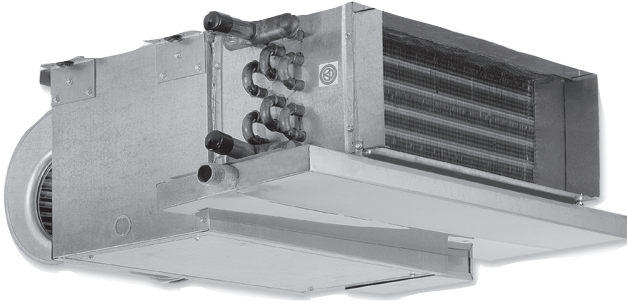
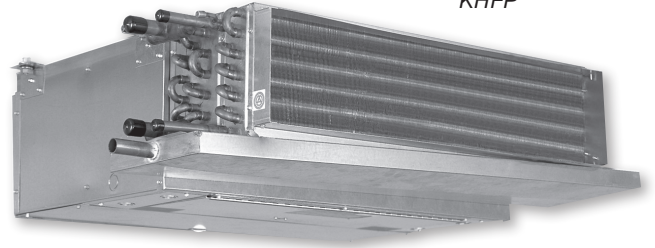


KHF Series

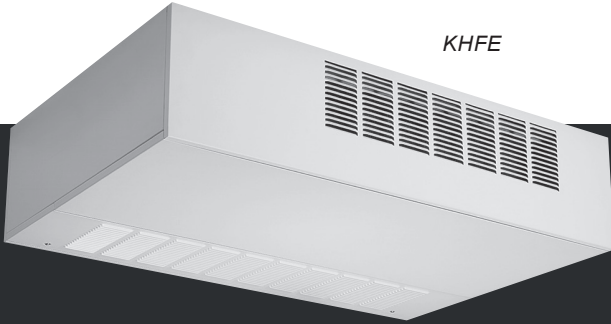
KHFH



KHFP



KHFE



INSTALLATION GUIDE

Installation, Assembly, Start-up, and Service Instructions

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CHANGEABILITY OF THIS DOCUMENT

In complying with Krueger's policy for continuous product improvement, the information contained in this document is subject to change without notice. Krueger makes no commitment to update or provide current information automatically to the manual owner. Updated manuals, if applicable, can be obtained on Krueger's website at www.krueger-hvac.com

Operating/service personnel maintain responsibility for the applicability of these documents to the equipment. If there is any question regarding the applicability of these documents, the technician should verify whether the equipment has been modified and if current literature is available from the owner of the equipment prior to performing any work on the unit.

CHANGE BARS

Revisions made to this document are indicated with a line along the left or right hand column in the area the revision was made. These revisions are to technical information and any other changes in spelling, grammar, or formatting are not included.

IMPORTANT!

READ BEFORE PROCEEDING!

GENERAL SAFETY CONSIDERATIONS

The equipment covered by this manual is designed for safe and reliable operation when installed and operated within its design specification limits. To avoid personal injury or damage to equipment or property while installing or operating this equipment, it is essential that qualified, experienced personnel perform these functions using good judgment and safe practices. See the following cautionary statements.

SAFETY SYMBOLS

The following symbols are used in this document to alert the reader to specific situations:



DANGER - Indicates a possible hazardous situation which will result in death or serious injury if proper care is not taken.



WARNING - Indicates a potentially hazardous situation which will result in possible injuries or damage to equipment if proper care is not taken.



CAUTION - Identifies a hazard which could lead to damage to the machine, damage to other equipment and/or environmental pollution if proper care is not taken or instructions are not followed.



NOTE - Highlights additional information useful to the technician in completing the work being performed properly.



DANGER - Indicates a possible hazardous situation which will result in death or serious injury if proper care is not taken.

DANGER - MOVING PARTS HAZARDS. Motor and Blower must be disconnected prior to opening access panels. Motors can start automatically, disconnect all power and control circuits prior to servicing to avoid serious crushing or dismemberment injuries.

DANGER - HOT PARTS HAZARD. Electric Resistance heating elements must be disconnected prior to servicing. Electric Heaters may start automatically, disconnect all power and control circuits prior to servicing to avoid burns.



WARNING - Check that the unit assembly and component weights can be safely supported by rigging and lifting equipment.

WARNING - All assemblies must be adequately secured during lifting and rigging by temporary supports and restraints until equipment is permanently fastened and set in its final location.

WARNING - All unit temporary and permanent supports must be capable of safely supporting the equipment's weight and any additional live or dead loads that may be encountered. All supports must be designed to meet applicable local codes and ordinances.

WARNING - All fastening devices must be designed to mechanically lock the assembly in place without the capability of loosening or breaking away due to system operation and vibration.



CAUTION - Protect adjacent flammable materials when brazing, Use flame and heat protection barriers where needed. Have fire extinguisher available and ready for immediate use.

SECTION 1 - RECEIPT AND INITIAL INSTALLATION

PREFACE

Krueger-HVAC fan coils represent a prudent investment which can, with proper installation, operation, and regular maintenance, give trouble-free operation and long service.

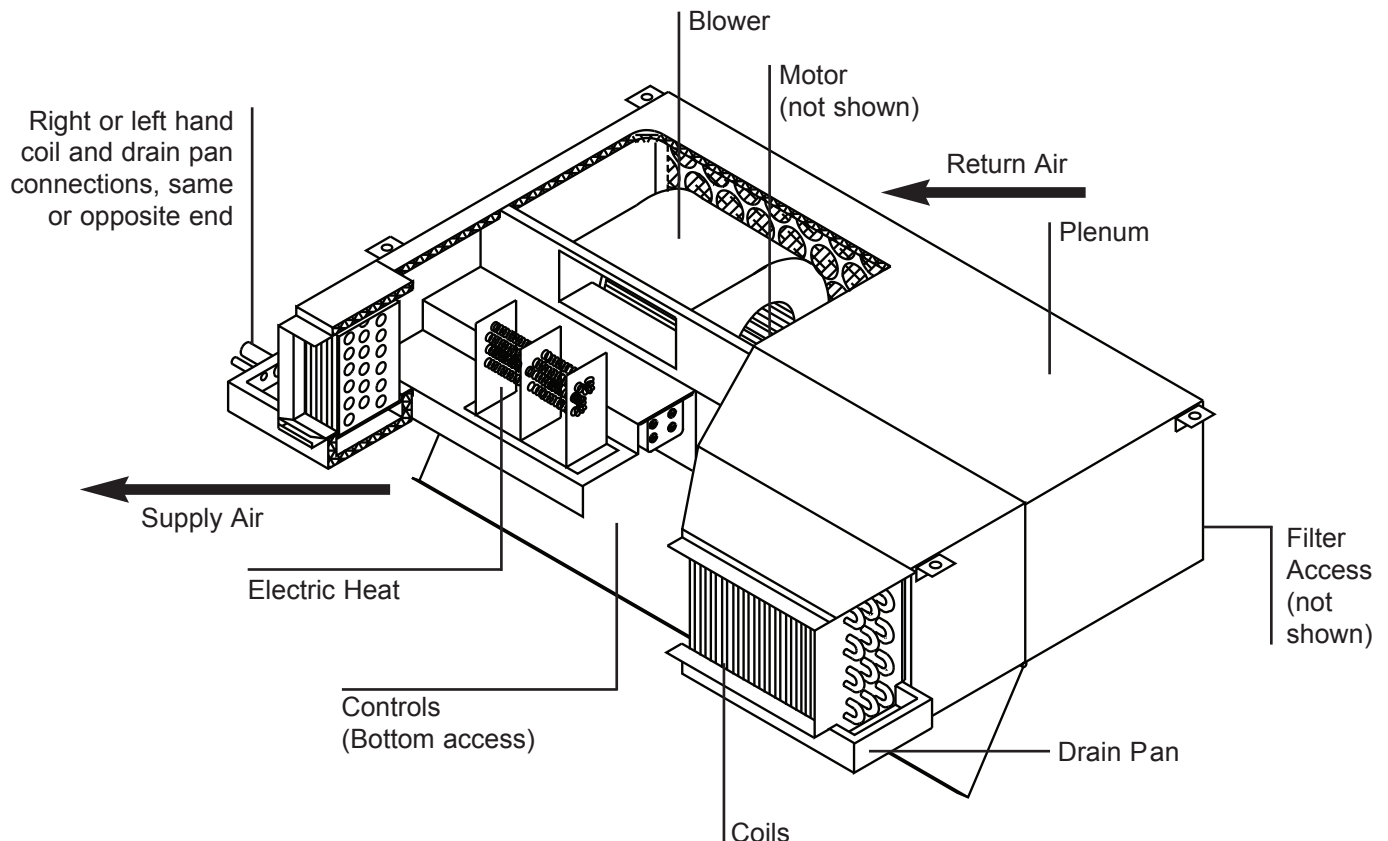
Your equipment is initially protected under the manufacturer's standard warranty; however, this warranty is provided under the condition that the steps outlined in this manual for initial inspection, proper installation, regular periodic maintenance, and everyday operation of the equipment be followed in detail. This manual should be fully reviewed in advance of any actual work being done on the equipment. Should any questions arise, please contact your local Sales Representative or the factory BEFORE proceeding.

The equipment covered by this manual is available with a vast variety of options and accessories. Consult the approved unit submittal, order acknowledgement, and other manuals for details on the options and accessories provided with the equipment on each project.



CAUTION - No attempt should be made to handle, install, or service any unit without following safe practices regarding mechanical equipment.

CAUTION - All power must be disconnected before any installation or service should be attempted. More than one power source may be supplied to a unit. Power to remote mounted control devices may not be supplied through the unit. Never wear bulky or loose fitting clothing when working on any mechanical equipment. Gloves should only be worn when required for proper protection from heat or other possible injury. Safety glasses or goggles should always be worn when drilling, cutting, or working with chemicals such as refrigerants or lubricants.



SECTION 1 - RECEIPT AND INITIAL INSTALLATION (CONTINUED)

The manufacturer assumes no responsibility for personal injury or property damage resulting from improper or unsafe practices during the handling, installation, service, or operation of any equipment.



CAUTION - Never pressurize any equipment beyond specified operating pressures. Always pressure test with some inert fluid or gas such as clear water or dry nitrogen to avoid possible damage or injury in the event of a leak or component failure during testing.

CAUTION - Always protect adjacent flammable material when welding or soldering. Use suitable heat shield material to contain sparks or drops of solder. Have fire extinguisher available for use when welding or brazing.

UNPACKING & INSPECTION

All units are carefully inspected at the factory throughout the manufacturing process under a strict detailed quality assurance program, and where possible, all major components and subassemblies are carefully tested for proper operation and verified to be in full compliance with the factory manufacturing documents. Customer furnished components such as control valves, switches and DDC controls are not factory tested.

Each unit is carefully packaged for shipment to avoid damage during normal transport and handling. The equipment should always be stored in a dry place in the proper orientation as marked on the carton.

All shipments are made F.O.B. factory and it is the responsibility of the receiving party to inspect the equipment upon arrival. Any obvious damage to the carton and/or its contents should be recorded on the bill of lading and a claim should be filed with the freight carrier.

After determining the condition of the carton exterior, carefully remove each unit from the carton and inspect for hidden damage. At this time check to make sure that "furnished only" items such as switches, thermostats, etc. are accounted for. Any hidden damage should be recorded and immediately reported to the carrier and a claim filed as before. In the event a claim for shipping damage is filed, the unit, shipping carton, and all packing must be retained for physical inspection by the freight carrier. All equipment should be stored in the factoryshipping carton with internal packing in place until installation.

At the time of receipt, the equipment type and arrangement should be verified against the order documents. Should any discrepancy be found, the local Sales Representative should be notified immediately so that the proper action may be instituted. Should any question arise concerning warranty repairs, the factory must be notified BEFORE any corrective action is taken. Where local repairs or alterations can be accomplished, the factory must be fully informed as to the extent and expected cost of those repairs before work is begun. Where factory operations are required, the factory must be contacted for authorization to return equipment and a Return Authorization Number will be issued. Unauthorized return shipments of equipment and shipments not marked with an authorization number will be refused. In addition, the manufacturer will not accept any claims for unauthorized expenses.

SECTION 1 - RECEIPT AND INITIAL INSTALLATION (CONTINUED)

HANDLING & INSTALLATION

While all equipment is designed for durability and fabricated for sturdy construction and may present a rugged appearance, great care must be taken to assure that no force or pressure be applied to the coil, piping or drain stub-outs during handling. Also, depending on the options and accessories, some units could contain delicate components that may be damaged by improper handling. Wherever possible, all units should be maintained in an upright position and handled by the chassis as close as possible to the mounting point locations.

In the case of a full cabinet unit, the unit must obviously be handled by the exterior casing. This is acceptable providing the unit is again maintained in an upright position and no impact forces are applied that may damage internal components, access panels, or painted surfaces. The equipment covered in this manual IS NOT suitable for outdoor installations. The equipment should never be stored or installed where it may be subjected to a hostile environment such as rain, snow, or extreme temperatures.

During and after installation, special care must be taken to prevent foreign material such as paint, plaster, and drywall dust from being deposited in the drain pan or on the motor or blower wheels. Failure to do so may have serious adverse effects on unit operation and in the case of the motor and blower assembly, may result in immediate or premature failure. All manufacturers' warranties are void if foreign material is allowed to be deposited on the motor or blower wheels of any unit. Some units and/or job conditions may require some form of temporary covering during construction.

While the manufacturer does not become involved in the design and selection of support methods and components, it should be noted that unacceptable system operating characteristics and/or performance might result from improper or inadequate unit structural support. In addition, adequate clearance must be provided for service and removal of the equipment and its accessory components. Anchoring the equipment in place is accomplished by using the mounting points provided and positioning the unit to maintain the unit on a LEVEL plane. The drain pan is internally sloped toward the outlet connection. Care must be taken to insure that the unit drain pan does not slope away from the outlet connection. All units are supplied with hanger brackets with rubber grommet isolators and brass inserts for use with 3/8" all thread hanger rod.



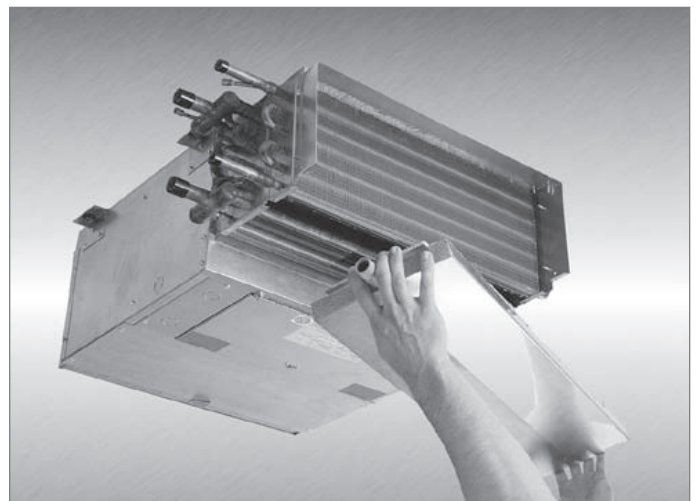
NOTE - The unit's drain pan is factory sloped toward the drain connection when the unit is installed level and plumb.

Standard drain pans are externally insulated, single wall galvanized steel and can be equipped with a secondary drain connection. The KHF drain pan is easily removable for cleaning or reversing connections. Auxiliary drip pan to catch condensed moisture from valves and piping must be sloped toward the drain pan.

Coils

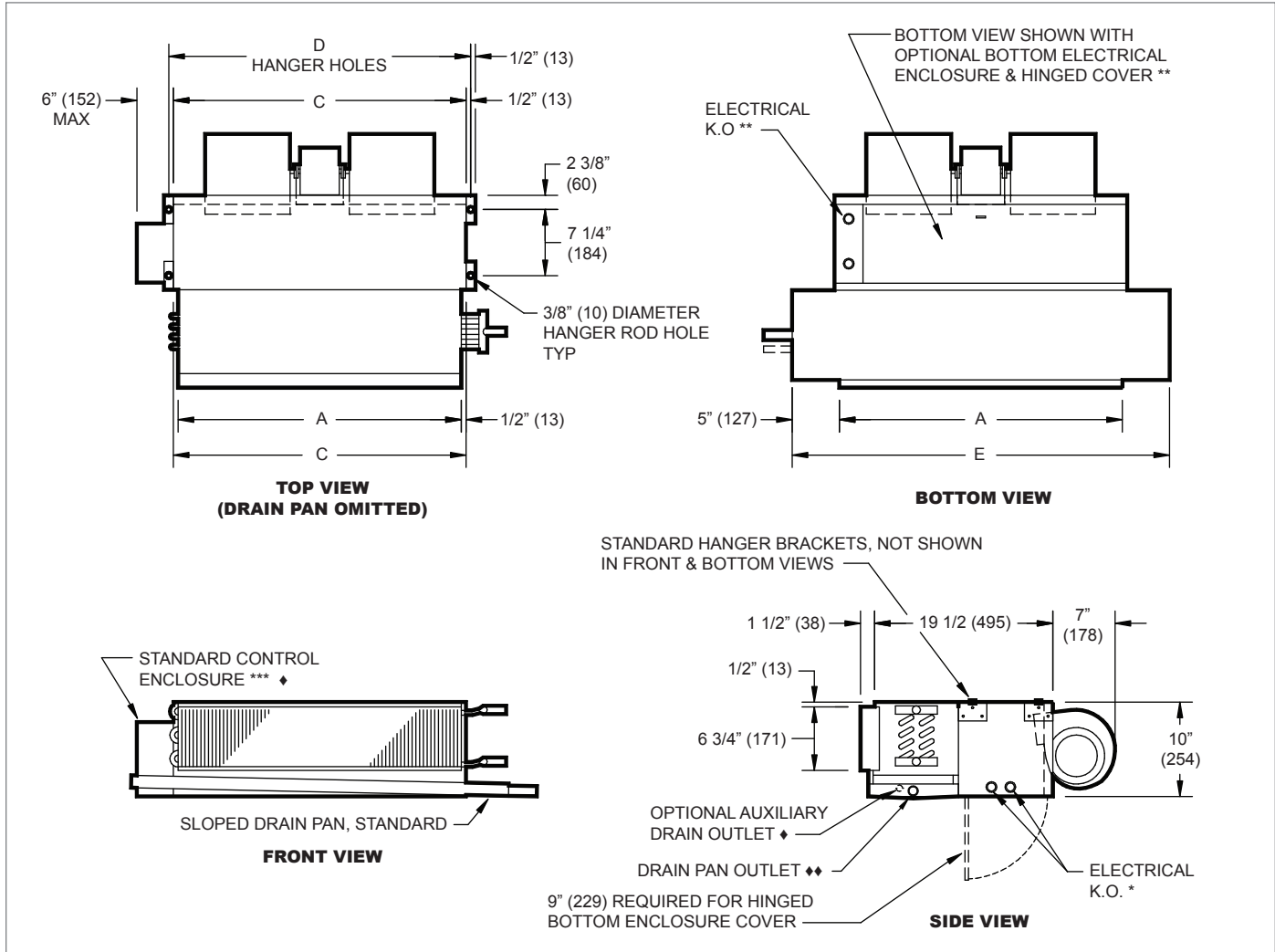
All fan coils are available in 2 or 4 pipe configurations. Heating coils are available in reheat or preheat position. Heating and cooling coils are available with right, left or opposite side connections.

Verify that the proper types of service are actually provided to the unit. On units with steam heating coils, the maximum steam pressure applied to the unit should never exceed 15 PSIG. The drain piping and steam trap should be sized and routed to allow for proper condensate flow. The electrical service to the unit should be compared to the unit nameplate to verify compatibility. The routing and sizing of all piping, and the type and sizing of all wiring and other electrical components such as circuit breakers, disconnect switches, etc. should be determined by the individual job requirements and should not be based on the size and/or type of connection provided on the equipment. All installations should be made in compliance with all governing codes and ordinances. Compliance with all codes is the responsibility of the installing contractor.



SECTION 1 - RECEIPT AND INITIAL INSTALLATION (CONTINUED)

KHFH, FREE RETURN



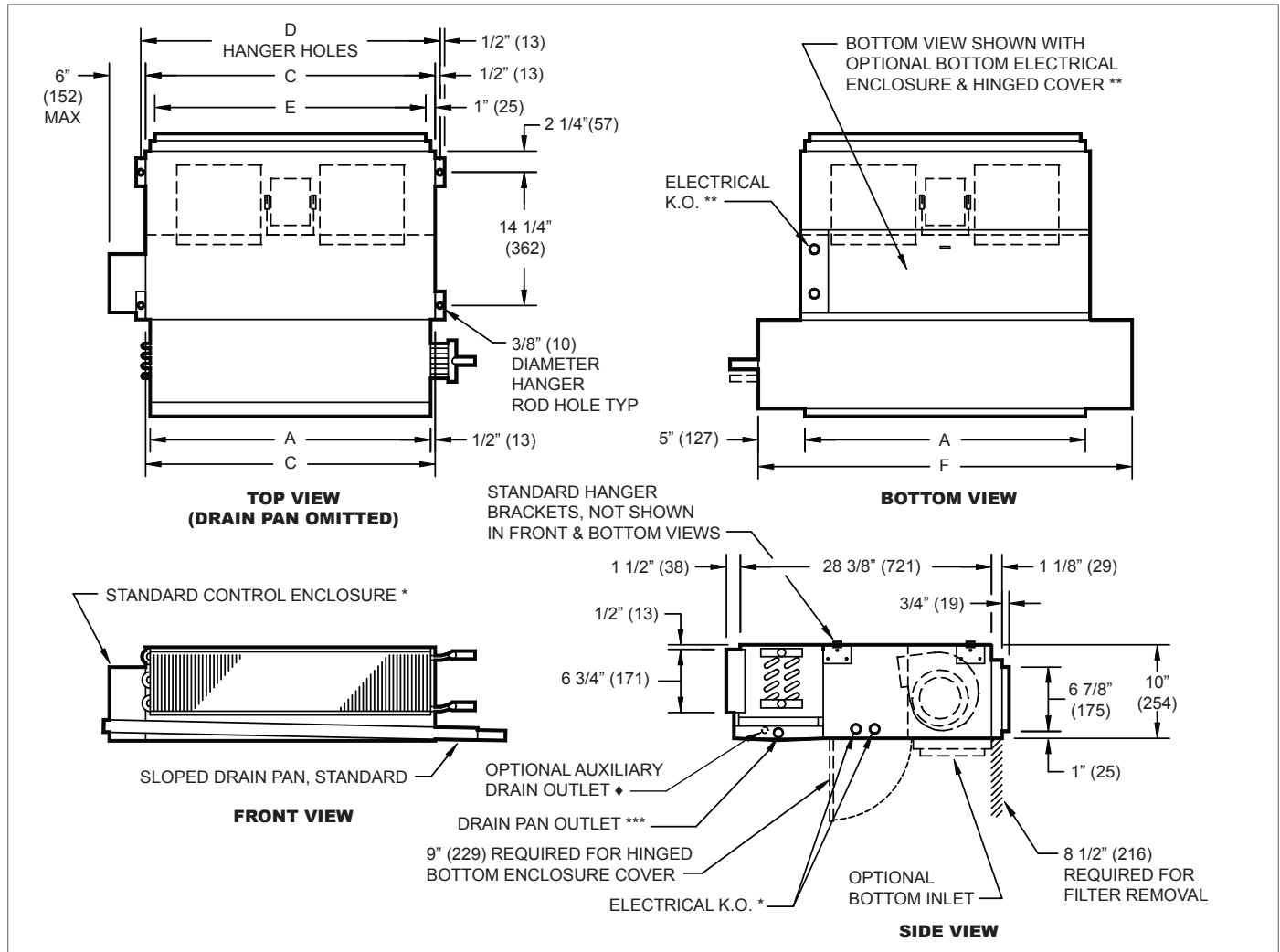
Unit Size	A	C	D	E
20	20" (508)	21" (533)	22" (559)	30" (762)
25	26" (660)	27" (686)	28" (711)	36" (914)
30	30" (762)	31" (787)	32" (813)	40" (1016)
40	40" (1016)	41" (1041)	42" (1067)	50" (1270)
50	50" (1270)	51" (1295)	52" (1321)	60" (1524)
60	60" (1524)	61" (1549)	62" (1575)	70" (1778)

NOTES: All dimensions in inches (millimeters). All dimensions $\pm 1/4"$ (6mm). Metric values are soft conversion. Left hand unit shown, right hand unit opposite.

- * Standard control enclosure is mounted on unit side opposite cooling coil connections. Unit casing includes (2) knockouts on each side. Provide sufficient clearance to access electrical controls and comply with applicable codes and ordinances.
- ** Optional bottom control enclosure with hinged cover replaces standard side mounted enclosure and includes (2) additional knockouts on bottom of unit, on left side.
- *** Standard externally foam coated galvanized steel drain pan has 7/8" ODM copper outlet. Stainless steel drain pan has 3/4" MPT galvanized steel outlet.
- ◆ Auxiliary drain outlet is 5/8" ODM copper or 3/8" MPT galvanized steel respectively.
- ◆◆ See coil connection drawings for coil connection sizes and locations.

SECTION 1 - RECEIPT AND INITIAL INSTALLATION (CONTINUED)

KHFP, PLENUM



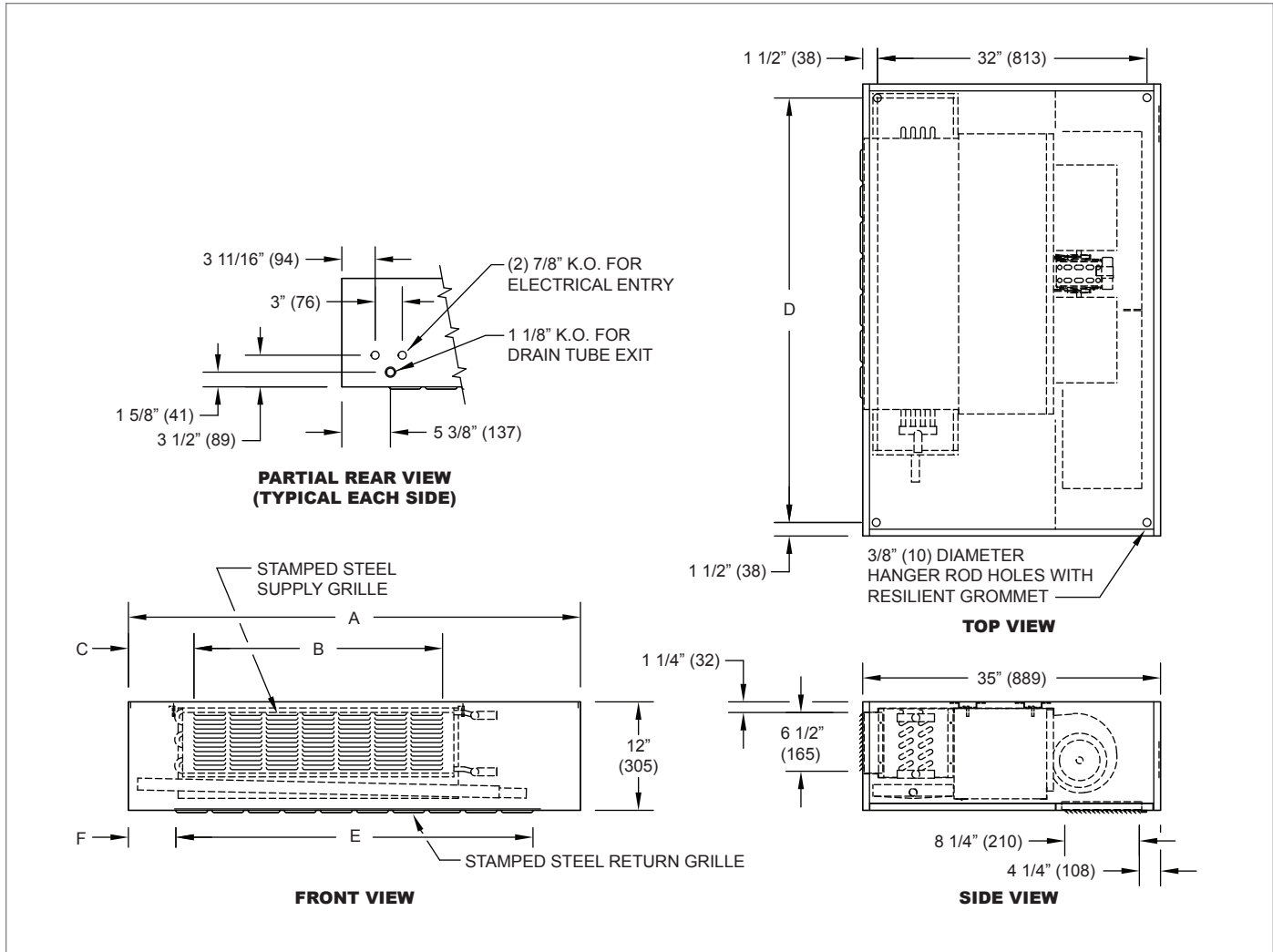
Unit Size	A	C	D	E	F
20	20" (508)	21" (533)	22" (559)	19" (483)	30" (762)
25	26" (660)	27" (686)	28" (711)	25" (635)	36" (914)
30	30" (762)	31" (787)	32" (813)	29" (737)	40" (1016)
40	40" (1016)	41" (1041)	42" (1067)	39" (991)	50" (1270)
50	50" (1270)	51" (1295)	52" (1321)	49" (1245)	60" (1524)
60	60" (1524)	61" (1549)	62" (1575)	59" (1499)	70" (1778)

NOTES: All dimensions in inches (millimeters). All dimensions $\pm 1/4"$ (6mm). Metric values are soft conversion. Left hand unit shown, right hand unit opposite. See coil connection drawings for coil connection sizes and locations.

- * Standard control enclosure is mounted on unit side opposite cooling coil connections. Unit casing includes (2) knockouts on each side. Provide sufficient clearance to access electrical controls and comply with applicable codes and ordinances.
- ** Optional bottom control enclosure with hinged cover replaces standard side mounted enclosure and includes (2) additional knockouts on bottom of unit, on left side.
- *** Standard externally foam coated galvanized steel drain pan has 7/8" ODM copper outlet. Stainless steel drain pan has 3/4" MPT galvanized steel outlet.
- † Auxiliary drain outlet is 5/8" ODM copper or 3/8" MPT galvanized steel respectively.

SECTION 1 - RECEIPT AND INITIAL INSTALLATION (CONTINUED)

KHFE, HORIZONTAL EXPOSED FAN COIL (Front Stamped Supply Grille, Bottom Stamped Return Grille)



Unit Size	A	B	C	D	E	F
20	40" (1016)	19 1/2" (495)	6 1/4" (159)	37" (940)	27 1/2" (699)	6 1/4" (159)
25	46" (1168)	23 1/2" (597)	6 1/4" (159)	43" (1092)	35 1/2" (902)	5 1/4" (133)
30	50" (1270)	27 1/2" (699)	7 1/4" (184)	47" (1194)	39 1/2" (1003)	5 1/4" (133)
40	60" (1524)	39 1/2" (1003)	6 1/4" (159)	57" (1448)	47 1/2" (1207)	6 1/4" (159)
50	70" (1778)	47 1/2" (1207)	7 1/4" (184)	67" (1702)	59 1/2" (1511)	5 1/4" (133)
60	80" (2032)	59 1/2" (1511)	6 1/4" (159)	77" (1956)	67 1/2" (1715)	6 1/4" (159)

NOTES: All dimensions in inches (millimeters). All dimensions $\pm 1/4"$ (6mm). Metric values are soft conversion. Left hand unit shown, right hand unit opposite. Electrical enclosure size and location may vary with optional features. Provide sufficient clearance to access electrical controls and comply with applicable codes and ordinances. Drain piping should be routed through casing opening indicated to provide proper drain slope. Louvered bottom panel is hinged and removable for access to filter and fan assembly. Fixed bottom panel is removable for access to optional electrical enclosure, coil, and drain pan. Internal insulation of field piping may be required. Field piping casing penetrations must be cut in the field to match individual job requirements.

SECTION 1 - RECEIPT AND INITIAL INSTALLATION (CONTINUED)

COOLING/HEATING MEDIUM CONNECTIONS



CAUTION - Toxic residues and loose particles resulting from manufacturing and field piping techniques such as joint compounds, soldering flux, and metal shavings may be present in the unit and the piping system. Special consideration must be given to system cleanliness when connecting to solar, domestic or potable water systems.

AHRI STANDARD RATINGS

Model / Size	Coil		Airflow CFM (Dry Flow)	Cooling Capacity		Water		Power Input (Watts)
	Rows	FPI		QT (BTUH)	QS (BTUH)	Flow Rate (GPM)	WPD (ft-wg)	
KHFH 20	3	10	331	9699	7210	1.9	5.26	57
KHFH 25	3	10	448	14189	10210	2.8	10.66	125
KHFH 30	3	10	771	18750	14640	3.8	6.5	165
KHFH 40	3	10	793	22559	16719	4.5	10.22	261
KHFH 50	3	10	1196	30370	23280	6.0	9.17	472
KHFH 60	3	10	1440	34169	27000	6.8	4.5	522
KHFH 20	4	10	312	12680	8760	2.5	10.22	57
KHFH 25	4	10	434	15869	11340	3.1	5.79	125
KHFH 30	4	10	721	23790	17469	4.8	11.51	165
KHFH 40	4	10	779	28399	20280	5.7	9.34	261
KHFH 50	4	10	1166	37490	27790	7.5	9.23	472
KHFH 60	4	10	1365	42849	32400	8.5	4.12	522
KHFP 20	3	10	265	8220	6039	1.6	4.05	57
KHFP 25	3	10	414	13430	9609	2.7	10.02	125
KHFP 30	3	10	620	16309	12500	3.3	5.19	165
KHFP 40	3	10	768	22069	16309	4.4	9.63	261
KHFP 50	3	10	1069	28579	21600	5.7	8.34	472
KHFP 60	3	10	1324	32639	25530	6.5	4.2	522
KHFP 20	4	10	253	10819	7369	2.2	8.42	57
KHFP 25	4	10	404	15100	10729	3	5.43	125
KHFP 30	4	10	604	21280	15310	4.3	9.52	165
KHFP 40	4	10	743	27530	19559	5.5	9.01	261
KHFP 50	4	10	1022	34490	25190	6.9	8.06	472
KHFP 60	4	10	1258	40409	30350	8	3.68	522
KHFE 20	3	10	287	8789	6469	1.8	4.56	57
KHFE 25	3	10	432	13829	9920	2.8	10.34	125
KHFE 30	3	10	668	17030	13159	3.4	5.51	165
KHFE 40	3	10	796	22600	16750	4.5	10.22	261
KHFE 50	3	10	1069	28579	21600	5.7	8.34	472
KHFE 60	3	10	1324	32639	25530	6.5	4.2	522
KHFE 20	4	10	275	11529	7900	2.3	9.11	57
KHFE 25	4	10	423	15680	11159	3.1	5.79	125
KHFE 30	4	10	638	21989	15939	4.4	9.8	165
KHFE 40	4	10	773	28299	20180	5.7	9.35	261
KHFE 50	4	10	1022	34490	25190	6.9	8.06	472
KHFE 60	4	10	1258	40409	30350	8	3.68	522

NOTES: Based on 80°F DB and 67°F WB EAT, 45°F EWT, 10°F temperature rise, high fan speed. Motor type is PSC and motor voltage is 115/1/60. Airflow under dry coil conditions. All models tested at 0.05" external static pressure.

SECTION 1 - RECEIPT AND INITIAL INSTALLATION (CONTINUED)

HEATING CAPACITY

Unit Type	Unit Size	1 Row				2 Rows			
		CFM	QS (MBH)	GPM	WPD	QS (MBH)	CFM	GPM	WPD
KHFH KHFP	20	264	10710	0.5	0.84	264	18110	0.9	0.62
	25	414	15890	0.8	2.11	414	27280	1.4	1.6
	30	619	20370	1	3.58	618	36209	1.9	2.88
	40	767	24440	1.3	0.88	766	46310	2.4	5.56
	50	1141	33569	1.7	1.85	1139	60689	3.1	1.55
	60	1433	42319	2.2	3.37	1429	76639	3.9	2.81
KHFE	20	286	11189	0.6	0.92	286	18920	1	0.67
	25	431	16239	0.8	2.22	430	27930	1.4	1.67
	30	667	21120	1.1	3.85	665	37790	1.9	3.13
	40	795	24860	1.3	0.9	794	47250	2.4	5.74
	50	1190	34189	1.8	1.92	1188	62169	3.2	1.63
	60	1489	43069	2.2	3.49	1485	78269	4	2.93

NOTES: Based on 70°F DB EAT, 180°F EWT, 40°F temperature drop, high fan speed.

Submittals and Product Catalogs detailing unit operation, controls, and connections should be thoroughly reviewed BEFORE beginning the connection of the various cooling and/or heating mediums to the unit.

All accessory valve packages should be installed as required, and all service valves should be checked for proper operation.

If coil and valve package connections are to be made with “sweat” or solder joint, care should be taken to assure that no components in the valve package are subjected to a high temperature which may damage seals or other materials. Many two-position electric control valves, depending on valve operation, are provided with a manual-opening lever. This lever should be placed in the “open” position during all soldering or brazing operations. Valve bodies should be wrapped with a wet rag to help dissipate heat encountered during brazing.

If the valve package connection at the coil is made with a union, the coil side of the union must be prevented from twisting (“backed up”) during tightening to prevent damage to the coil tubing. Over-tightening must be avoided to prevent distorting the union seal surface and destroying the union. In the case of field installed valves and piping, the chilled water valve cluster (or expansion valve on DX units) should be installed in such a way that any dripping or sweating is contained in the auxiliary drain pan or other device. Valves and TXV’s should be secured or supported to avoid damage to coil headers or distributor tubes.

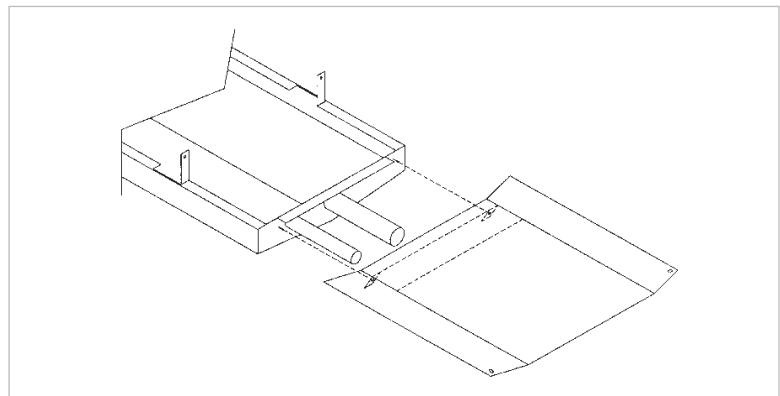
AUXILIARY DRAIN PANS

Mounted directly to the unit drain pan, AUXILIARY DRAIN PANS may also be secured by the mounting holes to field supports or to the unit coil utilizing pipe hanger wire, plastic ties, or metal strapping.

After the connections are completed, the system should then be tested for leaks. Since some components are not designed to hold pressure with a gas, hydronic systems should be tested with water.

Refrigerant systems should be tested with dry nitrogen rather than air to prevent the introduction of moisture into the system. In the event that leaking or defective components are discovered, the Sales Representative must be notified BEFORE any repairs are attempted. All leaks should be repaired before proceeding with the installation.

! **CAUTION** - All water coils must be protected from freezing after initial filling with water. Even if the system is drained, unit coils may still hold enough water to cause damage when exposed to temperatures below freezing.

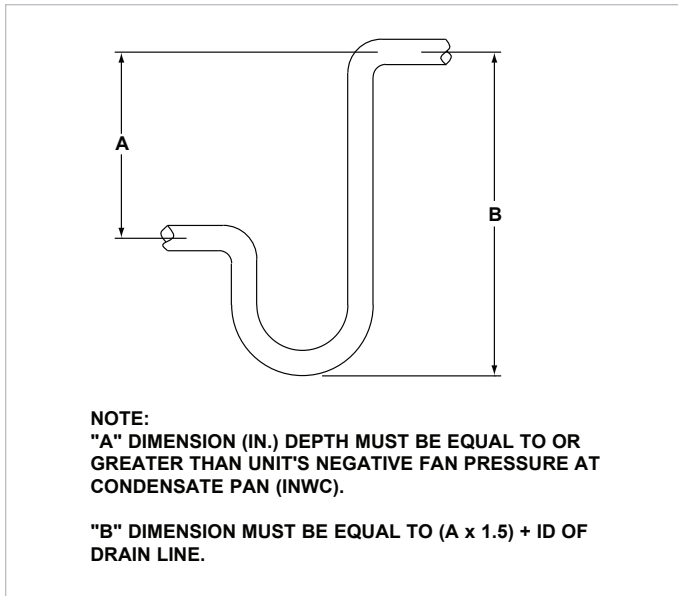


SECTION 1 - RECEIPT AND INITIAL INSTALLATION (CONTINUED)

Condensate Trap

After system integrity has been established the piping should be insulated in accordance with the project specifications. ALL chilled water piping and valves or refrigerant suction piping not located over drain pans must be insulated to prevent damage from sweating. This includes factory and field piping inside the unit cabinet.

The drain should always be connected and piped to an acceptable disposal point. For proper moisture carryoff, the drain piping should be sloped away from the unit at least 1/8" per foot. A drain trap may be required by local codes and it is strongly recommended for odor containment.



DUCTWORK CONNECTIONS

All ductwork and/or supply and return grilles should be installed in accordance with the project plans and specifications. If not included on the unit or furnished from the factory, Krueger-HVAC supply and return grilles are available in a variety of types.

All units must be installed in non-combustible areas.

Some models are designed to be connected to ductwork with a MINIMUM amount of external static pressure. Consult the approved submittals and the product catalog for unit external static pressure limitations.

Units provided with outside air for ventilation should have some form of low temperature protection to prevent coil freeze-up.

It should be noted that none of these methods would adequately protect a coil in the event of power failure. The safest method of freeze protection is to use glycol in the proper percent solution for the coldest expected air temperature.

The manufacturer assumes no responsibility for undesirable system operation due to improper design, equipment or component selection, and/or installation of ductwork, grilles, and other field supplied components.

ELECTRICAL CONNECTIONS

The unit nameplate lists the unit electrical characteristics such as the required supply voltage, fan and heater amperage and required circuit ampacities. The unit wiring diagram shows all unit and field wiring. Since each project is different and each unit on a project may be different, the installer must be familiar with the wiring diagram and nameplate on the unit BEFORE beginning any wiring. This unit is not acceptable for installation in hazardous/explosive areas.

SECTION 1 - RECEIPT AND INITIAL INSTALLATION (CONTINUED)

Electrical Enclosure

The optional bottom hinged electrical enclosure provides access to a spacious electrical compartment. This compartment houses all electric heat and control components. Terminal strips are furnished for simple power and control wiring connections.

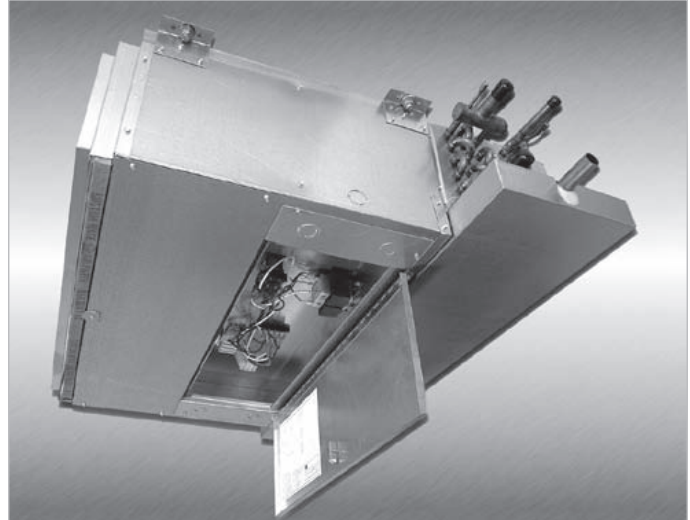
All components furnished for field installation, by either the factory or the controls contractor should be located and checked for proper function and compatibility. All internal components should be checked for shipping damage and all electrical connections should be tightened to minimize problems during start-up.

Any devices such as fan switches or thermostats that have been furnished from the factory for field installation must be wired in strict accordance with the applicable wiring diagrams. Failure to do so could result in personal injury or damage to components and will void all manufacturers' warranties.

The fan motor(s) should never be controlled by any wiring or device other than the factory furnished switch or thermostat/switch combination, without factory authorization.

All field wiring should be done in accordance with governing codes and ordinances. Any modification of the unit wiring without factory authorization will result in voiding of all factory warranties and will nullify any agency listings.

The manufacturer assumes no responsibility for any damages and/or injuries resulting from improperly field installed or wired components.



Electrical Enclosure



Telescoping Bottom Panel

TELESCOPING BOTTOM PANEL

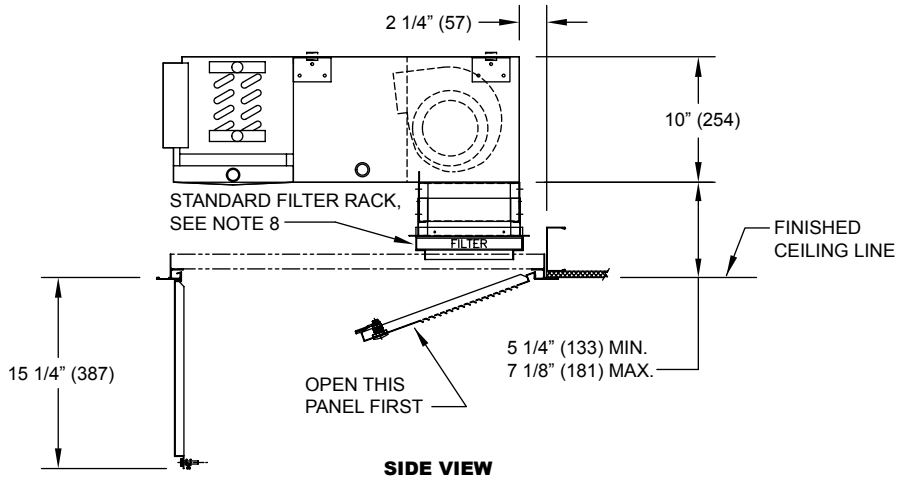
The telescoping bottom panel allows for fully recessing the unit while permitting service access into the ceiling plenum. The architectural ceiling panel is finished with a durable powder coat paint.



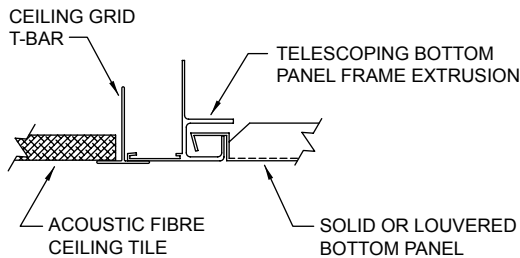
NOTE - Portions of the inlet louver not directly below unit inlet may require covering in the field on applications where infiltration of ceiling plenum air into space is undesired. Telescoping skirt and collar assembly must be field adjusted to assure a proper fit between filter frame and louvered inlet panel assembly. Refer to assembly submittal drawings for specific dimensions.

SECTION 1 - RECEIPT AND INITIAL INSTALLATION (CONTINUED)

KHFP OPTIONAL TELESCOPING BOTTOM PANEL ASSEMBLY, TYPICAL INSTALLATION INSTRUCTIONS

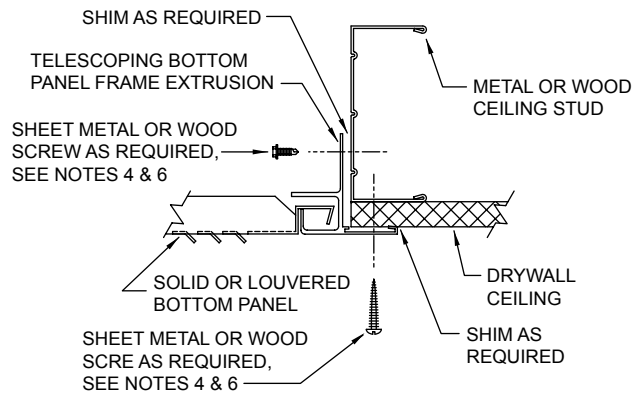


SUSPENDED GRID/TILE CEILING SYSTEM

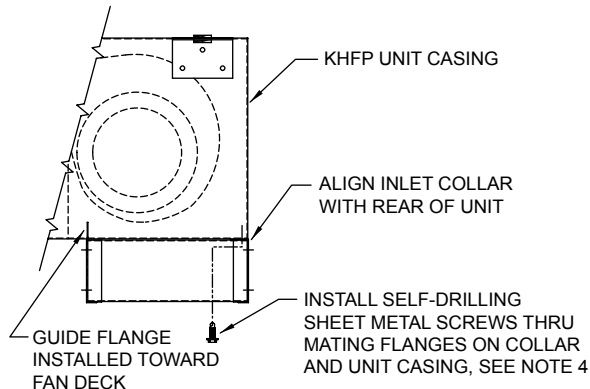


NOTE: CEILING T-BAR GRID MAY NOT SUPPORT TELESCOPING BOTTOM PANEL ASSEMBLY. BOTTOM PANEL ASSEMBLY MAY REQUIRE INDEPENDENT SUPPORT.

STUD/DRYWALL CEILING SYSTEM



INLET COLLAR INSTALLATION



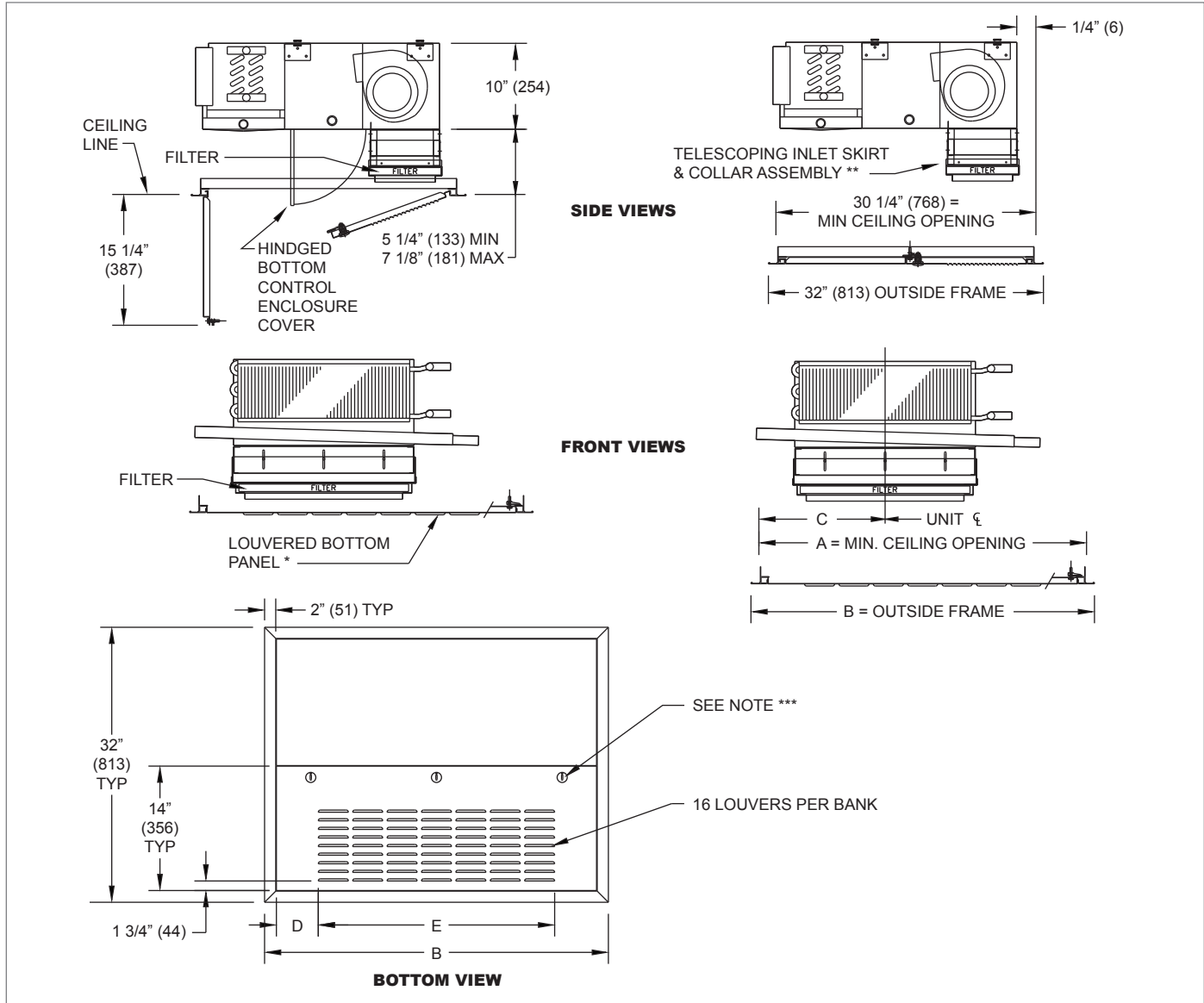
NOTES: All dimensions in inches (millimeters). All dimensions $\pm 1/4"$ (6mm). Metric values are soft conversion. Left hand unit shown, right hand unit opposite. Remove solid and louvered bottom panels before mounting frame assembly. Telescoping skirt assembly must be field adjusted to assure close fit of filter rack to louvered bottom panel. Portions of the inlet louver not directly below unit inlet may require covering in the field on applications where infiltration of ceiling plenum air into space is undesired.

* Attach standard filter rack assembly to bottom of telescoping skirt, after final adjustment of skirt location. Filter removal direction is optional.

** Mounting hardware not provided. Mounting holes must be located and drilled to suit individual job requirements. Frame assembly must be installed flat and square. Failure to do so may result in poor bottom panel fit and improper airflow pattern. Shim frame to support as required.

SECTION 1 - RECEIPT AND INITIAL INSTALLATION (CONTINUED)

KHFP OPTIONAL TELESCOPING BOTTOM PANEL ASSEMBLY, TYPICAL INSTALLATION INSTRUCTIONS



Unit Size	A	B	C	D	E
20	38 1/8" (968)	40" (1016)	14 1/2" (368)	4 1/4" (108)	27 1/2" (699)
25	44 1/8" (1121)	46" (1168)	17 1/2" (445)	3 1/4" (83)	35 1/2" (902)
30	48 1/8" (1222)	50" (1270)	19 1/2" (495)	3 1/4" (83)	39 1/2" (1003)
40	58 1/8" (1476)	60" (1524)	24 1/2" (622)	4 1/4" (108)	47 1/2" (1207)
50	68 1/8" (1730)	70" (1778)	29 1/2" (749)	3 1/4" (83)	59 1/2" (1511)
60	78 1/8" (1984)	80" (2032)	34 1/2" (876)	4 1/4" (108)	67 1/2" (1715)

NOTES: All dimensions in inches (millimeters). All dimensions $\pm 1/4"$ (6mm). Metric values are soft conversion. Left hand unit shown, right hand unit opposite.

* Portions of the inlet louver not directly below unit inlet may require covering in the field on applications where infiltration of ceiling plenum air into space is undesired.

** Telescoping skirt and collar assembly must be field adjusted to assure a proper fit between filter frame and louvered inlet panel assembly.

*** 1/4 turn latch, (2) quantity for standard sizes, (3) quantity for sizes 40-60.

SECTION 2 - START-UP

GENERAL

Before beginning any start-up operation, the startup personnel should familiarize themselves with the unit, options and accessories, and control sequence to understand the proper system operation. All personnel should have a good working knowledge of general start-up procedures and have the appropriate start-up and balancing guides available for consultation.

The initial step in any startup operation should be a final visual inspection. All equipment, plenums, duct-work, and piping should be inspected to verify that all systems are complete and properly installed and mounted, and that no debris or foreign articles such as paper or drink cans are left in the units or other areas. Each unit should be checked for loose wires, free blower wheel operation, and loose or missing access panels or doors. Except as required during start-up and balancing operations, no fan coil units should be operated without all the proper ductwork attached, supply and return grilles in place, and all access doors and panels in place and secure. A clean filter of the proper size and type must also be installed. Failure to do so could result in damage to the equipment or building and furnishings, and/or void all manufacturers' warranties.

COOLING/HEATING SYSTEM

Prior to the water system start-up and balancing, the chilled/hot water systems should be flushed to clean out dirt and debris, which may have collected in the piping during construction. During this procedure, all unit service valves must be in the closed position. This prevents foreign matter from entering the unit and clogging the valves and metering devices. Strainers should be installed in the piping mains to prevent this material from entering the units during normal operation.

During system filling, air venting from the unit is accomplished by the use of the standard manual, or optional automatic, air vent fitting installed on the coil.

In the case of the manual air vent fitting, the screw should be turned counterclockwise no more than 1-½ turns to operate the air vent. Automatic air vents may be unscrewed one turn counterclockwise to speed initial venting but should be screwed in for automatic venting after start-up operations.



CAUTION - *The air vent provided on the unit is not intended to replace the main system air vents and may not release air trapped in other parts of the system. Inspect the entire system for potential air traps and vent those areas as required, independently. In addition, some systems may require repeated venting over a period of time to properly eliminate air from the system.*

AIR SYSTEM BALANCING

All duct-work must be complete and connected, and all grilles, filters, access doors and panels must be properly installed to establish actual system operating conditions BEFORE beginning air balancing operations.

Each individual unit and attached duct-work is a unique system with its own operating characteristics. For this reason, air balancing is normally done by balance specialists who are familiar with all procedures required to properly establish air distribution and fan system operating conditions. These procedures should not be attempted by unqualified personnel.

After the proper system operation is established, the actual unit air delivery and the actual fan motor amperage draw for each unit should be recorded in a convenient place for future reference such as the inspection, installation, & start-up check sheet, a copy of which is provided on the back of this manual. Contact the Sales Representative or the factory for additional copies of this sheet.

SECTION 2 - START-UP (CONTINUED)

MOTOR AND FAN DATA

Unit Size	Fan Speed	Motor HP (Qty)	Number of Fans	115 Volts		208-230 Volts		277 Volts	
				Amps	Watts	Amps	Watts	Amps	Watts
20	High	(1) 1/30	1	0.8	57	0.6	77	0.3	71
	Medium	(1) 1/50		0.4	39	0.3	49	0.3	48
	Low	(1) 1/60		0.3	33	0.3	43	0.3	41
25	High	(1) 1/15	1	1.1	125	0.5	120	0.5	120
	Medium	(1) 1/30		0.9	90	0.3	80	0.3	80
	Low	(1) 1/60		0.5	60	0.2	60	0.2	60
30	High	(1) 1/10	2	1.9	165	0.8	158	0.8	162
	Medium	(1) 1/30		0.8	76	0.3	75	0.5	65
	Low	(1) 1/60		0.5	47	0.2	54	0.4	41
40	High	(1) 1/6	2	2.5	261	1.4	284	1.0	254
	Medium	(1) 1/12		1.5	162	0.5	171	0.5	152
	Low	(1) 1/40		0.6	75	0.4	79	0.3	74
50	High	(1) 1/8	3	1.6	215	0.9	216	0.8	214
		(1) 1/6		2.5	257	1.4	233	1.0	255
	Medium	(1) 1/15		1.3	145	0.6	109	0.5	132
		(1) 1/12		1.5	156	0.5	106	0.5	151
	Low	(1) 1/40		0.8	69	0.3	63	0.3	86
		(1) 1/40		0.6	75	0.4	62	0.3	84
60	High	(2) 1/6	4	5.0	522	2.8	568	2.0	508
	Medium	(2) 1/12		3.0	324	1.0	342	1.0	304
	Low	(2) 1/40		1.2	150	0.6	158	0.6	148

NOTES: Motor electrical data is nameplated data. Actual data will vary with application. 230 volt motor is nameplated for 208-230/1/60. Use 230 volt motor data for 208 volt applications. Unit size 30, 208-230 and 277 volt motors are 1/12 HP at high tap.

WATER SYSTEM BALANCING

A complete knowledge of the hydronic system, its components, and controls is essential to proper water system balancing and this procedure should not be attempted by unqualified personnel. The system must be complete and all components must be in operating condition BEFORE beginning water system balancing operations.

Each hydronic system has different operating characteristics depending on the devices and controls in the system. The actual balancing technique may vary from one system to another.

After the proper system operation is established, the appropriate system operating conditions such as various water temperatures and flow rates should be recorded in a convenient place for future reference.

Before and during water system balancing, conditions may exist which can result in noticeable water noise or undesired valve operation due to incorrect system pressures. After the entire system is balanced, these conditions will not exist on properly designed systems.

CONTROLS OPERATION

Before proper control operation can be verified all other systems must be in proper operation. The correct water and air temperatures must be present for the control function being tested. Some controls and features are designed to not operate under certain conditions.

A wide range of controls and electrical options and accessories may be used with the equipment covered in this manual. Consult the approved unit submittals, order acknowledgement, and other manuals for detailed information regarding each individual unit and its controls. Since controls and features may vary from one unit to another, care should be taken to identify the controls to be used on each unit and their proper control sequence. Information provided by component manufacturers regarding installation, operation, and maintenance of their individual controls is available upon request.

SECTION 3 - NORMAL OPERATION AND PERIODIC MAINTENANCE

GENERAL

Each unit on a job will have its own unique operating environment and conditions that may dictate a maintenance schedule for that unit that is different from other equipment on the job. A formal schedule of regular maintenance and an individual unit log should be established and maintained. This will help to achieve the maximum performance and service life of each unit on the job.



CAUTION - Information regarding safety precautions contained in the preface at the beginning of this manual should be followed during any service and maintenance operations.

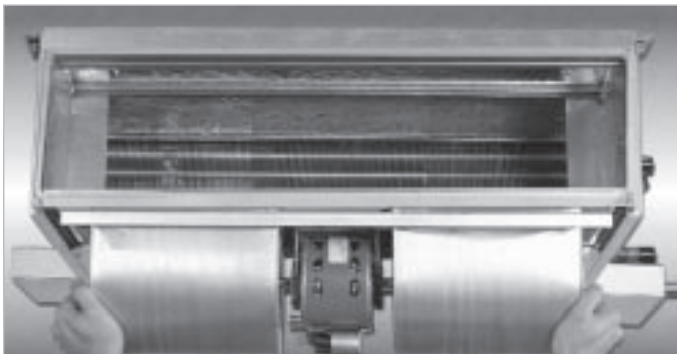
For more detailed information concerning service operations, consult your Sales Representative or the Factory.

MOTOR/BLOWER ASSEMBLY

The type of fan operation is determined by the control components and their method of wiring, and may vary from unit to unit. Refer to the wiring diagram for each unit for that unit's individual operating characteristics. Motors are permanently lubricated, PSC type and do not require field lubrication.

Fan Deck

The fan assembly is easily removed from the unit without disconnecting the ductwork for service access to motors and blowers at, or away from the unit.



Should the assembly require more extensive service, the motor/ blower assembly may be removed from the unit to facilitate such operations as motor or blower wheel/ housing replacement, etc. Dirt and dust should not be allowed to accumulate on the blower wheel or housing. This can result in an unbalanced blower wheel condition that can damage a blower wheel or motor. The wheel and housing may be cleaned periodically using a vacuum cleaner and a brush taking care not to dislodge the factory balancing weights on the blower wheel blades.

COIL

Coils may be cleaned in place by removing the motor/ blower assemblies and brushing the entering air face between fins with a soft brush parallel to fins. Do not brush perpendicular to fin orientation as damage may occur. Brushing should be followed by cleaning with a vacuum cleaner. If a compressed air source is available, the coil may also be cleaned by blowing air through the coil fins from the leaving air face. Vacuuming should again follow this. Units provided with the proper type of air filters, replaced regularly, may require periodic coil cleaning.

ELECTRIC RESISTANCE HEATER ASSEMBLY

Electric resistance heaters typically require no normal periodic maintenance when unit air filters are changed properly. Other conditions and equipment may affect the operation and service life in the system. The two most important operating conditions for an electric heater are proper airflow and proper supply voltage. High supply voltage and/or poorly distributed or insufficient airflow over the element will result in element overheating. This condition may result in the heater cycling on the high limit thermal cutout. Open wire type heaters provided have an automatic reset switch with a back-up high limit thermal switch. Automatic reset switches are as the name implies; they reset automatically after the heater has cooled down. High limit thermal switches must be replaced once the circuit has been broken. The high limit thermal cutout device is a safety device only and is not intended for continuous operation. With proper unit application and during normal operation, the high limit thermal cutout will not operate. This device only operates when some problem exists and ANY condition that causes high limit cutout MUST be corrected immediately. High supply voltage also causes excessive amperage draw and may result in tripping of the circuit breaker or blowing of the fuses on the incoming power supply.

SECTION 3 - NORMAL OPERATION AND PERIODIC MAINTENANCE (CONT)

ELECTRICAL WIRING & CONTROLS

The electrical operation of each unit is determined by the components and wiring of the unit and may vary from unit to unit. Consult the wiring diagram for the actual type and number of controls provided on each unit. The integrity of all electrical connections should be verified at least twice during the first year of operation. Afterwards, all controls should be inspected regularly for proper operation. Some components may experience erratic operation or failure due to age. Wall thermostats may also become clogged with dust and lint and should be periodically inspected and cleaned to provide reliable operation.

When replacing any components such as fuses, contactors, or relays, use only the exact type, size, and voltage component as furnished from the factory. Any deviation without factory authorization could result in personnel injury or damage to the unit and will void all factory warranties. All repair work should be done in such a manner as to maintain the equipment in compliance with governing codes and ordinances or testing agency listings.

More specific information regarding the use and operating characteristics of the standard controls offered by this manufacturer is contained in other manuals.

VALVES & PIPING

No formal maintenance is required on the valve package components most commonly used with fan coil units other than a visual inspection for possible leaks in the course of other normal periodic maintenance. In the event that a valve should need replacement, the same precautions taken during the initial installation to protect the valve package from excessive heat should also be used during replacement. In some cases, the valve actuator may fail and usually can be replaced without removing valve body from piping.

FILTERS, THROWAWAY

The type of throwaway filter most commonly used on fan coil units should be replaced on a regular basis. The time interval between each replacement should be established based on regular inspection of the filter and should be recorded in the log for each unit. Refer to the chart below for recommended filter size for each product type and size. If the replacement filters are not purchased from the factory, the filters used should be the same type and size as that furnished from or recommended by the factory. Pleated media or extended surface filters should not be used since the high air pressure drops encountered with these types of filters is not compatible with the type of fan coil unit covered in this manual. Consult the factory for applications using filter types other than the factory standard or optional product.

FACE AREA, FREE AREA AND FILTER SIZES

Unit Size	Coil Face Area	KHFE				KHFP	
		Return Air Grille Free Area	Supply Air Grille Free Area	Filter Face Area	Nominal Filter Sizes	Filter Face Area	Nominal Filter Sizes
20	1.04 [.09]	0.47 [.04]	0.40 [.04]	1.77 [.16]	30 x 8.5 x 1 [762 x 216 x 25]	1.18 [.11]	20 x 8.5 x 1 [508 x 216 x 25]
25	1.35 [.13]	0.58 [.05]	0.50 [.05]	2.36 [.22]	(2) 20 x 8.5 x 1 [508 x 216 x 25]	1.54 [.14]	26 x 8.5 x 1 [660 x 216 x 25]
30	1.56 [.14]	0.68 [.06]	0.56 [.05]	2.36 [.22]	(2) 20 x 8.5 x 1 [508 x 216 x 25]	1.77 [.16]	30 x 8.5 x 1 [762 x 216 x 25]
40	2.08 [.19]	0.81 [.08]	0.80 [.07]	2.95 [.27]	(1) 20, (1) 30 x 8.5 x 1 [508, 762 x 216 x 25]	2.36 [.22]	(2) 20 x 8.5 x 1 [508 x 216 x 25]
50	2.60 [.24]	1.01 [.09]	0.96 [.09]	3.54 [.33]	(2) 30 x 8.5 x 1 [762 x 216 x 25]	2.95 [.27]	(1) 20, (1) 30 x 8.5 x 1 [508, 762 x 216 x 25]
60	3.13 [.29]	1.15 [.11]	1.20 [.11]	4.13 [.38]	(2) 20, (1) 30 x 8.5 x 1 [508, 762 x 216 x 25]	3.54 [.33]	(2) 30 x 8.5 x 1 [762 x 216 x 25]

NOTES: Face and free areas are in square feet [square meters]. Filter sizes are in inches [millimeters]. Return Air Grille Free Area applies to KHFE and telescoping bottom panel return grilles. Supply Air Grille Free Area applies to KHFE supply grille and minimum free area allowable for a supply grille supplied by others.

SECTION 3 - NORMAL OPERATION AND PERIODIC MAINTENANCE (CONT)

UNIT WEIGHT DATA (lbs.)

Component		Unit Size					
		20	25	30	40	50	60
KHFH Base Unit		40 [18]	51 [23]	59 [27]	69 [31]	91 [41]	111 [50]
KHFP Base Unit		45 [20]	56 [25]	65 [30]	80 [36]	103 [47]	123 [56]
KHFE Base Unit		119 [54]	138 [63]	155 [70]	181 [82]	220 [100]	257 [117]
Coil Rows	1 Row - Dry	8 [4]	10 [5]	11 [5]	13 [6]	15 [7]	18 [8]
	1 Row - Wet	10 [5]	12 [5]	13 [6]	15 [7]	18 [8]	21 [10]
	2 Rows - Dry	11 [5]	13 [6]	15 [7]	18 [8]	22 [10]	26 [12]
	2 Rows - Wet	14 [6]	16 [7]	18 [8]	22 [10]	27 [12]	32 [15]
	3 Rows - Dry	14 [6]	17 [8]	19 [9]	24 [11]	29 [13]	34 [15]
	3 Rows - Wet	17 [8]	21 [10]	24 [11]	30 [14]	36 [16]	42 [19]
	4 Rows - Dry	17 [8]	20 [9]	23 [10]	29 [13]	36 [16]	42 [19]
	4 Rows - Wet	21 [10]	25 [11]	29 [13]	36 [16]	45 [20]	53 [24]

NOTES: Unit weight data is in pounds [kilograms].

DRAIN

The drain should be checked before initial start-up and at the beginning of each cooling season to assure that the lines are clear. If it is clogged, steps should be taken to clear the debris so that condensate will flow easily. Periodic checks of the drain should be made during the cooling season to maintain a free flowing condensate. Should the growth of algae and/or bacteria be a concern, consult an air conditioning and refrigeration supply organization familiar with local conditions for chemicals available to control these agents.

REPLACEMENT PARTS

Factory replacement parts should be used wherever possible to maintain the unit performance and operating characteristics and the testing agency listings. Replacement parts may be purchased through the local Sales Representative. Contact the local Sales Representative or the factory before attempting any unit modifications. Any modifications not authorized by the factory could result in personnel injury and damage to the unit and could void all factory warranties.

When ordering parts, the following information must be supplied to ensure proper part identification:

1. Complete unit model number
2. Unit hand connection (right or left hand) while facing the direction of airflow at the inlet
3. Complete part description including any numbers.

On warranty replacements, in addition to the information previously listed, the project CO # that appears on the unit nameplate, is required. Contact the factory for authorization to return any parts such as defective parts replaced in warranty. All shipments returned to the factory MUST be marked with a Return Authorization Number, which is provided by the factory.

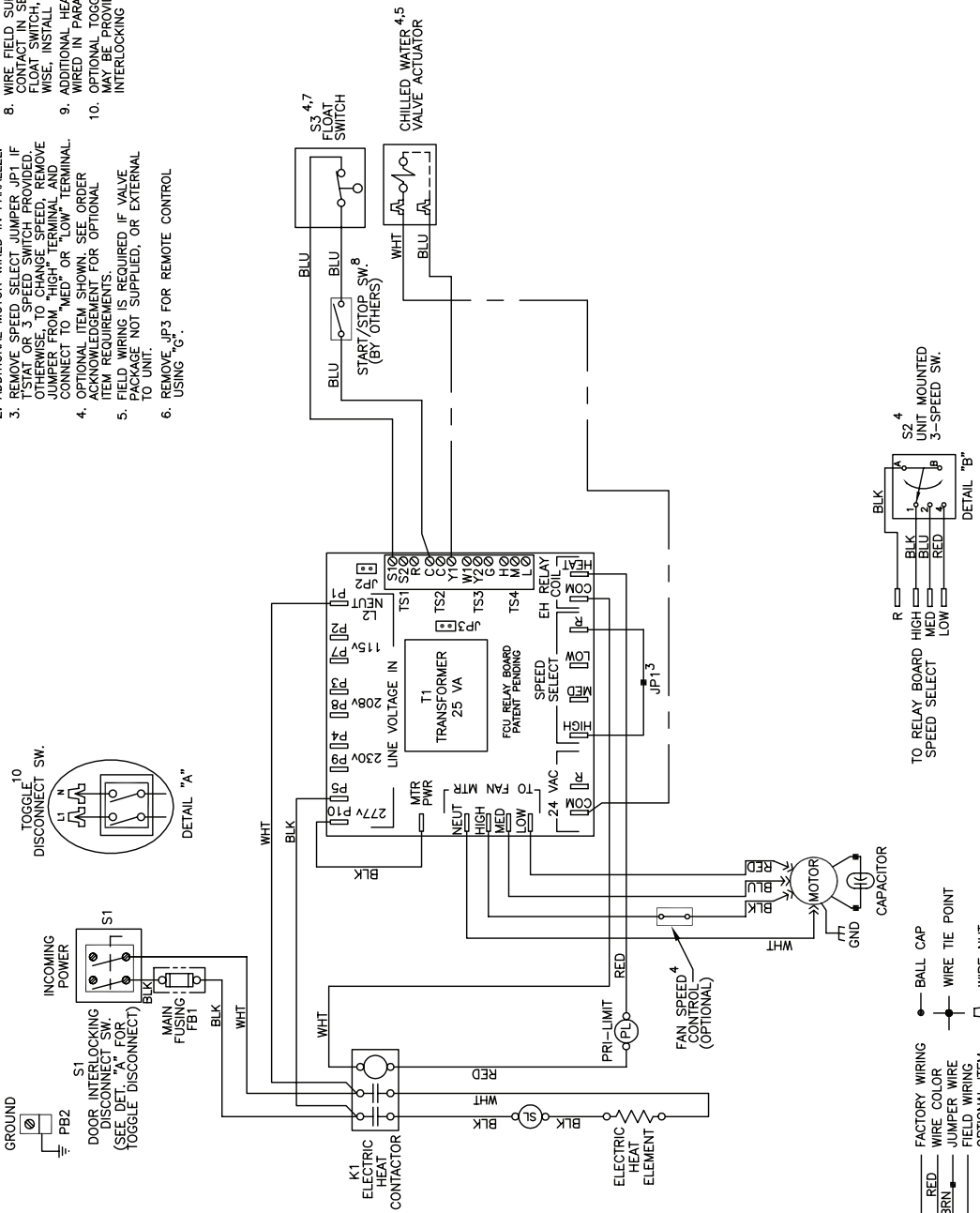
All equipment and components sold through the Parts Department are warranted under the same conditions as the standard manufacturer's warranty with the exception that the warranty period is 12 months unless the component is furnished as warranty replacement. Parts furnished as warranty replacements are warranted for the remaining term of the original unit warranties.

SECTION 3 - NORMAL OPERATION AND PERIODIC MAINTENANCE (CONT)

EXAMPLE WIRING DIAGRAMS

"Example Wiring Diagram - Typical 24 VAC Control Drawing (Refer to unit control enclosure for actual order-specific drawing)"

- FIELD NOTES:**
1. FIELD WIRING MUST BE COPPER CONDUCTOR, RATED AT 75°C MINIMUM.
 2. ADDITIONAL MOTOR WIRED IN PARALLEL.
 3. REMOVE SPEED SELECT JUMPER JPT IF USING 3 SPEEDS. REMOVE SPEED SELECT JUMPER FROM "HIGH" TERMINAL AND CONNECT TO "MED" OR "LOW" TERMINAL.
 4. OPTIONAL ITEM SHOWN. SEE ORDER ACKNOWLEDGEMENT FOR OPTIONAL ITEM REQUIREMENTS.
 5. FIELD WIRING IS REQUIRED IF VALVE PACKAGE NOT SUPPLIED, OR EXTERNAL TO UNIT.
 6. REMOVE JF3 FOR REMOTE CONTROL USING "G".
 7. IF FLOAT SWITCH PROVIDED, ATTACH JPT2 TO ONE PIN ONLY, OTHERWISE ATTACH TO BOTH PINS.
 8. WIRE FIELD SUPPLIED START/STOP CONTACT IN SERIES WITH OPTIONAL FLOAT SWITCH, IF PROVIDED. OTHERWISE, INSTALL JPT2.
 9. ADDITIONAL HEATER ELEMENT(S) WIRED IN PARALLEL.
 10. OPTIONAL TOGGLE DISCONNECT MAY BE PROVIDED IN LIEU OF DOOR INTERLOCKING DISCONNECT.

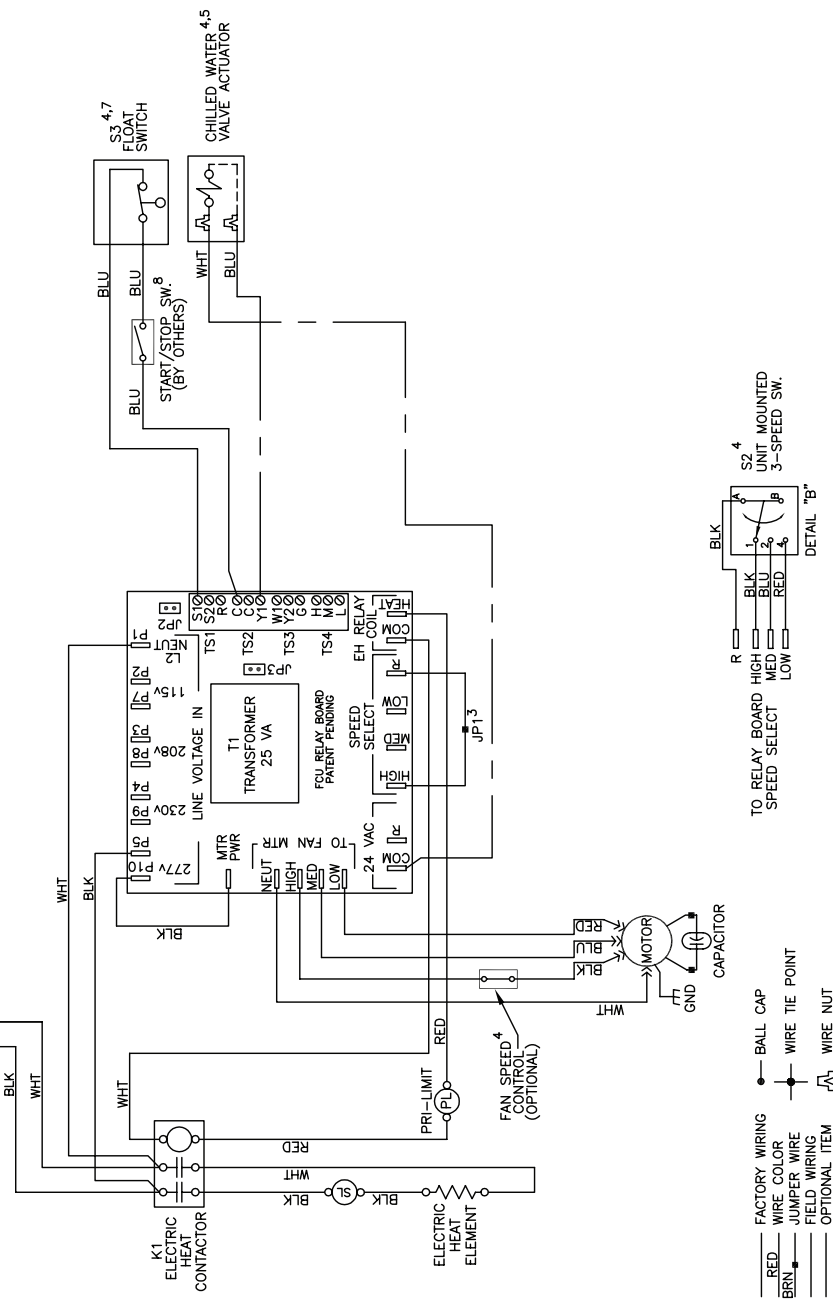
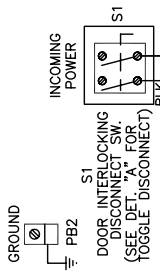
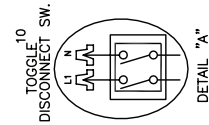


SECTION 3 - NORMAL OPERATION AND PERIODIC MAINTENANCE (CONT)

EXAMPLE WIRING DIAGRAMS (CONTINUED)

"Example Wiring Diagram - Typical 24 VAC Control Drawing (Refer to unit control enclosure for actual order-specific drawing)"

- FIELD NOTES:**
1. FIELD WIRING MUST BE COPPER CONDUCTOR, RATED AT 75°C MINIMUM.
 2. ADDITIONAL MOTOR WIRED IN PARALLEL.
 3. REMOVE SPEED SELECT JUMPER JPT IF USING 3 SPEED CONTROL. REMOVE JUMPER FROM "HIGH" TERMINAL AND CONNECT TO "MED" OR "LOW" TERMINAL.
 4. OPTIONAL ITEM SHOWN. SEE ORDER ACKNOWLEDGEMENT FOR OPTIONAL ITEM REQUIREMENTS.
 5. FIELD WIRING IS REQUIRED IF VALVE PACKAGE NOT SUPPLIED, OR EXTERNAL TO UNIT.
 6. REMOVE JF3 FOR REMOTE CONTROL USING "G".
 7. IF FLOAT SWITCH PROVIDED, ATTACH JPT2 TO ONE PIN ONLY, OTHERWISE ATTACH TO BOTH PINS.
 8. WIRE FIELD SUPPLIED START/STOP CONTACT IN SERIES WITH OPTIONAL FLOAT SWITCH, IF PROVIDED. OTHERWISE, INSTALL JPT2.
 9. ADDITIONAL HEATER ELEMENT(S) WIRED IN PARALLEL.
 10. OPTIONAL TOGGLE DISCONNECT MAY BE PROVIDED IN LIEU OF DOOR INTERLOCKING DISCONNECT.



SECTION 4 - INSPECTION & START-UP CHECKLIST

RECEIVING & INSPECTION

- Unit received undamaged.
- Unit arrangement/hand correct.
- Unit received complete as ordered.
- Unit structural support complete and correct.

HANDLING & INSTALLATION

- Unit mounted level and square.
- Proper electrical service provided.
- Proper service switch/disconnect provided.
- Proper chilled water line size to unit.
- Proper refrigerant line sizes to unit.
- Proper steam condensate trap on return line.
- All services to unit in code compliance.
- Proper access provided for unit and accessories.
- Proper overcurrent protection provided.
- Proper hot water line to unit.
- Proper steam line sizes to unit.
- Proper steam supply pressure to unit (15psi max).
- All shipping screws and braces removed.

COOLING/HEATING CONNECTIONS

- Protect valve package components from heat.
- Connect field piping to unit.
- Install drain line and traps as required.
- Install condensate pan under piping as required.
- Mount valve packages.
- Pressure test all piping for leaks.
- Insulate all piping as required.

DUCTWORK CONNECTIONS

- Install ductwork, fittings and grilles as required.
- Control outside air for freeze protection.
- Proper supply and return grille type and size used.
- Insulate all ductwork as required.

ELECTRICAL CONNECTIONS

- Refer to unit wiring diagram.
- All field wiring in code compliance.
- Connect incoming power service or services.

UNIT STARTUP

- General visual unit and system inspection.
- Record ambient temperature.
- Close all unit isolation valves.
- Fill systems with water/refrigerant.
- All ductwork and grilles in place.
- Start fans, etc.
- Check all ductwork and units for air leaks.
- Record all final settings for future use.
- Check all dampers for proper operation.
- Verify proper heating operation.
- Record electrical supply voltage.
- Check all wiring for secure connections.
- Flush water systems.
- Vent water systems as required.
- All unit panels and filters in place.
- Check for overload condition of all units.
- Balance air systems as required.
- Check piping and ductwork for vibration.
- Verify proper cooling operation.
- Reinstall all covers and access panels.



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