ROBERTS GORDON

Combat® DF-Series

Direct-Fired Heating, Cooling and Pressurization Systems

Equipment Specifications

1.800.828.7450

www.rg-inc.com

INTERTEK ETL LISTED C US

CANADA: 100% OUTSIDE AIR ONLY

PART 1 GENERAL

Please note: Brackets indicate required choices to be made in preparation of the final specification.
Provide units with gas-fired heating and ventilating sections, designed and manufactured for indoor or outdoor installation. Units shall be packaged air handlers which include casing, modulating burner, and non-overloading fan. Fixed Recirculation (FR) and Air Managment (AM) configurations also include a mixing chamber and positive position [fixed][modulating] return air dampers.

1.1 SECTION INCLUDES

A. Direct-fired air handler

B. Controls

1.2 REFERENCES

A. American National Standards Institute (ANSI): Establishes requirements applicable to certifying direct gas-fired heaters.

1. MUA, VAV Models: Standard Z83.4: Non-Recirculating Direct Gas-Fired Industrial Air Heaters
2. AM, FR Models: Standard Z83.18: Recirculating Direct Gas-Fired Industrial Air Heaters

B. American Society for Testing Materials (ASTM): Establishes standards for materials, products, systems and services.

1. Standard A653/653M: Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot Dip Process

C. ETL Testing Laboratories, Inc. (ETL): Nationally recognized testing laboratory certifies code conformance.

1. Requirements applicable to product labeling and listing in the Directory of ETL Listed Products.

D. Factory Mutual Insurance (FM): Ensures compliance of gas manifold to owner's insurance carrier.

E. XL Insurance (formerly IRI): Ensures compliance of gas manifold to owner's insurance carrier.

F. National Electrical Manufacturers Association (NEMA): Establishes technical standards for the electroindustry.

1. Standard 250: Enclosures for Electrical Equipment (1000 V Maximum)

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

1. Article 54: National Fuel Gas Code
2. Article 70: National Electric Code
3. Article 90A: Installation of Air Conditioning and Ventilating Systems

H. National Roofing Contractors Association (NRCA): Establishes best practices for the roofing industry.

1. The NRCA Roofing and Waterproofing Manual, Second Edition

I. Occupational Safety and Health Administration (OSHA): Enforces air quality standards and safety in the workplace.

J. Underwriters Laboratories, Inc. (UL): Nationally recognized testing laboratory certifies code conformance, product labeling and listing.

1. Standard UL916: Energy Management Equipment
2. Standard UL873: Temperature Indicating & Regulating Equipment

K. Canadian Standards Association (CSA):

1. CSA B140.1 National Gas and Propane Installation Guide

1.3 SUBMITTALS FOR REVIEW

A. Product Data: Provide data with dimensions, duct and service connections, accessories, controls, electrical nameplate data and wiring diagrams.

B. Submittal Drawings: Indicate dimensions, duct and service connections, accessories, controls, electrical nameplate data and wiring diagrams.

1.4 SUBMITTALS FOR INFORMATION

A. Manufacturer's Instructions: Indicate rigging, assembly and installation instructions.

1.5 SUBMITTALS AT PROJECT CLOSEOUT

A. Project Record Documents: Record actual locations of remote sensors, control panels and other components.

B. Operation and Maintenance Data: Include manufacturer's Installation, Operation and Service Manual.

C. Warranty: Submit manufacturer's warranty and ensure forms have been filled out in owner's name and registered with the manufacturer.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the product specified in this section (proportional, building pressure controlling, modulating direct-fired air handler) with a minimum of ten years documented experience. Equipment shall be the standard product of the manufacturer and shall have complete cataloged data.

B. Installer Qualifications: All installation and service of direct-fired air handlers must be performed by a contractor qualified in the installation and service of said products with proof of a minimum of three years documented experience.

C. Factory Testing: Each air handler shall be factory-tested. Testing shall consist of checking all circuits for continuity, operability of all valves, control motors, fan speed, linkages, switches and burner. Each air handler shall be test-fired for low and high fire conditions. See "Fan and Motor" for additional fan testing requirements.

1.7 REGULATORY REQUIREMENTS

A. Conform to ANSI Standards Z83.18 or Z83.4 (latest revision) and provide evidence that the air handler and its control system have been found in compliance with these standards by a nationally recognized testing laboratory.

B. Conform to NFPA 90A.

C. Conform to the National Fuel Gas Code (NFPA 54/ANSI Z223.1).

D. Conform to required or specified insurance specifications [FM, XL Insurance (formerly known as IRI), etc.] for the gas manifold construction.

1.8 WARRANTY

A. The product shall have a manufacturer's limited warranty of at least 24 months, subject to the manufacturer's standard warranty limitations.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. COMBAT® DF-Series, incorporating one of the following configurations as specified herein or shown on the plans:

- Modulating 20% outdoor air /80% return air to 100% outdoor air /0% return air with constant discharge air volume (Air Management [AM] Model)
- 100% outdoor air with constant discharge air volume (Make-Up Air [MUA] Model)
- Fixed 20% outdoor air and 80% return air with constant discharge air volume (Fixed Recirculation [FR] Model)
- 100% outdoor air with 50%-100% variable discharge air volume (Variable Air Volume [VAV] Model)

2.2 MANUFACTURED UNITS

A. Unit: [Constant] [Variable] volume [outdoor] [indoor] direct-fired air handler.

2.3 FABRICATION

A. Casing and Components: Galvanized steel panels, minimum 20 gauge; reinforced with a rugged integral frame.

B. Fan Support: The fan and bearings shall be supported by a reinforced structural steel framework independent of the cabinet.

C. Access Doors: Hinged and/or latched access doors to allow service access to burner, fan, controls and motor.

D. Outdoor Installation: Including caulking of all unit seams between panels and around control enclosure. Inlet hood shall be used on outdoor horizontal units.

E. Lifting Points: Internal members shall be properly sized to allow rigging and handling of the unit from the top.

F. Finish: For Models DF40, standard finish is a white powder coat. For Models DF75 - DF410, standard finishes are [unpainted galvanized] [white powder-coat.] For Models DF700A and DF700B, standard finishes are [unpainted galvanized] [white water-based, rust- inhibiting, machinery-grade enamel].

G. Observation Port: Provide on burner section for observing main and pilot flames.

H. Bearing Access Panel (Models DF40 - DF410 only): Provide on fan section for access to blower shaft bearings.

2.4 BURNER AND GAS TRAIN

A. Burner: Line burner specially designed to burn natural gas or LPG at or below the non-contaminating levels required by ANSI and OSHA. The burner shall have a cast iron manifold and heat resistant Type 430 stainless steel burner plates. The burner shall have a nominal turndown ratio of 30:1 and be designed for 100% combustion efficiency for the life of the equipment.

B. Burner Profile: The outdoor air velocity across the burner shall be controlled by fixed burner profile plates. The design of the unit profile plates shall maintain manufacturer's specified air velocity at all times over the burner during operation. No air from the occupied space shall be allowed to recirculate across the burner at any time.

C. Burner Assembly / Gas Train: The burner assembly shall include automatic ignition controls and ultraviolet (UV) scanner flame failure system (Models DF75 - DF700B)/flame rod (Model DF40). Gas train shall be sized to provide full unit capacity at specified inlet pressure to the gas train. The gas train components are dependent upon the type of manifold selected:

1. ANSI Compliant Gas Train: An ANSI- Compliant manifold is constructed of black pipe with fluid-powered primary and secondary automatic shut-off valve and manual shut-off valve. ANSI-Compliant manifolds can accept a maximum inlet gas pressure of 14" w.c. (Models DF40-DF410)/5 psi (Models DF700A-DF700B).
2. FM Compliant Gas Train: An FM-Compliant manifold includes all items on an ANSI-Compliant manifold plus block valve and actuator, high gas pressure switch and low gas pressure switch. All FM-Compliant manifolds can accept a maximum inlet gas pressure of 5 psi.
3. XL Insurance (formerly known as IRI) Compliant Gas Train: An XL Insurance-Compliant manifold includes all items on an FM-Compliant manifold plus a normally open solenoid vent valve located between the main shut off valves. On an XL Insurance-Compliant manifold, the high and low as pressure switches are upgraded to include an auto reset. All XL Insurance-Compliant manifolds can accept a maximum inlet gas pressure of 5psi.

D. Pilot: Electronic spark ignition through a high voltage ignition transformer.

E. Positive Low-Fire Start (Optional): Positive low-fire start helps ensure the burner ignites at its low-fire setting. The burner maintains its low-fire setting for a factory-set duration of twenty seconds, after which time the burner begins to modulate.

2.5 FAN AND MOTOR

A. Fan: Built-in, double-width, double-inlet (DWDI), forward-curved type, dynamically balanced with a rugged solid steel shaft ground smooth for extended life and durability.

B. Drive: The fan shaft shall be connected to the motor by a single V-belt drive (Model DF40)/multiple V-belt drive (Models DF75 - DF700B) designed to handle 25% more power than the motor name plate capacity. The fan wheel and bearings shall be supported by reinforced structural steel framework independent of the unit housing. The motor sheave shall be an adjustable design balancing final air flow (Models DF40 - DF410)/fixed design (Models DF700A and DF700B).

C. Fan Bearings: Self-aligning, ball bearing type (DF40) / pillow block type (DF75-DF700B) and shall have (for external static pressures less than 1" w.c.) an American Bearing Manufacturers Association (ABMA) L10 rated life of 30,000 hours.

D. Extended Grease Lines (Optional): Extended grease lines extend the fan bearing grease fittings to the fan cabinet exterior on the control side.

E. Motor: The motor shall be an [open drip proof (ODP)] [totally-enclosed, fan-cooled (TEFC)], [standard efficiency] [premium efficiency] design with minimum service factor of 1.15, wired for [208 V, 1Ø] [208 V, 3Ø] [230 V, 1Ø] [230 V, 3Ø] [460 V, 3Ø] [575 V, 3Ø] 1750 rpm, standard NEMA frame and mounted on an adjustable slide base.

F. Sound Power: The fan sound power shall not exceed 85 dBA at a distance of ten feet from the air handler discharge opening.

2.6 CONTROL SYSTEM

A. Factory Testing: The complete control system and all burner and gas manifold functions shall be factory tested for proper operation and to simplify field commissioning.

B. Control Enclosure: The unit control enclosure shall be constructed to NEMA 3R specifications with a hinged door. The control enclosure shall contain the gas train and all principal electrical components, such as motor starter, 120 V and 24 V transformers, control circuit protection, control relay(s), circuit check lights, pressure transducer, flame relay and full number-coded terminal strip. A fused disconnect switch is also shipped loose to be mounted on or near the control enclosure. (Fuses to be provided by others.)

C. Flame Relay: The air handler control panel shall have a burner flame relay to lock out the flame in abnormal conditions.

D. Safety Controls

1. High Gas Pressure Switch (Standard on FM-Compliant manifolds above 2,500 MBH and all IRI-Compliant manifolds only): The high gas pressure switch, located on the burner end of the manifold, shall turn the burner off when the gas pressure is above its setpoint. The maximum gas pressure shall be factory-set at 1" w.c. above the maximum high fire gas pressure.

2. Low Gas Pressure Switch (Standard on Models DF700A and DF700B FM-Compliant manifolds and all IRI-Compliant manifolds only): The low gas pressure switch, located on the inlet end of the manifold, shall turn the burner off when the gas pressure is below its setpoint. The minimum gas pressure shall be factory-set at 3" wc.

3. Air Flow Switch: The air flow switch measures air pressure differential across the burner to help assure proper air flow during burner operation and prior to ignition. It shall be factory-set at 0.3" wc for the low setting and 1.4" wc (Models DF40 - DF410)/'0.9" wc (Models DF700A - DF400B) for the high setting.

4. High Temperature Limit Switch: A manual reset high temperature switch shall turn the burner off when air is discharged above its set point. The High Temperature Limit Switch shall be factory-set at 160° F (71.1°C) (Models DF40 - DF410) / 150° F (65.5°C) (Models DF700A - DF700B).

5. Carbon Dioxide Interlock: For FR amd AM-style units, a field-supplied carbon dioxide detector needs to be installed to limit the room air carbon dioxide concentration to less than 5000 ppm.

E. Conventional Electronic Controls System:

1. Temperature Controller: Provide amplifier with room temperature control, room temperature sensor and discharge air temperature sensor.

2. Photohelic (VAV Model Only): Provide a photohelic for controlling the internal bypass damper. Photohelic factory-set for minimum pressure of .75" wc and maximum pressure of .90" wc.

3. Null Pressure Switch (AM Model Only): Provide a null pressure switch for controlling the mixing dampers. Pressure switch factory-set to .01" wc with a tolerance of .01" wc.

4. Remote Control Panels (Optional): Mount unit operating switches and pilot lights, as follows:

- Basic Remote: Includes fan on/off switch; burner on/off switch; status light for fan and burner operation; and Maxitrol Series 14 discharge temperature selector in a NEMA 1 enclosure.

- Standard Discharge Control Remote: Includes fan on/off/auto switch; burner summer/winter switch; status light for fan operation, burner operation, clogged filters and burner lockout; Maxitrol Series 14 discharge temperature selector; and space thermostat in a NEMA 1 enclosure.

- Deluxe Temperature Control Remote: Includes fan on/off/auto switch; burner summer/winter switch status lights for fan operation, burner operation, clogged filters and burner lockout; Maxitrol Series 44 temperature selector; and space thermostat in a NEMA 1 enclosure.

5. Control Options (Optional):

- Auxilary Relay: The auxiliary relay shall provide for field interface with remote devices. Relays are available for 24V or 120V signals.

- Low Temperature Limit Switch with Bypass Timer: The low temperature limit shall turn the unit off when air is discharged below its setpoint for a period in excess of the timer setpoint. The switch shall be factory-set at 50°F (10°C). The bypass timer, which allows the fan to run while burner operation is established during initial unit start-up, shall be factory set at 5 minutes.

- Outdoor Air Stat: The outdoor air stat shall turn off the unit burner when the ambient temperature reaches the setpoint. The stat shall be factory-set of 85°F (29.4°C).

2.7 AIR HANDLER UPGRADES AND ACCESSORIES [Select Applicable Items]

A. Roof Curb: The roof curb shall be 19" (482 mm) full-perimeter (burner and blower sections only), formed of minimum 16-gauge galvanized steel as required to support the unit with all the hardware for bolt-together assembly in the field. Roof curb to be used on horizontal air handlers only.

B. Stand (Models DF40-DF410 only): The stand shall measure 30" (762 mm) for Model DF40; 72" (1828 mm) for Models DF75 - DF410. Stand to be used on upright air handlers only.

C. Legs (Models DF40-DF410 only): The legs shall be 46" (1168 mm) high, formed of minimum 16 gauge galvanized steel as required to support the unit. Legs to be used on horizontal air handlers only.

D. Legs (Models DF700A-DF700B only): Legs shall be available in heights of 24"(610 mm), 36" (914 mm), 48" (1219 mm), 60" (1524 mm), 72" (1829 mm) or 84" (2134 mm). They shall be formed of minimum 16 gauge galvanized steel as required to support the unit. Legs to be used on horizontal or upright air handlers

E. Suspension Kit (Models DF40 - DF150 only): The suspension kit shall be composed of two side pieces and two end pieces that are to be field assembled using field-provided hardware. Once assembled, suspend using field-provided threaded rods. Suspension kit to be used on horizontal air handlers only.

F. Inlet Hood: The [painted] [unpainted] inlet hood shall mount on the outdoor air intake and be constructed of galvanized steel. All hardware required for bolt-together assembly in the field is included. Inlet hood for Models DF40-DF410 include 1" (25.4 mm) thick washable aluminum filters for installation on face. Inlet hood for Models DF700A-DF700B can be purchased with [no filters on face] [1" (25.4 mm) thick washable aluminum filters for installation on face] [moisture eliminator media for installation on face]. The inlet hood can be used on horizontal air handlers only.

G. Insulation: The unit walls and ceiling downstream of the burner shall be lined with 1" (25.4mm), 1.5 lb density, neoprene coated, glass fiber insulation, which complies with UL181 for erosion and NFPA 90A for fire resistivity. The insulation shall be secured via adhesive and mechanical pin fasteners per SMACNA standards. All exposed edges shall be coated.

H. Three-Way Discharge Head (Models DF40 - DF410 only): The head openings are offset 40° from each other, resulting in a total air distribution range of 120°. Each opening includes

adjustable horizontal deflection blades for control of discharge airflow direction. The [painted] [unpainted] discharge head is shipped loose for field installation. The three-way discharge head shall be used on horizontal air handlers with an end discharge or upright air handlers with a side discharge.

I. Discharge Plate: The [painted] [unpainted] plate shall be constructed of 16 gauge galvanized steel, and shall be suspended below the horizontal air handler's down discharge by field-supplied threaded rod. Discharge plate is shipped loose for field installation.

J. One-Way Discharge Head (Models DF700A - DF700B only): The head opening includes adjustable horizontal deflection blades for control of discharge airflow direction. The discharge [painted] [unpainted] head is shipped loose for field installation. The one-way discharge head shall be used on horizontal air handlers with an end discharge or upright air handlers with a side discharge.

K. Outdoor Air Filter Section: The outdoor air (only) is filtered. Section shall be available with all necessary hardware for bolt-together assembly (Models DF75-DF410)/shall be available factory-assembled (Models DF40, DF700A-DF700B). The [painted] [unpainted] section shall be available with [1" (25.4 mm) thick linked polyester media treated on the leaving side] [1" (25.4 mm) thick washable aluminum filters].

L. Service Platform (Models DF700A - DF700B only): Each air handler shall be furnished with a minimum 46" (1168.4 mm) deep service platform running the full width of the air handler. The platform shall be constructed with minimum 1" (25.4 mm) thick galvanized grating, an OSHA approved handrail on three sides and steel safety chains on the remaining side.

M. High Gas Pressure Regulator: The high gas pressure regulator regulates down the inlet gas pressure to a level accepted by the unit manifold.

N. Opposite Hand Controls: The opposite hand controls option moves the control panel and access door to the opposite side of the unit. (As standard, controls on a DF40 are located on the left-hand side of the unit when looking down from the inlet end. Models DF75-DF700B have controls located on the right-hand side of the unit when looking downstream from the inlet end.)

O. Additional NEMA Starters: As required by equipment schedules, mounted in control enclosure (fed by main air handler disconnect).

P. Discharge Damper: Motorized with end switch to prove position before burner will fire. Discharge damper is shipped loose for field installation.

Q. Inlet Damper: Motorized with end switch to prove before burner will fire. MUA style unit shall utilize 100% damper; FR, AM and VAV-style unit shall utilize 20% damper. An inlet damper is factory-installed, (Models DF40 - DF410)/shipped loose for field installation (Model DF700A and DF700B).

R. Double-Wall Construction (Models DF40 - DF410 only): The unit walls and ceiling shall be lined with 1" (25.4 mm), 1.5lb. density, neoprene coated, glass fiber insulation. This insulation shall then be covered by metal liners with a minimum thickness of 20 gauge. All exposed edges shall be covered by metal liners

2.8 PERFORMANCE

A. See Schedule on plans.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install equipment in strict accordance with manufacturer's instructions and in accordance with applicable governmental regulations by a contractor qualified in the installation of the manufacturer's product.

B. Install per NFPA 90A.

C. Install per NFPA 54 (ANSI Z223.1) by providing connection to fuel gas system.

D. Units which are shipped in multiple sections shall be assembled on the job site by the installing contractor. Assembly includes caulking all seams weather tight and extending electrical power and network control wires to the terminals provided, reconnecting the motor and control wiring between sections to create a complete and operable installation (per air handler manufacturer's recommendations).

E. Contractor shall extend pressure sensing tubes to inside and to outside of building as recommended by the air handler manufacturer.

F. Contractor shall provide a proper gas service drip leg and a lockable, lever handle manual shutoff valve. A high pressure regulator shall be installed if manifold pressure will exceed [14" w.c. for Models DF40-DF410 ANSI-compliant manifolds][5 psi for Models DF700A-DF700B ANSI-compliant manifolds and all FM-compliant and IRI-compliant manifolds].

G. Furnish Contractor with field wiring diagram and electrical data to permit power wiring connections to the unit.

H. Installation contractor is to provide equipment check, test and commissioning in strict accordance with manufacturer's instructions.

I. Provide the owner's operating personnel with instruction on proper use of the air handler and controls.

J. Contractor shall supply all necessary hanger rods and install the discharge head or plate (if provided) in accordance with manufacturer's instructions.

K. Contractor shall level the roof curb and install a cant strip and wood nailer per applicable details on the plans.

L. Install carbon monoxide / nitrogen dioxide sensors in the vicinity of the source contaminant (e.g., an operating vehicle), preferable at the breathing level of the occupants. Do not install sensors in confined ("dead") spaces.

M. The air handler shall be either an upright or horizontal design as shown on the plans and designed to be supported (e.g., legs, suspension by rods, structural platform, etc.) as shown on the plans.

N. Installation shall take place within three months following date of shipment of product by manufacturer.

3.2 SCHEDULES

A. See plans.

Thank You for Your Business!

Installation Code and Annual Inspections:
All installation and service of ROBERTS GORDON® equipment must be performed by a contractor qualified in the installation and service of equipment sold and supplied by Roberts-Gordon and conform to all requirements set forth in the ROBERTS GORDON® manuals and all applicable governmental authorities pertaining to the installation, service and operation of the equipment. To help facilitate optimum performance and safety, Roberts-Gordon recommends that a qualified contractor conduct, at a minimum, annual inspections of your ROBERTS GORDON® equipment and perform service where necessary, using only replacement parts sold and supplied by Roberts-Gordon.

Further Information: Applications, engineering and detailed guidance on systems design, installation and equipment performance is available through ROBERTS GORDON® representatives. Please contact us for any further information you may require, including the Installation, Operation and Service Manual.

This product is not for residential use.

This document is intended to assist licensed professionals in the exercise of their professional judgment.

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