

MAINTENANCE ESTIMATE

ESTIMATED START DATE:

ESTIMATED COMPLETION DATE:

SCHOOL: FAIRWAY ELEMENTARY

LOC. #: 1641

WORK ORD.#:

DEPT. GIVING ESTIMATE: SAC

ESTIMATOR: DAN CIGALOTTI

TITLE LEADMAN

PHONE # 754 321 2907

ASBESTOS documents have been checked YES NO **INITIALS:** _____

DETAILED DESCRIPTION OF PROJECT:

REPLACE ROOFTOP PACKAGE UNITS RTU # 2 AND RTU # 3. WE WILL BE USING A CRANE TO FLY THE NEW UNITS ONTO ROOF. WE WILL BE RECONNECTING ELECTRIC, AND GETTING AN ASSIST FROM SMM TO SECURE UNIT TO CURB. ALSO NEED AN ASSIST FROM ELECTRICIANS TO RECONNECT POWER.

A PORTION OF THIS JOB WILL BE DONE ON OVERTIME AND WILL REFLECT BELOW.

ESTIMATED COSTS:

EVENT:	Event_Descript	SKILL CODE	MEN:	HRS MAN	Subbacklog Code	RATE:	TOTAL:
ACR	REPLACE	A1	2	22	SAC	65	2860.00
ACR	LABORER ASSIST	L1	1	8	SAC	43	344.00
SMM	SHEET MEATAL ASSIST	W2	2	12		64	1536.00
ELE	ELECTRICIAN ASSIST	E1	1	8	SEL	65	520.00

UCBI
Required

TOTAL LABOR: \$5,260.00

5% added to material totals to compensate for valuation increases

VENDOR: \$1,500.00

TOTAL COST FROM MATERIAL LIST: \$9,521.05

(<\$5000 = PC / \$5000 & up = Supv) **ESTIMATE TOTAL:** \$16,281.05

Foreperson Reviewed: _____ Date: 9/17/20

Supervisor's Approval: _____ Date: _____

Manager's Approval: _____ Date: 9/17/20

Planning & Scheduling Reviewed: _____ Date: _____

Please contact the supervisor to answer any questions you may have.

SUPERVISOR APPROVAL: _____ **DATE:** 9/14/2020

SUPERVISOR PHONE: _____

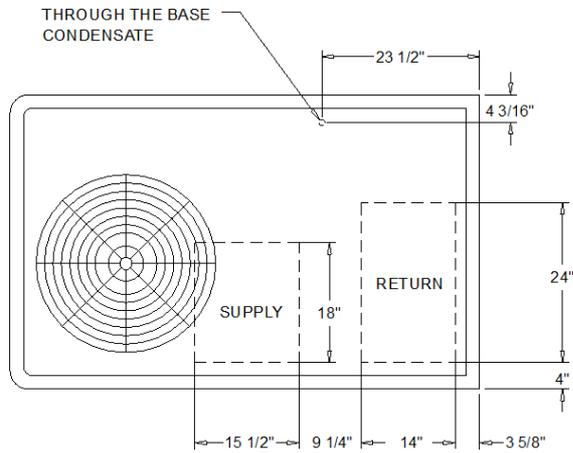
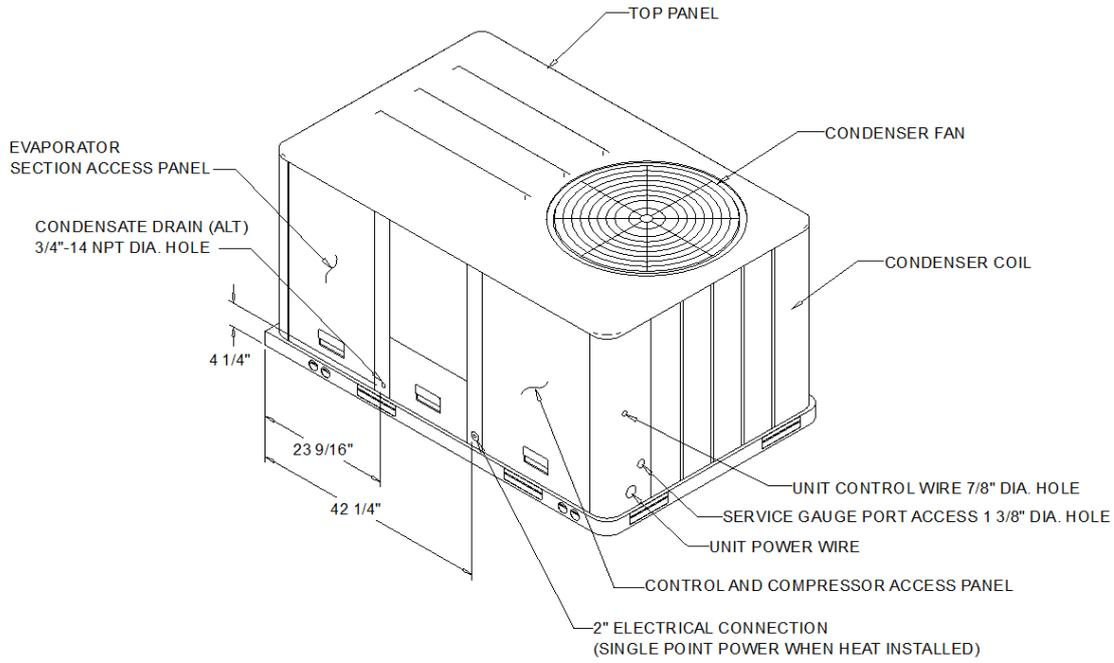


Acoustics

Sound Path	63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz
Ducted Discharge	89 dB	70 dB	65 dB	59 dB	56 dB	51 dB	47 dB	40 dB
Ducted Inlet	89 dB	72 dB	60 dB	52 dB	48 dB	44 dB	41 dB	36 dB
Outdoor Noise	79 dB	85 dB	79 dB	79 dB	77 dB	71 dB	67 dB	58 dB

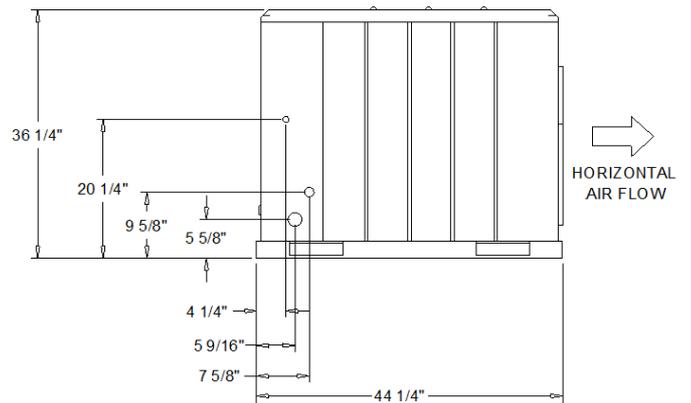
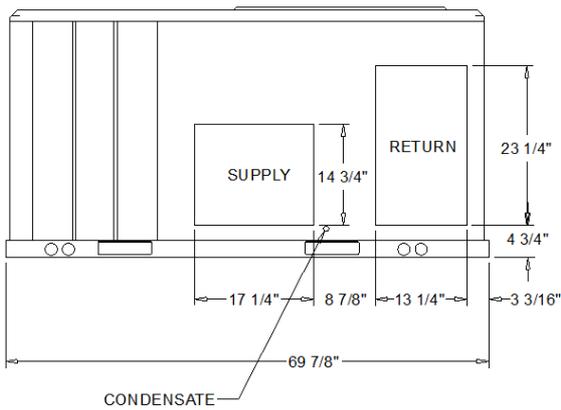
Note: Ducted Inlet and Ducted Discharge Sound Power Levels are in accordance with AHRI 260.

Note: Outdoor Sound Power Levels are in accordance with AHRI 270.

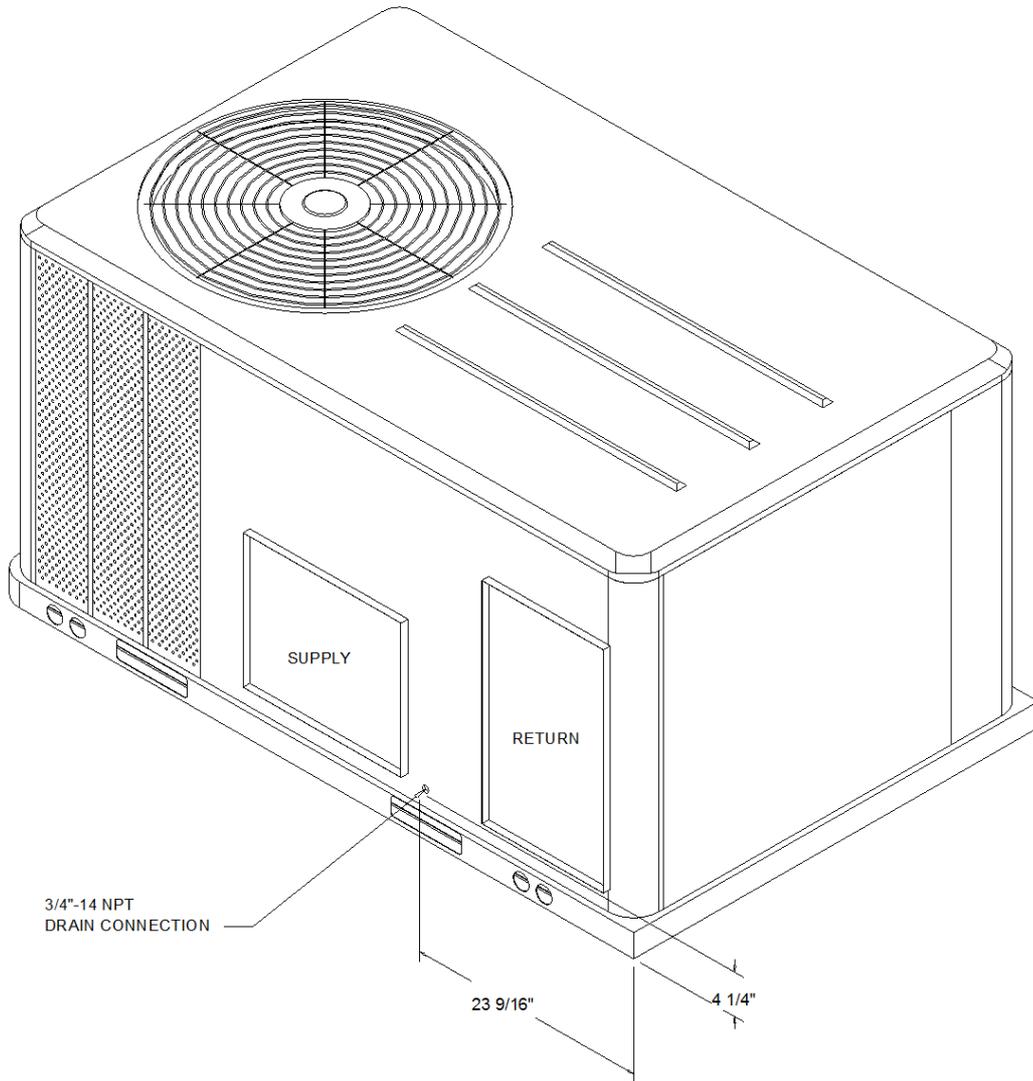


- NOTES:
1. THRU -THE -BASE ELECTRICAL IS NOT STANDARD ON ALL UNITS.
 2. VERIFY WEIGHT, CONNECTION, AND ALL DIMENSION WITH INSTALLER DOCUMENTS BEFORE INSTALLATION

PLAN VIEW UNIT
 DIMENSION DRAWING



PACKAGED COOLING
 DIMENSION DRAWING



ISOMETRIC-PACKAGED COOLING

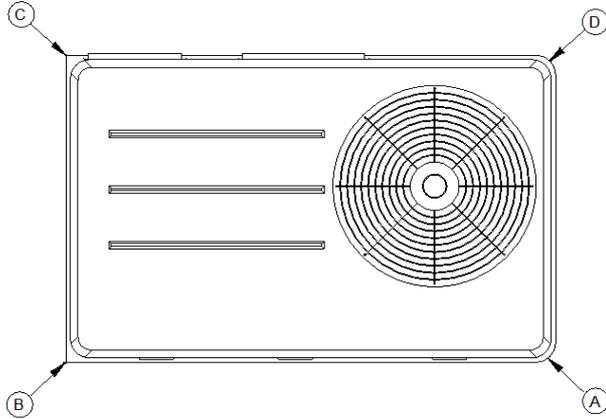


ELECTRICAL / GENERAL DATA

GENERAL (2)(4)(6) Model: THC036E Oversized Motor Unit Operating Voltage: 414-506 Unit Primary Voltage: 460 Unit Secondary Voltage: -- Unit Hertz: 60 Unit Phase: 3 SEER: 13.0 Standard Motor: 12.7/15.0 MCA: 10.0 MFS: 15.0 MCB: 15.0		WITH HEATER Heater kW Rating : 6.0 Stage: 1 MCA: 13.0 MFS: 15.0 MCB: 15.0 Oversized Motor MCA: N/A MFS: N/A MCB: N/A																																											
Field Installed Oversized Motor MCA: N/A MFS: N/A MCB: N/A		Field Installed Oversized Motor MCA: N/A MFS: N/A MCB: N/A																																											
INDOOR MOTOR <table border="0"> <tr> <td>Standard Motor</td> <td></td> <td>Outsized Motor</td> <td></td> <td>Field Installed Oversized Motor</td> <td></td> </tr> <tr> <td>Number:</td> <td>1</td> <td>Number:</td> <td>N/A</td> <td>Number:</td> <td>N/A</td> </tr> <tr> <td>Horsepower:</td> <td>1.0</td> <td>Horsepower:</td> <td>N/A</td> <td>Horsepower:</td> <td>N/A</td> </tr> <tr> <td>Motor Speed (RPM):</td> <td>--</td> <td>Motor Speed (RPM):</td> <td>N/A</td> <td>Motor Speed (RPM):</td> <td>N/A</td> </tr> <tr> <td>Phase:</td> <td>3</td> <td>Phase:</td> <td>N/A</td> <td>Phase:</td> <td>N/A</td> </tr> <tr> <td>Full Load Amps:</td> <td>1.6</td> <td>Full Load Amps:</td> <td>N/A</td> <td>Full Load Amps:</td> <td>N/A</td> </tr> <tr> <td>Locked Rotor Amps:</td> <td>--</td> <td>Locked Rotor Amps:</td> <td>N/A</td> <td>Locked Rotor Amps:</td> <td>N/A</td> </tr> </table>				Standard Motor		Outsized Motor		Field Installed Oversized Motor		Number:	1	Number:	N/A	Number:	N/A	Horsepower:	1.0	Horsepower:	N/A	Horsepower:	N/A	Motor Speed (RPM):	--	Motor Speed (RPM):	N/A	Motor Speed (RPM):	N/A	Phase:	3	Phase:	N/A	Phase:	N/A	Full Load Amps:	1.6	Full Load Amps:	N/A	Full Load Amps:	N/A	Locked Rotor Amps:	--	Locked Rotor Amps:	N/A	Locked Rotor Amps:	N/A
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COMPRESSOR Circuit 1/2 Number: 1 Horsepower: 2.7 Phase: 3 Rated Load Amps: 5.8 Locked Rotor Amps: -		OUTDOOR MOTOR Number: 1 Horsepower: 0.20 Motor Speed (RPM): 1075 Phase: 3 Full Load Amps: 0.6 Locked Rotor Amps: 1.3																																											
POWER EXHAUST ACCESSORY (3,7) (Field Installed Power Exhaust) Phase: N/A Horsepower: N/A Motor Speed (RPM): N/A Full Load Amps: N/A Locked Rotor Amps: N/A		FILTERS Type: Throwaway Furnished: Yes Number: 2 Recommended: 20"x30"x2"																																											
REFRIGERANT (2) Type: R-410 Factory Charge Circuit #1: 6.2 lb Circuit #2: N/A																																													

NOTES:

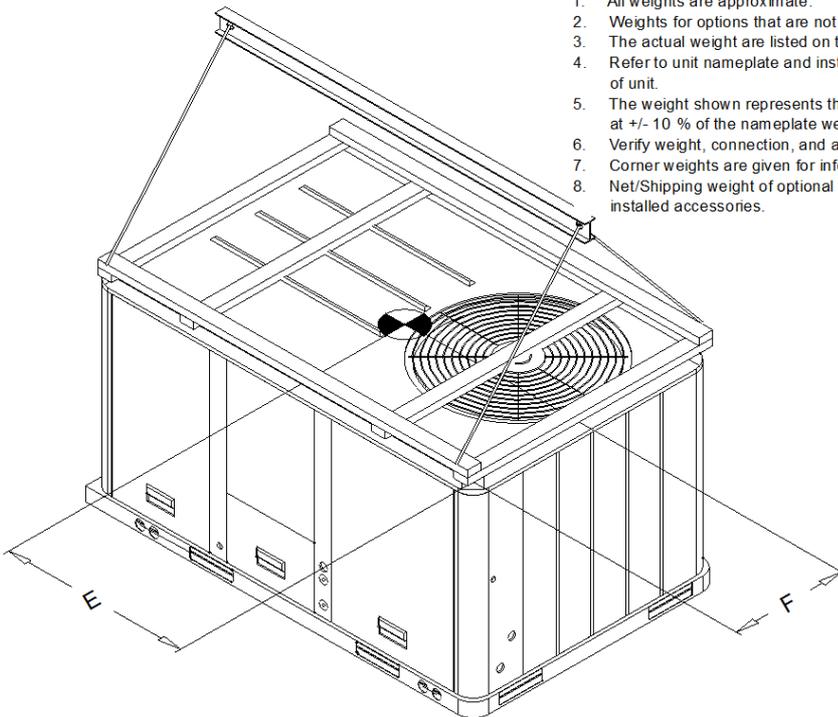
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3. Value does not include Power Exhaust Accessory.
4. Value includes oversized motor.
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6. EER is rated at AHRI conditions and in accordance with DOE test procedures.
7. Installation of this power exhaust kit will affect unit level MCA and could affect MOP sizing having a direct impact on existing field wiring and unit protection devices. The change in MCA/MOP is the sole responsibility of the field installing party. Trane will not issue new nameplates as a result of this power exhaust accessory installation. FLA of the power exhaust kit option must be added to the MCA of the unit for building supply conductor sizing determination.

INSTALLED ACCESSORIES NET WEIGHT DATA

CORNER WEIGHT

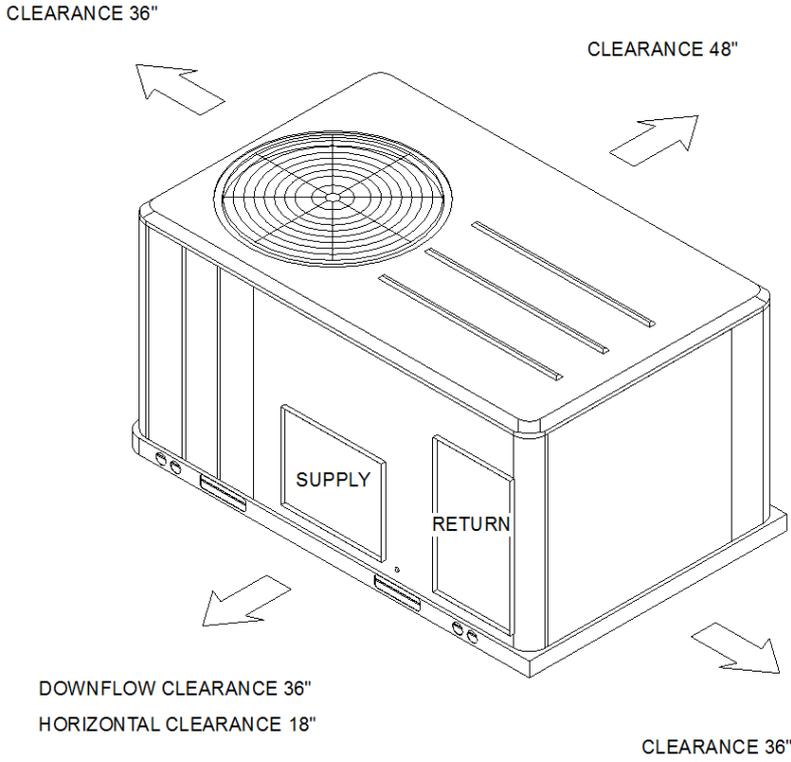
ACCESSORY		WEIGHTS			
ECONOMIZER					
MOTORIZED OUTSIDE AIR DAMPER					
MANUAL OUTSIDE AIR DAMPER					
BAROMETRIC RELIEF					
OVERSIZED MOTOR					
BELT DRIVE MOTOR					
POWER EXHAUST					
HEATER		15.0 lb			
REHEAT					
THROUGH THE BASE ELECTRICAL (FIOPS)					
UNIT MOUNTED CIRCUIT BREAKER (FIOPS)					
UNIT MOUNTED DISCONNECT (FIOPS)					
POWERED CONVENIENCE OUTLET (FIOPS)					
HINGED DOORS (FIOPS)					
HAIL GUARD					
SMOKE DETECTOR, SUPPLY / RETURN					
NOVAR CONTROL					
ROOF CURB					
BASIC UNIT WEIGHTS		CORNER WEIGHTS		CENTER OF GRAVITY	
SHIPPING	NET	(A)	(C)	(E) LENGHT	(F) WIDTH
555.0 lb	481.0 lb	(B) 122.0 lb	(D) 107.0 lb	31"	19"

NOTE:

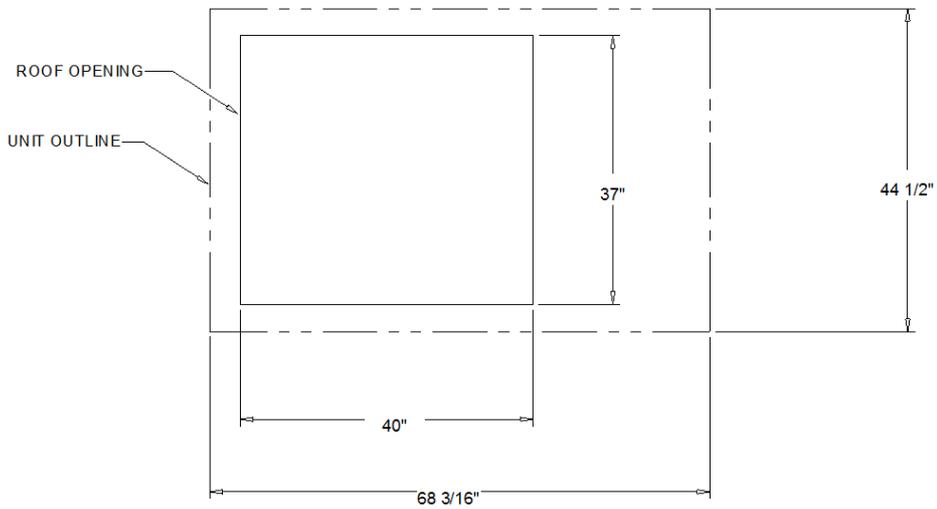
- All weights are approximate.
- Weights for options that are not list refer to Installation guide.
- The actual weight are listed on the unit nameplate.
- Refer to unit nameplate and installation guide for weights before scheduling transportation and installation of unit.
- The weight shown represents the typical unit operating weight for the configuration selected. Estimated at +/- 10 % of the nameplate weight.
- Verify weight, connection, and all dimension with installer documents before installation.
- Corner weights are given for information only.
- Net/Shipping weight of optional accessories should be added to unit weight when ordering factory or field installed accessories.


RIGGING AND CENTER OF GRAVITY

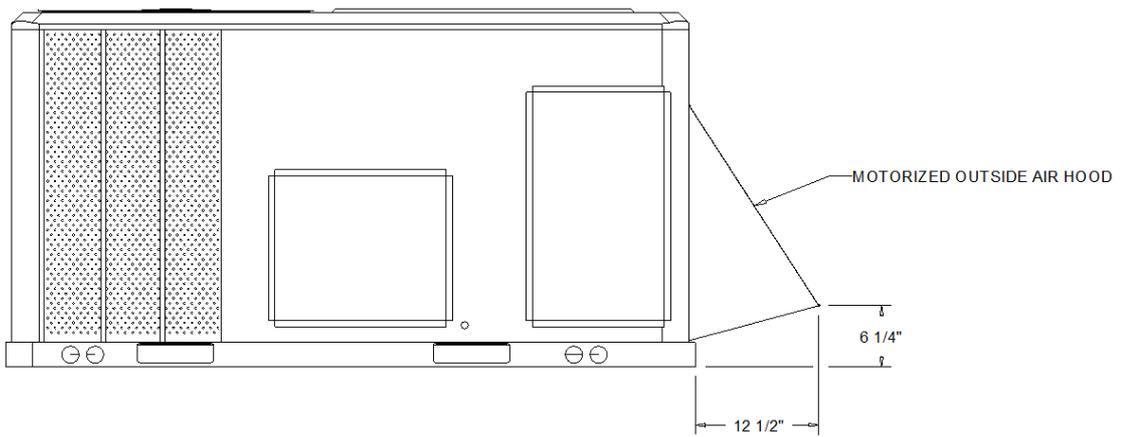
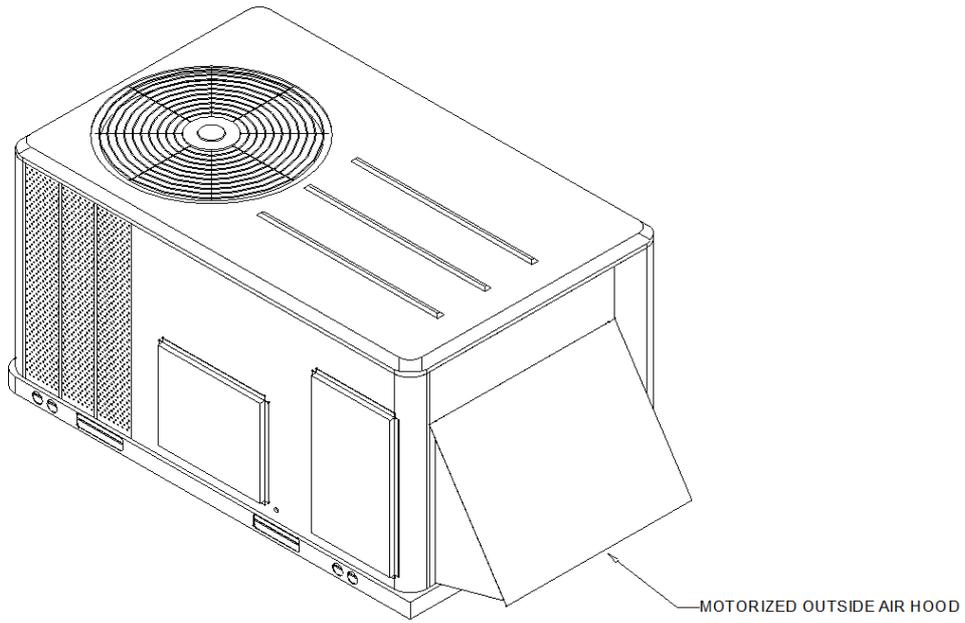
CLEARANCE FROM TOP OF UNIT 72"



PACKAGED COOLING
 CLEARANCE



PACKAGED COOLING
 DOWNFLOW TYPICAL ROOF OPENING



MOTORIZED OUTSIDE AIR HOOD
ACCESSORY



General

The units shall be convertible airflow. The operating range shall be between 115°F and 0°F in cooling as standard from the factory for units with microprocessor controls. Operating range for units with electromechanical controls shall be between 115°F and 40°F. Cooling performance shall be rated in accordance with ARI testing procedures. All units shall be factory assembled, internally wired, fully charged with R-410A, and 100 percent run tested to check cooling operation, fan and blower rotation, and control sequence before leaving the factory. Wiring internal to the unit shall be colored and numbered for simplified identification. Units shall be cULus listed and labeled, classified in accordance for Central Cooling Air Conditioners.

Casing

Unit casing shall be constructed of zinc coated, heavy gauge, galvanized steel. Exterior surfaces shall be cleaned, phosphatized, and finished with a weather-resistant baked enamel finish. Units surface shall be tested 672 hours in a salt spray test in compliance with ASTM B117. Cabinet construction shall allow for all maintenance on one side of the unit. Service panels shall have lifting handles and be removed and reinstalled by removing two fasteners while providing a water and air tight seal. All exposed vertical panels and top covers in the indoor air section shall be insulated with a cleanable foil-faced, fire-retardant permanent, odorless glass fiber material. The base of the unit shall be insulated with 1/8", foil-faced, closed-cell insulation. All insulation edges shall be either captured or sealed. The units base pan shall have no penetrations within the perimeter of the curb other than the raised 1 1/8" inch high downflow supply/return openings to provide an added water integrity precaution, if the condensate drain backs up. The base of the unit shall have provisions for forklift and crane lifting, with forklift capabilities on three sides of the unit.

Unit Top

The top cover shall be one piece construction or, where seams exist, it shall be double-hemmed and gasket-sealed. The ribbed top adds extra strength and enhances water removal from unit top.

Filters

Throwaway filters shall be standard on all units. Optional 2-inch MERV 8 and MERV 13 filters shall also be available.

Two-Inch Pleated Filters

Two inch pleated media filters shall be available on all models.

Compressors

All units shall have direct-drive, hermetic, scroll type compressors with centrifugal type oil pumps. Motor shall be suction gas-cooled and shall have a voltage utilization range of plus or minus 10 percent of unit nameplate voltage. Internal overloads shall be provided with the scroll compressors.

Dual compressors are outstanding for humidity control, light load cooling conditions and system back-up applications. Dual compressors are available on 7½-10 ton models and allow for efficient cooling utilizing 3-stages of compressor operation for all high efficiency models.

Evaporator and Condenser Coils

Internally finned, 5/16" copper tubes mechanically bonded to a configured aluminum plate fin shall be standard. Evaporator coils are standard for all 3 to 10 ton standard efficiency models. Microchannel condenser coils are standard for all 3 to 10 ton standard efficiency models and 4, 5, 6, 7.5, 8.5 ton high efficiency models. The microchannel type condenser coil is not offered on the 4 and 5 ton dehumidification model. Due to flat streamlined tubes with small ports, and metallurgical tube-to-fin bond, microchannel coil has better heat transfer performance. Microchannel condenser coil can reduce system refrigerant charge by up to 50% because of smaller internal volume, which leads to better compressor reliability. Compact all-aluminum microchannel coils also help to reduce the unit weight. These all aluminum coils are recyclable. Galvanic corrosion is also minimized due to all aluminum construction. Strong aluminum brazed structure provides better fin protection. In addition, flat streamlined tubes also make microchannel coils more dust resistant and easier to clean. Coils shall be leak tested at the factory to ensure the pressure integrity. The evaporator coil and condenser coil shall be leak tested to 600 psig. The assembled unit shall be leak tested to 465 psig. The condenser coil shall have a patent pending 1+1+1 hybrid coil designed with slight gaps for ease of cleaning. A plastic, dual-sloped, removable and reversible condensate drain pan with through-the-base condensate drain is standard.

Outdoor Fans



The outdoor fan shall be direct-drive, statically and dynamically balanced, draw-through in the vertical discharge position. The fan motor shall be permanently lubricated and shall have built-in thermal overload protection.

Indoor Fan

The following units shall be equipped with a direct drive plenum fan design (T/YSC120F,T/YHC074F, T/YHC092F,T/YHC102F, 120F). Plenum fan design shall include a backward-curved fan wheel along with an external rotor direct drive variable speed indoor motor. All plenum fan designs will have a variable speed adjustment potentiometer located in the control box.

3 to 5 ton units (high efficiency 3-phase with optional motor) are belt driven, FC centrifugal fans with adjustable motor sheaves. 3 to 5 ton units have multispeed, direct drive motors. All 6 to 8½ ton units (standard efficiency) shall have belt drive motors with an adjustable idler-arm assembly for quick-adjustment to fan belts and motor sheaves. All motors shall be thermally protected. All 10 tons, 6 ton (074), 7½ to 8½ (high efficiency) units have variable speed direct drive motors. All indoor fan motors meet the U.S. Energy Policy Act of 1992 (EPACT).

Controls

Unit shall be completely factory-wired with necessary controls and contactor pressure lugs or terminal block for power wiring. Unit shall provide an external location for mounting a fused disconnect device. A choice of microprocessor or electromechanical controls shall be available. Microprocessor controls provide for volt control functions. The resident control algorithms shall make all heating, cooling, and/or ventilating decisions in response to electronic signals from sensors measuring indoor and outdoor temperatures. The control algorithm maintains accurate temperature control, minimizes drift from set point, and provides better building comfort. A centralized Microprocessor shall provide anti-short cycle timing and time delay between compressors to provide a higher level of machine protection.

Refrigerant Circuits

Each refrigerant circuit offer thermal expansion valve as standard. Service pressure ports, and refrigerant line filter driers are factory-installed as standard. An area shall be provided for replacement suction line driers.

Phase monitor

Phase monitor shall provide 100% protection for motors and compressors against problems caused by phase loss, phase imbalance, and phase reversal. Phase monitor is equipped with an LED that provides an ON or FAULT indicator. There are no field adjustments. The module will automatically reset from a fault condition.

Electric Heaters

Electric heat modules shall be available for installation within basic unit. Electric heater elements shall be constructed of heavy-duty nickel chromium elements internally delta connected for 240 volt, wye connected for 480 and 600 volt. Staging shall be achieved through ReliaTel. Each heater package shall have automatically reset high limit control operating through heating element contactors. All heaters shall be individually fused from the factory, where required, and shall meet all NEC and CEC requirements when properly installed. Power assemblies shall provide single point connection. Electric heat modules shall be UL listed or CSA certified.

Motorized Outside Air Dampers

Manually set outdoor air dampers shall provide up to 50 percent outside air. Once set, outdoor air dampers shall open to set position when indoor fan starts. The damper shall close to the full closed position when indoor fan shuts down.

Sequence of Operation (if applied in a SINGLE-ZONE CONSTANT-VOLUME SYSTEM or a CHANGEOVER BYPASS SYSTEM)

B. SINGLE-ZONE CONSTANT-VOLUME SYSTEM

1. OCCUPIED HEAT/COOL:

The RTU shall operate the supply fan continuously and modulate (or cycle) compressors, modulate (or stage) heat, and/or enable airside economizing to maintain zone temperature at setpoint. The OA damper shall open to bring in the required amount of ventilation.

2. MORNING WARM-UP/PRE-COOL:



The RTU shall operate the supply fan and modulate (or cycle) compressors or modulate (or stage) heat to raise/lower zone temperature to its occupied setpoint. The OA damper shall remain closed, unless economizing.

D. CHANGEOVER BYPASS SYSTEM

1. OCCUPIED HEAT/COOL:

Each VAV terminal shall use pressure-independent control, with airflow measurement, to vary primary airflow to maintain zone temperature at its occupied setpoint. The RTU shall modulate the bypass damper to maintain duct static pressure at setpoint and modulate (or cycle) compressors, modulate (or stage) heat, and/or enable airside economizing based on current zone cooling/heating demands. The OA damper shall open to bring in the required amount of ventilation.

2. MORNING WARM-UP/PRE-COOL:

Each VAV terminal unit shall vary primary airflow to raise/lower zone temperature to its occupied setpoint. The RTU shall modulate the bypass damper to maintain duct static pressure at setpoint and modulate (or cycle) compressors or modulate (or stage) heat based on current zone cooling/heating demands. The OA damper shall remain closed, unless economizing.

3. COOLING/HEATING CHANGEOVER LOGIC:

The System Controller shall determine the overall system cooling/heating mode based on "voting" from each zone. When the majority of zones require cooling, the RTU shall operate in cooling mode and any zone that requires heating shall reduce primary airflow to minimum. When the majority of zones require heating, the RTU shall operate in heating mode and any zone that requires cooling shall reduce primary airflow to minimum.

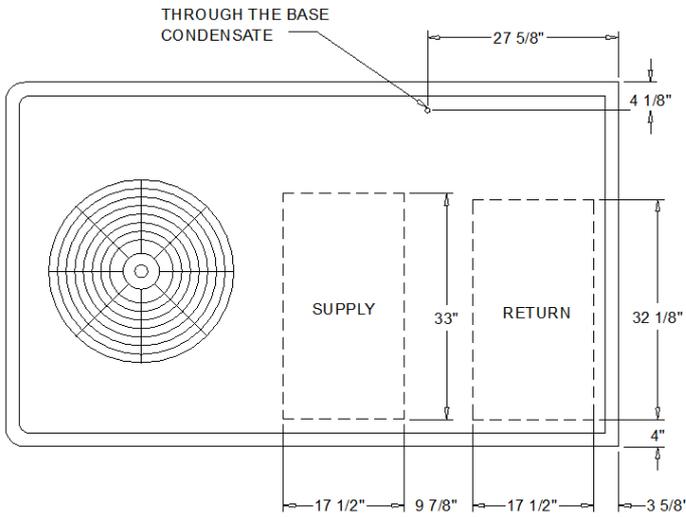
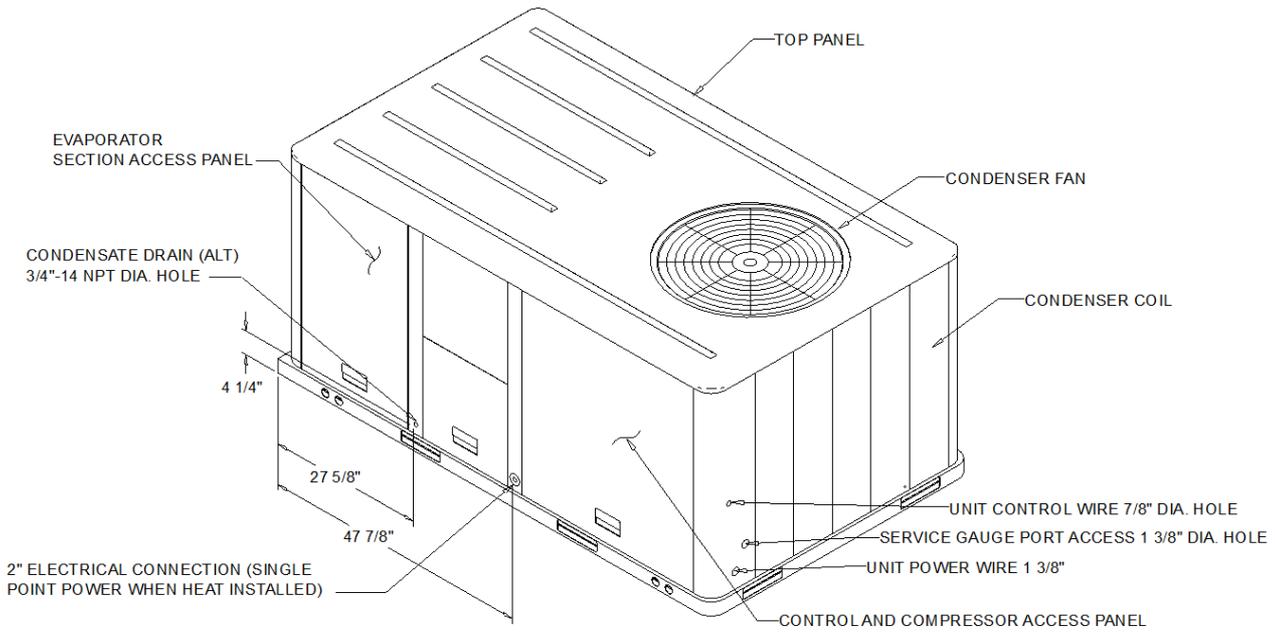


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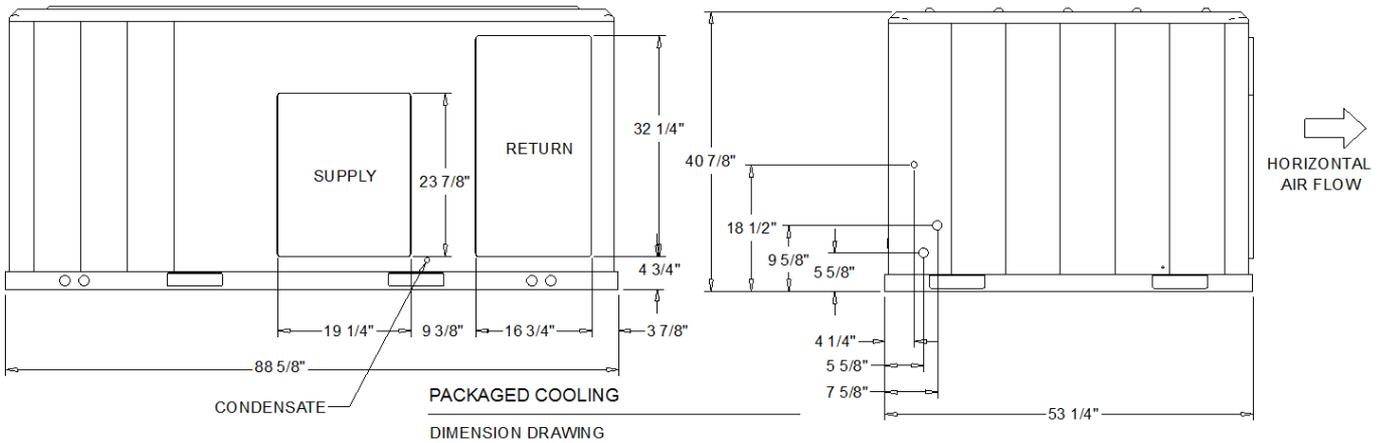
Note: Ducted Inlet and Ducted Discharge Sound Power Levels are in accordance with AHRI 260.

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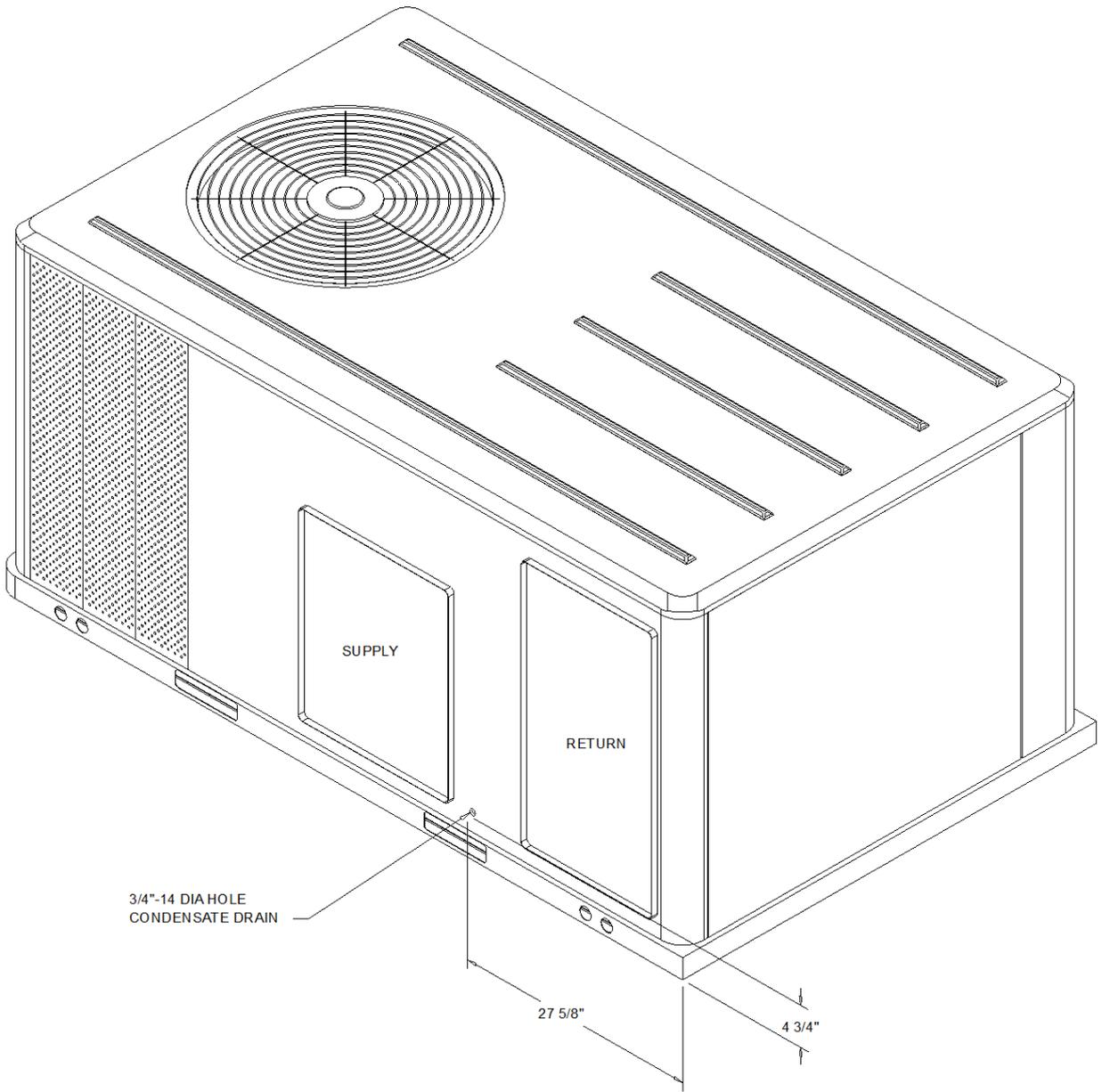


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PLAN VIEW UNIT
 DIMENSION DRAWING



PACKAGED COOLING
 DIMENSION DRAWING



ISOMETRIC-PACKAGED COOLING



ELECTRICAL / GENERAL DATA

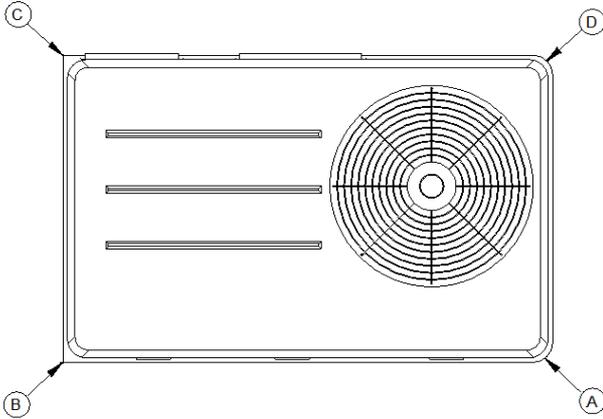
GENERAL (2)(4)(6) Model: THC048F Oversized Motor Unit Operating Voltage: 414-506 Unit Primary Voltage: 460 Unit Secondary Voltage: -- Unit Hertz: 60 Unit Phase: 3 SEER: 15.0 Standard Motor MCA: 11.0 MFS: 15.0 MCB: 15.0		WITH HEATER Heater kW Rating : 6.0 Stage: 1 MCA: 13.0 MFS: 15.0 MCB: 15.0 Oversized Motor MCA: N/A MFS: N/A MCB: N/A									
MCA: N/A MFS: N/A MCB: N/A		Field Installed Oversized Motor MCA: N/A MFS: N/A MCB: N/A									
INDOOR MOTOR Standard Motor Number: 1 Horsepower: 1.0 Motor Speed (RPM): -- Phase: 3 Full Load Amps: 1.6 Locked Rotor Amps: --				Outsized Motor Number: N/A Horsepower: N/A Motor Speed (RPM): N/A Phase: N/A Full Load Amps: N/A Locked Rotor Amps: N/A				Field Installed Oversized Motor Number: N/A Horsepower: N/A Motor Speed (RPM): N/A Phase: N/A Full Load Amps: N/A Locked Rotor Amps: N/A			
COMPRESSOR Circuit 1/2 Number: 1 Horsepower: 3.5 Phase: 3 Rated Load Amps: 6.2 Locked Rotor Amps: --		OUTDOOR MOTOR Number: 1 Horsepower: 0.40 Motor Speed (RPM): 1075 Phase: 3 Full Load Amps: 1.0 Locked Rotor Amps: --									
POWER EXHAUST ACCESSORY (3,7) (Field Installed Power Exhaust) Phase: N/A Horsepower: N/A Motor Speed (RPM): N/A Full Load Amps: N/A Locked Rotor Amps: N/A		FILTERS Type: Throwaway Furnished: Yes Number: 4 Recommended: 16"x25"x2"		REFRIGERANT (2) Type: R-410 Factory Charge Circuit #1: 5.2 lb Circuit #2: N/A							

NOTES:

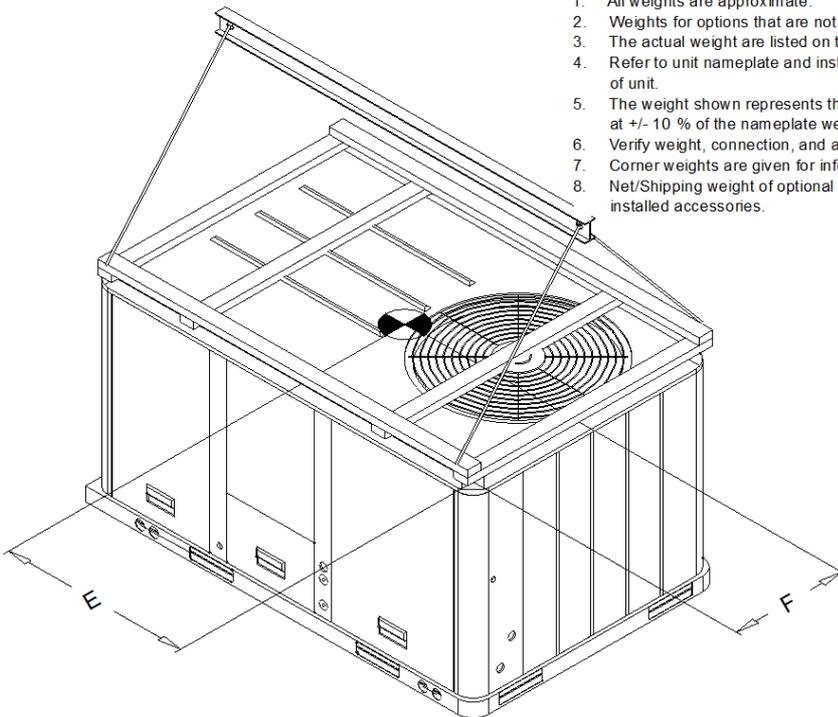
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INSTALLED ACCESSORIES NET WEIGHT DATA

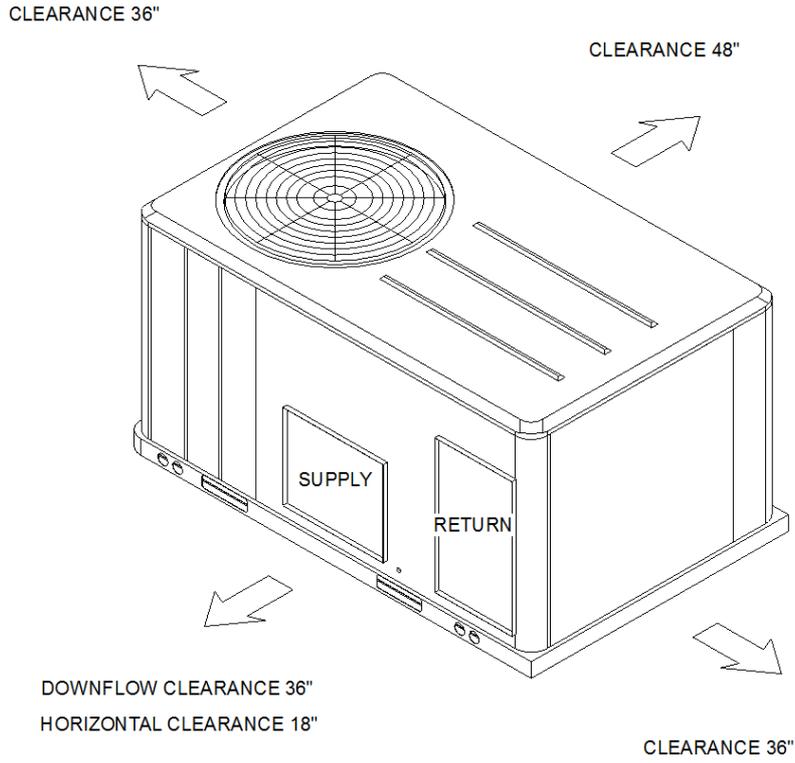
ACCESSORY		WEIGHTS					
ECONOMIZER							
MOTORIZED OUTSIDE AIR DAMPER		30.0 lb					
MANUAL OUTSIDE AIR DAMPER							
BAROMETRIC RELIEF							
OVERSIZED MOTOR							
BELT DRIVE MOTOR							
POWER EXHAUST							
HEATER		30.0 lb					
REHEAT		15.0 lb					
THROUGH THE BASE ELECTRICAL (FIOPS)							
UNIT MOUNTED CIRCUIT BREAKER (FIOPS)							
UNIT MOUNTED DISCONNECT (FIOPS)							
POWERED CONVENIENCE OUTLET (FIOPS)							
HINGED DOORS (FIOPS)							
HAIL GUARD							
SMOKE DETECTOR, SUPPLY / RETURN							
NOVAR CONTROL							
ROOF CURB							
BASIC UNIT WEIGHTS		CORNER WEIGHTS		CENTER OF GRAVITY			
SHIPPING	NET	(A)	208.0 lb	(C)	128.0 lb	(E) LENGHT	(F) WIDTH
737.0 lb	642.0 lb	(B)	117.0 lb	(D)	130.0 lb	44"	22"


CORNER WEIGHT
NOTE:

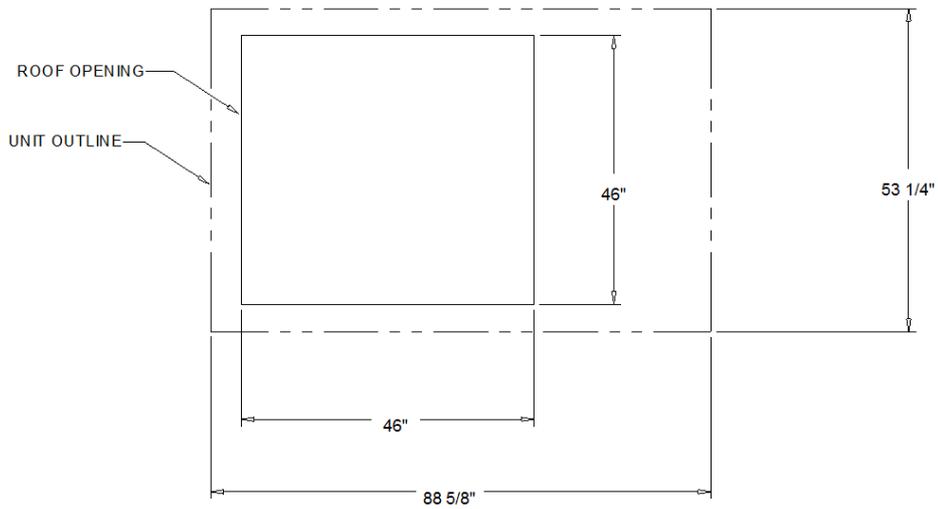
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- Net/Shipping weight of optional accessories should be added to unit weight when ordering factory or field installed accessories.


RIGGING AND CENTER OF GRAVITY

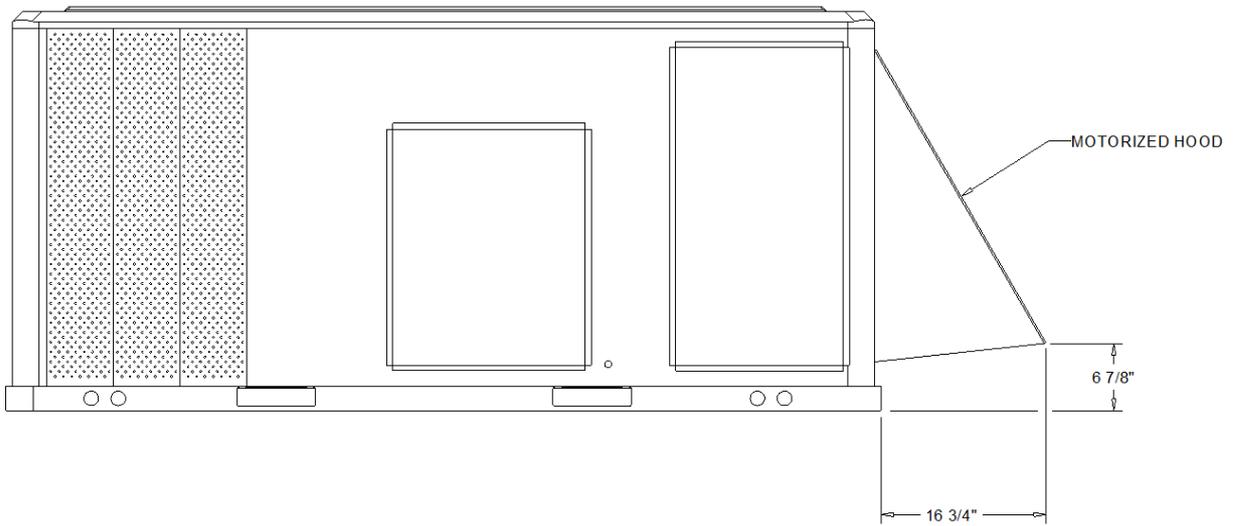
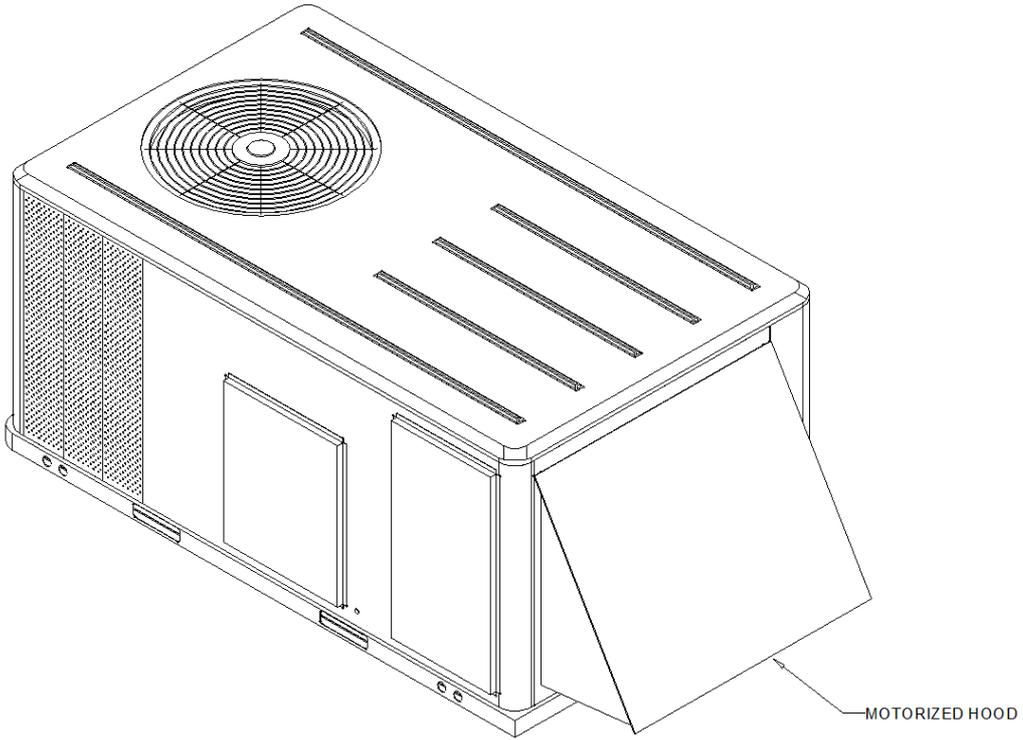
CLEARANCE FROM TOP OF UNIT 72"



PACKAGED COOLING
 CLEARANCE



PACKAGED COOLING
 DOWNFLOW TYPICAL ROOF OPENING



MOTORIZED OUTSIDE AIR HOOD
ACCESSORY



General

The units shall be convertible airflow. The operating range shall be between 115°F and 0°F in cooling as standard from the factory for units with microprocessor controls. Operating range for units with electromechanical controls shall be between 115°F and 40°F. Cooling performance shall be rated in accordance with ARI testing procedures. All units shall be factory assembled, internally wired, fully charged with R-410A, and 100 percent run tested to check cooling operation, fan and blower rotation, and control sequence before leaving the factory. Wiring internal to the unit shall be colored and numbered for simplified identification. Units shall be cULus listed and labeled, classified in accordance for Central Cooling Air Conditioners.

Casing

Unit casing shall be constructed of zinc coated, heavy gauge, galvanized steel. Exterior surfaces shall be cleaned, phosphatized, and finished with a weather-resistant baked enamel finish. Units surface shall be tested 672 hours in a salt spray test in compliance with ASTM B117. Cabinet construction shall allow for all maintenance on one side of the unit. Service panels shall have lifting handles and be removed and reinstalled by removing two fasteners while providing a water and air tight seal. All exposed vertical panels and top covers in the indoor air section shall be insulated with a cleanable foil-faced, fire-retardant permanent, odorless glass fiber material. The base of the unit shall be insulated with 1/8", foil-faced, closed-cell insulation. All insulation edges shall be either captured or sealed. The units base pan shall have no penetrations within the perimeter of the curb other than the raised 1 1/8" inch high downflow supply/return openings to provide an added water integrity precaution, if the condensate drain backs up. The base of the unit shall have provisions for forklift and crane lifting, with forklift capabilities on three sides of the unit.

Unit Top

The top cover shall be one piece construction or, where seams exist, it shall be double-hemmed and gasket-sealed. The ribbed top adds extra strength and enhances water removal from unit top.

Filters

Throwaway filters shall be standard on all units. Optional 2-inch MERV 8 and MERV 13 filters shall also be available.

Two-Inch Pleated Filters

Two inch pleated media filters shall be available on all models.

Compressors

All units shall have direct-drive, hermetic, scroll type compressors with centrifugal type oil pumps. Motor shall be suction gas-cooled and shall have a voltage utilization range of plus or minus 10 percent of unit nameplate voltage. Internal overloads shall be provided with the scroll compressors.

Dual compressors are outstanding for humidity control, light load cooling conditions and system back-up applications. Dual compressors are available on 7½-10 ton models and allow for efficient cooling utilizing 3-stages of compressor operation for all high efficiency models.

Evaporator and Condenser Coils

Internally finned, 5/16" copper tubes mechanically bonded to a configured aluminum plate fin shall be standard. Evaporator coils are standard for all 3 to 10 ton standard efficiency models. Microchannel condenser coils are standard for all 3 to 10 ton standard efficiency models and 4, 5, 6, 7.5, 8.5 ton high efficiency models. The microchannel type condenser coil is not offered on the 4 and 5 ton dehumidification model. Due to flat streamlined tubes with small ports, and metallurgical tube-to-fin bond, microchannel coil has better heat transfer performance. Microchannel condenser coil can reduce system refrigerant charge by up to 50% because of smaller internal volume, which leads to better compressor reliability. Compact all-aluminum microchannel coils also help to reduce the unit weight. These all aluminum coils are recyclable. Galvanic corrosion is also minimized due to all aluminum construction. Strong aluminum brazed structure provides better fin protection. In addition, flat streamlined tubes also make microchannel coils more dust resistant and easier to clean. Coils shall be leak tested at the factory to ensure the pressure integrity. The evaporator coil and condenser coil shall be leak tested to 600 psig. The assembled unit shall be leak tested to 465 psig. The condenser coil shall have a patent pending 1+1+1 hybrid coil designed with slight gaps for ease of cleaning. A plastic, dual-sloped, removable and reversible condensate drain pan with through-the-base condensate drain is standard.

Outdoor Fans



The outdoor fan shall be direct-drive, statically and dynamically balanced, draw-through in the vertical discharge position. The fan motor shall be permanently lubricated and shall have built-in thermal overload protection.

Indoor Fan

The following units shall be equipped with a direct drive plenum fan design (T/YSC120F,T/YHC074F, T/YHC092F,T/YHC102F, 120F). Plenum fan design shall include a backward-curved fan wheel along with an external rotor direct drive variable speed indoor motor. All plenum fan designs will have a variable speed adjustment potentiometer located in the control box.

3 to 5 ton units (high efficiency 3-phase with optional motor) are belt driven, FC centrifugal fans with adjustable motor sheaves. 3 to 5 ton units have multispeed, direct drive motors. All 6 to 8½ ton units (standard efficiency) shall have belt drive motors with an adjustable idler-arm assembly for quick-adjustment to fan belts and motor sheaves. All motors shall be thermally protected. All 10 tons, 6 ton (074), 7½ to 8½ (high efficiency) units have variable speed direct drive motors. All indoor fan motors meet the U.S. Energy Policy Act of 1992 (EPACT).

Controls

Unit shall be completely factory-wired with necessary controls and contactor pressure lugs or terminal block for power wiring. Unit shall provide an external location for mounting a fused disconnect device. A choice of microprocessor or electromechanical controls shall be available. Microprocessor controls provide for volt control functions. The resident control algorithms shall make all heating, cooling, and/or ventilating decisions in response to electronic signals from sensors measuring indoor and outdoor temperatures. The control algorithm maintains accurate temperature control, minimizes drift from set point, and provides better building comfort. A centralized Microprocessor shall provide anti-short cycle timing and time delay between compressors to provide a higher level of machine protection.

Refrigerant Circuits

Each refrigerant circuit offer thermal expansion valve as standard. Service pressure ports, and refrigerant line filter driers are factory-installed as standard. An area shall be provided for replacement suction line driers.

Phase monitor

Phase monitor shall provide 100% protection for motors and compressors against problems caused by phase loss, phase imbalance, and phase reversal. Phase monitor is equipped with an LED that provides an ON or FAULT indicator. There are no field adjustments. The module will automatically reset from a fault condition.

Electric Heaters

Electric heat modules shall be available for installation within basic unit. Electric heater elements shall be constructed of heavy-duty nickel chromium elements internally delta connected for 240 volt, wye connected for 480 and 600 volt. Staging shall be achieved through ReliaTel. Each heater package shall have automatically reset high limit control operating through heating element contactors. All heaters shall be individually fused from the factory, where required, and shall meet all NEC and CEC requirements when properly installed. Power assemblies shall provide single point connection. Electric heat modules shall be UL listed or CSA certified.

Motorized Outside Air Dampers

Manually set outdoor air dampers shall provide up to 50 percent outside air. Once set, outdoor air dampers shall open to set position when indoor fan starts. The damper shall close to the full closed position when indoor fan shuts down.

Sequence of Operation (if applied in a SINGLE-ZONE CONSTANT-VOLUME SYSTEM or a CHANGEOVER BYPASS SYSTEM)

B. SINGLE-ZONE CONSTANT-VOLUME SYSTEM

1. OCCUPIED HEAT/COOL:

The RTU shall operate the supply fan continuously and modulate (or cycle) compressors, modulate (or stage) heat, and/or enable airside economizing to maintain zone temperature at setpoint. The OA damper shall open to bring in the required amount of ventilation.

2. MORNING WARM-UP/PRE-COOL:



The RTU shall operate the supply fan and modulate (or cycle) compressors or modulate (or stage) heat to raise/lower zone temperature to its occupied setpoint. The OA damper shall remain closed, unless economizing.

D. CHANGEOVER BYPASS SYSTEM

1. OCCUPIED HEAT/COOL:

Each VAV terminal shall use pressure-independent control, with airflow measurement, to vary primary airflow to maintain zone temperature at its occupied setpoint. The RTU shall modulate the bypass damper to maintain duct static pressure at setpoint and modulate (or cycle) compressors, modulate (or stage) heat, and/or enable airside economizing based on current zone cooling/heating demands. The OA damper shall open to bring in the required amount of ventilation.

2. MORNING WARM-UP/PRE-COOL:

Each VAV terminal unit shall vary primary airflow to raise/lower zone temperature to its occupied setpoint. The RTU shall modulate the bypass damper to maintain duct static pressure at setpoint and modulate (or cycle) compressors or modulate (or stage) heat based on current zone cooling/heating demands. The OA damper shall remain closed, unless economizing.

3. COOLING/HEATING CHANGEOVER LOGIC:

The System Controller shall determine the overall system cooling/heating mode based on "voting" from each zone. When the majority of zones require cooling, the RTU shall operate in cooling mode and any zone that requires heating shall reduce primary airflow to minimum. When the majority of zones require heating, the RTU shall operate in heating mode and any zone that requires cooling shall reduce primary airflow to minimum.