Section 15700 (CSI 23 74 33) **I-Series** (06/18/09)
Indirect-Fired Heating & Ventilating

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

Part 1: GENERAL

1.1 Section Includes:

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

1.2 Related Sections:

A. Section 01655: Starting up mechanical system
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 indirect gas-fired heaters in the USA.

B. **Canadian Standards Association (C.S.A.):** Establishes requirements applicable to certifying indirect gas-fired heaters in Canada.

C. **ETL Testing Laboratories**: Independent testing facility certifies standards conformance.

D. **Occupational Safety & Health Administration (OSHA)**: Enforces air quality standards and safety in the work place.

E. **National Electric Code (NEC)**: Establishes electrical standards.

F. **Underwriters Laboratory (UL)**: Independent testing facility certifies component conformance to appropriate standards.

G. **National Fire Protection Agency (NFPA)**: Establishes fire prevention standards.

H. **Factory Mutual Insurance (FM)**: Certifies gas manifold to owners insurance carrier.

I. **Sheet Metal & Air Conditioning Contractors National Association (SMACNA):** Covers sheet metal fabrication and insulation standards.

1.4 Quality Assurance:

Manufacturer shall:

A. Provide indirect gas-fired heating equipment built in conformance to NFPA-54 with duct furnace section(s) certified to C.S.A. design certification for use in both the U.S. and Canada to the ANSI Z83.8 – latest revision, standard for "Gas Unit Heater and Gas-Fired Duct Furnaces" for safe operation, construction, and performance.

B. Furnish proof, satisfactory to the owner or his representative, of having manufactured gas-fired space heating systems for a minimum of 10 years.

C. 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 Manufacturers:

AbsolutAire, Inc. (Kalamazoo, MI) (269) 382-1875

2.2 Indirect-Fired Heaters:

A. Manufacturer shall provide an indirect gas-fired [indoor / outdoor] horizontal heater with [(O) 100% OA / (B) 2-Position OA/RA / (F) Fixed OA/RA / (M) Modulating OA/RA / (R) 100% RA / (V) 100% OA Variable Volume] capability.

B. **Unit Casing:** shall be a minimum 18 gauge [aluminized / galvanized] steel. All exterior casing seams shall be 100% weather-tight. All interior and exterior surfaces will be cleaned of all oil & grease and painted exterior will consist of a high-quality catalyzed primer coat and a finish coat of machine enamel with rust inhibitors. Color selected by owner.

C. **Furnace(s) section:** with 80% minimum efficiency, provided by an indirect-fired heat exchanger with dimpled tube pattern for efficient heat transfer.

a. ***Venting Arrangements:***

i. **Gravity Outdoor (GO) Vented:** the venting shall be a gravity vented arrangement with a combination combustion air / exhaust vent cap that minimizes the pressure differential between the inlet and exhaust of the venting

system. This pressure differential shall reduce the burner flame disturbance to insure proper ignition when the unit is subjected to 40 mile per hour wind velocities. The cap shall prevent rain from entering the unit through the use of combustion air inlet louvers at a minimum of 6 inches from the unit roof.

ii. **Power Outdoor (PO) Vented:** the unit shall be a power exhausted arrangement. The unit shall be tested to insure proper ignition when the unit is subjected to 40 mile per hour wind velocities.

iii. **Gravity Indoor (GI) Vented**: the unit shall be gravity vented arrangement with a 45° angled round vent connection to allow for tighter installation to duct system components. The unit shall have a field installed power vent kit and vent piping provided by others.

iv. **Power Indoor (PI) Vented:** the unit shall be a power vented with side vent connection access. Vent piping to outside provided by others.

v. **Separated Combustion Indoor (SI) Vented:** the unit casing shall be designed for the venting/combustion air arrangement to be separated from room atmosphere. The unit shall have a factory mounted power exhauster enclosed in the unit casing to prevent the motor from being subjected to room atmosphere. The unit shall also include a factory mounted differential pressure switch designed to prevent pilot and main burner ignition until positive venting has been proven. A removable gasketed door shall contain both the vent and combustion air connection collars to allow for servicing of the power exhauster. Vent piping to outside provided by others.

b. The heat exchanger(s) shall be made of 20 gauge aluminized steel tubes and headers (optional 20 gauge 409 stainless steel tubes and headers).

c. The thermal efficiency of the unit(s) shall be a minimum of 80% efficient for all air flow ranges. The restrictor shall be sized to maintain the unit(s) efficiency of 80% in the temperature range of 20°F-60°F or 20°F-100°F.

d. Each heat exchanger tube shall be individually and directly flame-fired. The heat exchanger tube shall be contoured and dimpled to provide efficient heat transfer and crimped to allow for thermal expansion and contraction. The flue collector box shall be made of 20 gauge aluminized steel.

e. The heat exchanger(s) seams and duct connections shall be certified to withstand 3.0" W.C. external static pressure without burner flame disturbance.

f. The burner(s) shall be made of the same material as the heat exchanger with a thickness of not less than 28 gauge. Burner(s) shall have non-clogging, slotted ports with a stainless steel separator strip designed for good lighting characteristics without noise of extinction for both natural and propane gas. The burner(s) shall be located for service removal without disconnecting the main gas supply piping.

g. The bottom of the unit shall be angled for draining any condensation to the corners of the unit. The condensation shall be removed through openings in the bottom pan. The drain pan shall be constructed of 20 gauge aluminized steel (opt 409 stainless steel).

h. The gas manifold(s) piping shall allow for a gas piping connection on the side of the unit for slab mounted units and through the unit bottom for roof curb mounted or suspended units. The manifold(s) shall include a ground joint union for ease of servicing of the orifices without removing the burner assembly or main gas valve string.

i. The orifices shall be provided for both natural and propane gas with adjustable air shutters for controlling the primary air mixture.

    i. The ignition control(s) shall be standing pilot for [natural / propane] gas.

    ii. The ignition controller(s) shall be 100% shut-off with continuous retry for [natural / propane] gas.

j. The gas pressure shall be between 6-7" W.C for natural gas.

k. (opt) The gas pressure shall be 11-14" W.C. for propane gas.

l. The solid state ignition system shall intermittently light the pilot each time the system is energized. Once the pilot is proven, the main gas valve shall open and allow gas flow to the main burner.

m. The unit gas controls shall be provided with the following:

    i. Single-stage gas controls with a single-stage combination gas control, an ignition control, and a single-stage low voltage thermostat. The unit fires at 100% full fire based on a call for heat from a space thermostat.

    ii. (opt) Two-stage gas controls with a two-stage combination gas control, an ignition control, and a two-stage low voltage thermostat. The unit fires at 50% fire on low stage or 100% fire on high stage of the unit based on the call for heat from either a space or duct thermostat.

    iii. (opt) Mechanical modulation gas controls with a mechanical modulating gas control and an ignition control. The discharge air temperature is maintained by setting the non-electric control dial of the modulating gas valve in one of ten positions ranging from Lo to Hi. A hydrostatic sensing bulb that is mechanically attached to the modulating gas valve is factory installed in the discharge air stream and modulates the gas flow. Modulation occurs between 40% through 100% full fire. When the discharge air hydrostatic sensing bulb is satisfied, the modulating valve closes completely. The hydrostatic sensing bulb is included with the system. Because this control is non-electric, it cannot be used with a space override thermostat.

    iv. (opt) Electronic modulation gas controls with an electronic modulating / regulating gas control, combination gas valve, an ignition control, modulating

amplifier, and either a modulating space thermostat or modulating duct thermostat with remote temperature set point adjuster. The thermostat can modulate the system gas flow between 40% through 100% full fire. The firing rate shall be controlled by a:

1. (opt) duct sensor with remote temperature adjuster.
2. (opt) duct sensor with remote temperature adjuster and room override thermostat.
3. (opt) space thermostat.

v. (opt) Electronic Modulation Master gas controls with an electronic modulating/ regulating gas control, combination gas valve, an ignition control, modulating amplifier and either a modulating room thermostat or modulating duct thermostat with remote temperature set point adjuster. The thermostat can modulate the gas flow between 40% through 100% full fire. Allows one duct sensing thermostat to control the firing rate of the Master duct furnace and up to three Slave duct furnaces. The Master furnace sends a signal to all of the gas valves so that they modulate at the same percentage. When the thermostat is satisfied, the amplifier cuts power to the combination gas valves of the Master unit and all Slave units which prevents gas flow to both the main an pilot burners. The firing rate shall be controlled by a:

1. (opt) duct sensor with remote temperature adjuster.
2. (opt) duct sensor with remote temperature adjuster and space override thermostat.
3. (opt) space thermostat.

vi. (opt) Electronic Modulation Slave gas controls with an electronic modulating/regulating gas control, combination gas valve, and an ignition control, but does not include a modulating amplifier and does not require a discharge air thermostat. The modulating gas valve receives the modulation percentage from the Master duct furnace. Up to three Slave duct furnaces can be connected to one Master unit.

vii. (opt) Electronic Modulation - 0-10 Vdc External Input. Allows for control of the duct furnace firing rate by a Building Management System (BMS). Utilizes an electronic modulating/regulating gas control, combination gas valve, an ignition control, modulating signal conditioner, and an inverted 0-10 Vdc input signal provided by a BMS (0 Vdc being high fire and 10 Vdc being low fire). The gas controls can modulate the gas flow between 40% and 100% full fire. When the BMS thermostat (supplied by others) is satisfied, the BMS heat contact (supplied by others) opens to cut power to the combination gas valve which prevents gas flow to both the main and pilot burners.

viii. (opt) Electronic Modulation - 4-20 mA External Input. Allows for control of the duct furnace firing rate by a Building Management System (BMS). Utilizes an electronic modulating/regulating gas control, combination gas valve, an ignition control, modulating signal conditioner, and an inverted 4-20 mA input signal provided by a BMS (4 mA being high fire and 20 mA being low fire). The gas

controls can modulate the gas flow between 40% and 100% full fire. When the BMS thermostat (supplied by others) is satisfied, the BMS heat contact (supplied by others) opens to cut power to the combination gas valve which prevents gas flow to both the main and pilot burners.

n. A 1/8" manifold pressure tap shall be located after all valves to test the manifold pressure directly before the main burner orifices.

o. The unit shall be provided with a single gas control transformer to step down the supply voltage to 24V.

p. Separate line voltage and low voltage terminal strips shall be provided to prevent the unit from being mis-wired for premium unit and low voltage terminals for standard units.

q. Automatic reset high limit switch (optional manual reset high limit switch).

r. Provide the following factory installed options:

i. (opt) A low gas pressure switch(s) prevents the burner from firing if the inlet gas pressure is below the minimum gas pressure.

ii. (opt) A high gas pressure switch(s) which prevents the burner from firing if the manifold gas pressure is above the maximum manifold gas pressure.

iii. (opt) An air flow proving switch shall be an adjustable differential pressure switch to insure air flow across the heat exchanger before allowing the gas controls to be energized.

iv. (opt) A timed freeze protection discharge air thermostat used to prevent building freeze up in the event of a burner failure. The timer shall be adjustable from 1 to 5 minutes.

v. (opt) A manual reset supply air fire stat shall shut the system down if the temperature at the limit switch location exceeds 200°F.

vi. (opt) A time delay relay which delays the start of the blower to allow the heat exchanger a warm-up period after a call for heat. The time delay relay shall also continue the blower operation after the thermostat has been satisfied to remove any residual heat on the heat exchanger.

D. **Supply blower and motor section:** containing a single supply blower & motor that is supported from the bottom to prevent the blower flanges supporting the weight of the motor. The blower, motor, and drive package shall be isolated with (standard) rubber-type grommet vibration isolators (optional rubber-in-shear or spring). The isolators will be installed by the manufacturer for blower and motor isolation from the unit housing. The isolator design shall be deflection specific for the blower and motor load. Includes a flexible gasket connection between the fan housing discharge and the unit supply air opening.

a. The supply blower shall be a double-width, double-inlet, centrifugal design, belt driven for the required air capacity with:

   i. Spider ball bearings.
   ii. (opt) Heavy duty, pillow block ball bearings.
   iii. (opt) extended grease lines which include external zerk fittings for applying grease.

b. The motor type shall be:

   i. Single-speed, open drip proof (ODP)
   ii. Single-speed, totally enclosed fan cooled (TEFC)
   iii. Single-speed, ODP, high efficiency
   iv. Single-speed, TEFC, high efficiency
   v. Variable-speed, Inverter Capable ODP, high efficiency
   vi. Variable-speed, Inverter Capable TEFC, high efficiency
   vii. Two-speed, ODP, 1800/900 rpm
   viii. Two-speed, ODP, 1800/1200 rpm
   ix. Two-speed, TEFC, 1800/900 rpm
   x. Two-speed, TEFC, 1800/1200 rpm

c. The motor shall be rated for:

   i. 115V / 1 Ph / 60 Hz
   ii. 208V / 1 Ph / 60 Hz
   iii. 230V / 1 Ph / 60 Hz
   iv. 208V / 3 Ph / 60 Hz
   v. 230V / 3 Ph / 60 Hz
   vi. 460V / 3 Ph / 60 Hz
   vii. 575V / 3 Ph / 60 Hz

d. The motor shall be provided with an adjustable motor sheave to allow for minor adjustment of the blower rpm at the job site.

e. The motor shall have a 1.30 service factor, suitable for continuous service at 120° F ambient temperature, and shall be wired for the specified voltage, as well as be controlled by a time delay relay and:

   i. Motor starter w/overload protection
   ii. (opt) Variable frequency drive (vfd)

f. The blower, motor, and drive shall be factory tested to ensure the specified air delivery (per ANSI) at the design total static pressure. The blower shaft shall be connected to the motor shaft by a V-belt drive, capacity designed for 30% over the motor nameplate horsepower. The blower shaft shall be a turned, ground and polished solid shaft. A protective coating shall be applied to the shaft to minimize oxidation. Blower shall have ball bearings, and shall be designed for a minimum L10 life of 100,000 hours.

E. **Access door panels:** shall consist of positive latching lift out type, with rustproof handles, hardware, and full gasket.

F. **Controls:**

a. **Main control panel** shall be NEMA 3R and contain all standard electrical components, [non] fused disconnect switch, motor starter, 120-volt and/or 24-volt control transformers, control circuit fuses, color coded wires, and an ignition module to lockout the flame in abnormal conditions. The complete control and safety system as well as the burner and gas manifold shall be factory tested prior to shipment.

b. **Temperature Controls** shall be a solid-state system located in the main control panel. It shall have a sensor located in the supply air stream which controls the supply air temperature (maximum and minimum) in response to heating requirements.

c. **Remote Control Panel** shall be provided and includes a summer-off-winter switch, a fan on indicator light, and a heat on indicator light. The unit serial number and customer tag number will be on the panel face. The following optional items are included which are specific to this application and specification:

i. (opt) Discharge temperature set point dial
ii. (opt) Space temperature set point dial
iii. (opt) Unoccupied space temperature set point dial
iv. (opt) Mechanical [electronic programmable] 7-day time clock
v. (opt) A remote manual positioner for controlling the percentage of fresh and return air on units provided with modulating damper actuators.
vi. (opt) Low temperature alarm light
vii. (opt) Dirty filter light [and/or alarm horn]

d. **High Temperature Limit Switch** turns the burner off when the discharge air temperature exceeds 150° F. This switch must then be manually reset at the heater.

2.3 Optional Accessories (select accessories as desired):

A. **Dampers:** all motorized inlet or discharge dampers shall be Vent Products (or equal) model # 5102-12 with 14 gauge galvanized press formed steel with welded corners frame, 16 gauge galvanized steel with press formed damper blades, and nylon bearings/bushings. Dampers to be rated for a maximum temperature of 250°F and maximum velocity of 2,000 feet per minute (FPM). Dampers to also include:

a. (opt) Blade edge seals (max 200°F)
b. (opt) Spring stainless steel side seals
c. (opt) Stainless steel bearings/bushings
d. (opt) Stainless steel construction

The damper actuator shall be Belimo (or equal) mounted directly to the shaft of the outside air (OA) damper. If return air (RA) dampers are provided, a damper linkage rod may be provided to set the positions of the opposite dampers (varies - based on square footage of damper).

B. **Discharge/Supply Air Plenum:** provide a section at the unit discharge for downward, upward, or side discharge of the supply air.

C. **Inlet Hood:** provide a "knock-down" or field-assembled inlet hood with:

   a. (opt) Expanded Metal Bird Screen
   b. (opt) Flat-bank Aluminum Washable Filters
   c. (opt) Drainable Blade Louver

D. **Filters:** Provide [1" / 2"] [aluminum washable / 30% pleated disposable] filters, accessible at the [inlet hood / side access filter section]. [Provide a clogged filter warning (light / alarm / photohelic gauge) at the main (remote) control panel].

E. **Insulation:** all interior surfaces will be lined with 1 inch thick, 1-1/2 pound density [thermafiber / foil-face] fiberglass insulation. The insulation shall comply with UL standard 181 for erosion and NFPA 90A for fire resistance and will be held in place with [weld pins / adhesive]. **PLEASE NOTE:** entire unit, excluding duct furnace section, can have optional insulation added, as manufacturer of duct-furnace section does not offer insulation as an option.

F. **Roof Curb:** Each heater shall have a full-perimeter, 20" high curb, formed of minimum 18-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. Roof curb to ship knocked-down, for field assembly by installing contractor.

G. **Service Platforms**: Heater shall be furnished with a service platform, running the full length of the unit, which shall be constructed of corrosion resistant 16-gauge multi-grip floor plate with an OSHA-compliant handrail and steel safety chains at each end.

H. **Vibration Isolators (for indoor suspended units):** 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. Structural steel channels shall support the heater and service platform as one. Hangers and miscellaneous hardware will be sized & furnished by the installing contractor.

I. **Discharge Splash Plates:** Discharge plates 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.

J. **Discharge Heads:** Manufacturer shall provide double deflection, 180 degree or 360 degree discharge head(s), as detailed on the planes. The head shall be constructed of a minimum of 18-gauge aluminized steel. Adjustable, locking, double deflection blades will be provided to control direction of airflow, both vertically and horizontally. Each discharge head will be properly cleaned and then prime and finish coat painted to match the unit color. 360 degree discharge heads shall be provided with insulation (1", 1-1/2#) installed on the interior floor area for noise reduction.

K. **EVR (recirculating) or EVN (non-recirculating) Evaporative Coolers:**

a. The evaporative unit shall be provided with:

i. 6" Munters CELdek® media
ii. (opt) 6" Munters GLASdek® media
iii. (opt) 12" Munters CELdek® media
iv. (opt) 12" Munters GLASdek® media

b. The casing of the evaporative cooler shall be minimum 18 gauge [aluminized / galvanized] steel. All exterior casing seams shall be 100% weather-tight. All interior and exterior surfaces will be cleaned of all oil & grease and painted exterior will consist of a high-quality catalyzed primer coat and a finish coat of machine enamel with rust inhibitors. Color selected by owner.

c. A pitched water sump / drain pan shall be minimum 18 gauge 304 stainless steel.

d. (opt) [1" / 2"] [pleated / aluminum washable] pre-filter

e. (opt) Flow meter

f. (opt) Fan-run timing sequence

g. (opt) Humidity controls

h. The EVN (non-recirculating) evaporative cooler will be provided with the following:

i. PVC water distribution piping (optional copper piping)
ii. Water spray/distribution nozzles
iii. Freeze protection
iv. Moisture sensor
v. Belimo (or equal) internal water control valve

i. The EVR (recirculating) evaporative cooler will be provided with the following:

i. The pump motor shall have internal thermal overload protection.
ii. A step down transformer for the pump motor.
iii. A float switch, to prevent the pump motor from operating if the water level in the reservoir is below the switch.
iv. A single stage duct thermostat to control the operation of the pump motor.

v. (opt) A manually operated remote fill and drain kit to fill the water reservoir when the unit is in cooling mode. When not in operation, the water shall be drained to prevent the recirculation of stagnant water.
vi. (opt) A manually operated remote fill and drain kit with freeze protection to fill the water reservoir when the unit is in cooling mode. When not in cooling mode, the water shall be drained to prevent the recirculation of stagnant water. The freeze thermostat shall prevent the evaporative cooler from filling when the outside air temperature is below the set point.

vii. (opt) An automatic fill and drain kit to fill the water reservoir, controlled by a time clock, when the unit is in cooling mode. When not in cooling mode, the water shall be drained to prevent the recirculation of stagnant water.

viii. (opt) An automatic fill and drain kit with freeze protection to fill the water reservoir, controlled by a time clock, when the unit is in cooling mode. When not in cooling mode, the water shall be drained to prevent the recirculation of stagnant water. The freeze thermostat shall prevent the evaporative cooler from filling when the outside air temperature is below the set point.

L. Accessory Control Devices:

a. A mild temperature thermostat used to automatically lock out the gas controls when the outdoor temperature reaches the desired set point.

b. A low profile duct style photo-electronic smoke detector with two DPDT contacts.

c. A smoke detector tube extension for duct widths between:

i. (opt) 1 to 2 feet.

ii. (opt) 2 to 4 feet.

iii. (opt) 4 to 8 feet.

d. A [1-5 / 5-25] psi gas pressure regulator to reduce the inlet gas pressure for the operating controls.