shall be provided with

heaters, as shown on the plans. These plates are to be constructed of 16-gauge corrosion resistant steel, reinforced with angle iron, painted by the manufacturer. Contractor shall supply all necessary hanger rods and shall install discharge plate in accordance with manufacturer's recommendations.

- L. **Discharge Diffuser:** shall be provided and will include horizontal [and vertical] blades. The diffuser will be constructed such that it discharges supply air in 3 [4] directions and will be constructed of a minimum of 16-gauge aluminized steel. The directional blades will be 14-gauge aluminized steel and will be field adjustable and are able to be locked into place. [4-way discharge heads shall be provided with insulation (1"-1-1/2#) installed on the interior floor area for noise reduction].

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