MG450 | 21.9L | 450 kW

INDUSTRIAL SPARK-IGNITED GENERATOR SET

EPA Certified Stationary Emergency and Non-Emergency

GENERAC | INDUSTRIAL POWER

GENERATOR
SCREENED IN AT GROUND LEVEL - EAST SIDE OF BUILDING A

DEMAND RESPONSE READY

Standby Power Rating
450 kW, 562 kVA, 60 Hz

Demand Response Rating
450 kW, 562 kVA, 60 Hz

Prime Power Rating
360 kW, 450 kVA, 60 Hz

ISO 9001:2008

USA ENGINEERED & BUILT*
*Assembled in the USA using domestic and foreign parts

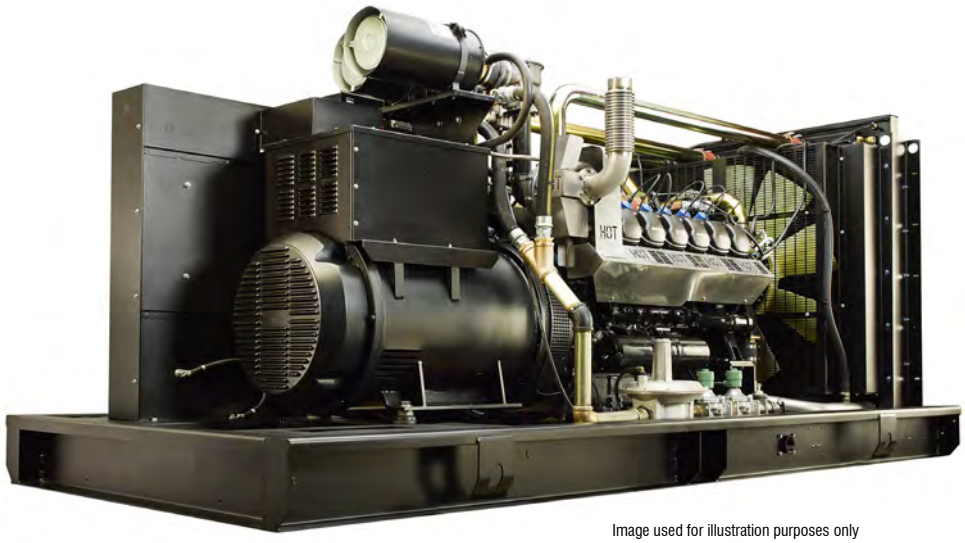

Image used for illustration purposes only

Codes and Standards

Not all codes and standards apply to all configurations. Contact factory for details.

UL2200, UL6200, UL1236, UL489

CSA C22.2, B149

BS5514 and DIN 6271

SAE J1349

NFPA 37, 70, 99, 110

NEC700, 701, 702, 708

ISO 3046, 7637, 8528, 9001

NEMA ICS10, MG1, 250, ICS6, AB1

ANSI C62.41

IBC 2009, CBC 2010, IBC 2012, ASCE 7-05, ASCE 7-10, ICC-ES AC-156 (2012)

Powering Ahead

Generac ensures superior quality by designing and manufacturing most of its generator components, such as alternators, enclosures, control systems and communications software. Generac also makes its own spark-ignited engines, and you'll find them on every Generac gaseous-fueled generator. We engineer and manufacture them from the block up — all at our facilities throughout Wisconsin. Applying natural gas and LP-fueled engines to generators requires advanced engineering expertise to ensure reliability, durability and necessary performance. By designing specifically for these dry, hotter-burning fuels, the engines last longer and require less maintenance. Building our own engines also means we control every step of the supply chain and delivery process, so you benefit from single-source responsibility.

Plus, Generac Industrial Power's distribution network provides all parts and service so you don't have to deal with third-party suppliers. It all leads to a positive owner experience and higher confidence level. Generac spark-ignited engines give you more options in commercial and industrial generator applications as well as extended run time from utility-supplied natural gas.

MG450 | 21.9L | 450 kW

INDUSTRIAL SPARK-IGNITED GENERATOR SET

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GENERATOR
SCREENED IN AT GROUND LEVEL - EAST SIDE OF BUILDING A

STANDARD FEATURES

DEMAND RESPONSE READY

ENGINE SYSTEM

- Oil Drain Extension
- Air Cleaner
- Stainless Steel Flexible Exhaust Connection
- Factory Filled Oil and Coolant
- Radiator Duct Adapter (Open Set Only)
- Critical Silencer

Fuel System

- NPT Fuel Connection on Frame
- Primary and Secondary Fuel Shutoff

Cooling System

- Closed Coolant Recovery System
- UV/Ozone Resistant Hoses
- Factory-Installed Radiator
- 50/50 Ethylene Glycol Antifreeze
- Radiator Drain Extension

Electrical System

- Battery Charging Alternator
- Battery Cables
- Battery Tray
- Rubber-Booted Engine Electrical Connections
- Solenoid Activated Starter Motor

ALTERNATOR SYSTEM

- UL2200 GENprotect™
- Class H Insulation Material
- 2/3 Pitch
- Skewed Stator
- Permanent Magnet Excitation
- Sealed Bearing
- Amortisseur Winding
- Full Load Capacity Alternator

GENERATOR SET

- Internal Genset Vibration Isolation
- Separation of Circuits - High/Low Voltage
- Separation of Circuits - Multiple Breakers
- Wrapped Exhaust Piping
- Standard Factory Testing
- 2 Year Limited Warranty (Standby and Demand Response Rated Units)
- 1 Year Limited Warranty (Prime Rated Units)
- Silencer Mounted in the Discharge Hood (Enclosed Units Only)

ENCLOSURE (If Selected)

- Rust-Proof Fasteners with Nylon Washers to Protect Finish
- High Performance Sound-Absorbing Material (Sound Attenuated Enclosures)
- Gasketed Doors
- Upward Facing Discharge Hood (Radiator and Exhaust)
- Stainless Steel Lift Off Door Hinges
- Stainless Steel Lockable Handles
- RhinoCoat™ - Textured Polyester Powder Coat Paint

CONTROL SYSTEM

Power Zone® Pro Sync Controller

Program Functions

- NFPA 110 Level 1 Compliant
- Engine Protective Functions
- Alternator Protective Functions
- Digital Engine Governor Control
- Digital Voltage Regulator
- Multiple Programmable Inputs and Outputs
- Remote Display Capability
- Remote Communication via Modbus® RTU, Modbus TCP/IP, and Ethernet 10/100
- Alarm and Event Logging with Real Time Stamping
- Expandable Analog and Digital Inputs and Outputs
- Remote Wireless Software Update Capable
- Wi-Fi, Bluetooth, BMS and Remote Telemetry
- Built-In Programmable Logic Eliminates the Need for External Controllers Under Most Conditions
- Ethernet Based Communications Between Generators
- Programmable I/O Channel Properties
- Built-In Diagnostics

Protections

- Low Oil Pressure
- Low Coolant Level
- High/Low Coolant Temperature
- Sensor Failure
- Oil Temperature
- Over/Under Speed
- Over/Under Voltage
- Over/Under Frequency
- Over/Under Current
- Over Load
- High/Low Battery Voltage
- Battery Charger Current
- Phase to Phase and Phase to Neutral Short Circuits (I^2T Algorithm)

7 Inch Color Touch Screen Display

- Resistive Color Touch Screen
- Sunlight Readable (1400 NITS)
- Easily Identifiable Icons
- Multi-Lingual
- On Screen Editable Parameters
- Key Function Monitoring
- Three Phase Voltage, Amperage, kW, kVA, and kVAr
- Selectable Line to Line or Line to Neutral Measurements
- Frequency
- Engine Speed
- Engine Coolant Temperature
- Engine Oil Pressure
- Engine Oil Temperature
- Battery Voltage
- Hourmeter
- Warning and Alarm Indication
- Diagnostics
- Maintenance Events/Information

PARALLELING CONTROLS

- Auto-Synchronization Process
- Isochronous Load Sharing
- Reverse Power Protection
- Maximum Power Protection
- Electrically Operated, Mechanically Held Paralleling Switch
- Sync Check System
- Independent On-Board Paralleling
- Optional Programmable Logic Full Auto Back-Up Controls (PLS)
- Shunt Trip and Auxiliary Contact

MG450 | 21.9L | 450 kW

INDUSTRIAL SPARK-IGNITED GENERATOR SET

EPA Certified Stationary Emergency and Non-Emergency

GENERAC® | INDUSTRIAL POWER

CONFIGURABLE OPTIONS

DEMAND RESPONSE READY

ENGINE SYSTEM

- ○ Baseframe Cover/Rodent Guard
- ○ Oil Heater
- ○ Air Filter Restriction Indicator
- ○ Radiator Stone Guard (Open Set Only)
- ○ Level 1 Fan and Belt Guards (Enclosed Units Only)

FUEL SYSTEM

- ○ NPT Flexible Fuel Line

ELECTRICAL SYSTEM

- ○ 10A UL Listed Battery Charger
- ○ Battery Warmer

ALTERNATOR SYSTEM

- ○ Alternator Upsizing
- ○ Anti-Condensation Heater
- ○ Tropical Coating

CIRCUIT BREAKER OPTIONS

- ○ Main Line Circuit Breaker
- ○ Electronic Trip Breakers

GENERATOR SET

- ○ Demand Response Rating
- ○ Extended Factory Testing (3-Phase Only)
- ○ 12 Position Load Center

ENCLOSURE

- ○ Weather Protected Enclosure
- ○ Level 1 Sound Attenuated
- ○ Level 2 Sound Attenuated
- ○ Level 2 Sound Attenuated with Motorized Dampers
- ○ Level 3 Sound Attenuated (Steel Only)
- ○ Steel Enclosure
- ○ Aluminum Enclosure
- ○ Damper Alarm (Motorized Dampers Only)
- ○ Up to 200 MPH Wind Load Rating (Contact Factory for Availability)
- ○ AC/DC Enclosure Lighting Kit
- ○ Enclosure Heaters
- ○ Door Open Alarm Switch

CONTROL SYSTEM

- ○ Oil Temperature Sender with Indication Alarm
- ○ Remote E-Stop (Break Glass-Type, Surface Mount)
- ○ Remote E-Stop (Red Mushroom-Type, Surface Mount)
- ○ Remote E-Stop (Red Mushroom-Type, Flush Mount)
- ○ 10A Engine Run Relay
- ○ Ground Fault Annunciator
- ○ 100 dB Alarm Horn
- ○ 120V GFCI and 240V Outlets

WARRANTY (Standby Gensets Only)

- ○ 2 Year Extended Limited Warranty
- ○ 5 Year Limited Warranty
- ○ 5 Year Extended Limited Warranty
- ○ 7 Year Extended Limited Warranty
- ○ 10 Year Extended Limited Warranty

ENGINEERED OPTIONS

ENGINE SYSTEM

- ○ Coolant Heater Ball Valves
- ○ Fluid Containment Pans

CONTROL SYSTEM

- ○ Battery Disconnect Switch

GENERATOR SET

- ○ Special Testing
- ○ Battery Box

GENERATOR
SCREENED IN AT GROUND LEVEL - EAST SIDE OF BUILDING A

MG450 | 21.9L | 450 kW

INDUSTRIAL SPARK-IGNITED GENERATOR SET

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GENERAC | INDUSTRIAL POWER

APPLICATION AND ENGINEERING DATA

DEMAND RESPONSE READY

ENGINE SPECIFICATIONS

General

Make	Generac
Cylinder #	12
Type	V12
Displacement - In^3 (L)	1,336.4 (21.9)
Bore - in (mm)	5.03 (128)
Stroke - in (mm)	5.6 (142)
Compression Ratio	10.0:1
Intake Air Method	Turbocharged/Aftercooled
Number of Main Bearings	7
Connecting Rods	Steel Alloy
Cylinder Head	Cast Iron
Cylinder Liners	Cast Steel Alloy
Ignition	Electronic
Piston Type	Cast Aluminum Alloy
Crankshaft Type	Steel
Lifter Type	Solid
Intake Valve Material	High Temp Steel Alloy
Exhaust Valve Material	High Temp Steel Alloy
Hardened Valve Seats	Proprietary Alloy

Engine Governing

Governor	Electronic
Frequency Regulation (Steady State)	±0.25%

Lubrication System

Oil Pump Type	Gear
Oil Filter Type	Full-Flow Spin-On Cartridge
Crankcase Capacity - qt (L)	31.7 (30)

Cooling System

Cooling System Type	Pressurized Closed Recovery
Fan Type	Pusher
Fan Speed - RPM	1,404
Fan Diameter - in (mm)	44 (1,118)

Fuel System

Fuel Type	Natural Gas
Carburetor	Down Draft
Secondary Fuel Regulator	Standard
Fuel Shut Off Solenoid	Standard
Operating Fuel Pressure - in H_2O (kPa)	11 - 14 (2.7 - 3.5)
Optional Operating Fuel Pressure - in H_2O (kPa)	7 - 11 (1.7 - 2.7)

Engine Electrical System

System Voltage	24 VDC
Battery Charger Alternator	57 A
Battery Size	See Battery Index 0161970SBY
Battery Voltage	(2) - 12 VDC
Ground Polarity	Negative

ALTERNATOR SPECIFICATIONS

Standard Model	K0500124Y23
Poles	4
Field Type	Revolving
Insulation Class - Rotor	H
Insulation Class - Stator	H
Total Harmonic Distortion	<5% (3-Phase)
Telephone Interference Factor (TIF)	<52

Standard Excitation	Permanent Magnet
Bearings	Sealed Ball
Coupling	Direct via Flexible Disc
Prototype Short Circuit Test	Yes
Voltage Regulator Type	Full Digital
Number of Sensed Phases	All
Regulation Accuracy (Steady State)	±0.25%

GENERATOR
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OPERATING DATA

DEMAND RESPONSE READY

POWER RATINGS

	Standby/Demand Response		Prime	
Three-Phase 277/480 VAC @0.8pf	450 kW/563 kVA	Amps: 677	405 kW/506 kVA	Amps: 610
Three-Phase 346/600 VAC @0.8pf	450 kW/563 kVA	Amps: 542	405 kW/506 kVA	Amps: 488

MOTOR STARTING CAPABILITIES (skVA)

skVA vs. Voltage Dip

277/480 VAC	30%
K0500124Y23	1,020
K0600124Y23	1,560

FUEL CONSUMPTION RATES*

Natural Gas – scfh (m^3/hr)

Percent Load	Standby/Demand Response	Prime
25%	1,800 (51.0)	1,740 (49.3)
50%	2,880 (81.6)	2,640 (74.8)
75%	3,960 (112.1)	3,600 (101.9)
100%	5,040 (142.7)	4,620 (130.8)

* Fuel supply installation must accommodate fuel consumption rates at 100% load.

COOLING

		Standby/Demand Response	Prime
Air Flow (Fan Air Flow Across Radiator)	scfm (m^3/min)	28,004 (793)	28,004 (793)
Coolant Flow	gpm (Lpm)	211 (799)	211 (799)
Coolant System Capacity	gal (L)	15.5 (58.7)	15.5 (58.7)
Maximum Operating Ambient Temperature	°F (°C)	122 (50)	122 (50)
Maximum Operating Ambient Temperature (Before Derate)		See Bulletin No. 0199270SSD	
Maximum Radiator Backpressure	in H_2O (kPa)	0.5 (0.12)	0.5 (0.12)

COMBUSTION AIR REQUIREMENTS

	Standby/Demand Response	Prime
Flow at Rated Power - scfm (m^3/min)	801 (22.7)	733 (20.8)

ENGINE

		Standby/Demand Response	Prime
Rated Engine Speed	RPM	1,800	1,800
Horsepower at Rated kW**	hp	656	590
Piston Speed	ft/min (m/min)	1,680 (512)	1,680 (512)
BMEP	psi (kPa)	216 (1,489)	194 (1,340)

EXHAUST

		Standby/Demand Response	Prime
Exhaust Flow (Rated Output)	scfm (m^3/min)	2,685 (76.0)	2,385 (67.5)
Max. Backpressure (Post Silencer)	inHg (kPa)	0.75 (2.54)	0.75 (2.54)
Exhaust Temp (Rated Output - Post Silencer)	°F (°C)	1,350 (732)	1,297 (703)

** Refer to "Emissions Data Sheet" for maximum bHP for EPA and SCAQMD permitting purposes.

Deration – Operational characteristics consider maximum ambient conditions. Derate factors may apply under atypical site conditions.
Please contact a Generac Power Systems Industrial Dealer for additional details. All performance ratings in accordance with ISO3046, BS5514, ISO8528, and DIN6271 standards.
Standby - See Bulletin 0187500SSB
Demand Response - See Bulletin 10000018250
Prime - See Bulletin 0187510SSB

GENERATOR
SCREENED IN AT GROUND LEVEL - EAST SIDE OF BUILDING A

MG450 | 21.9L | 450 kW

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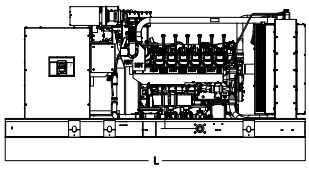
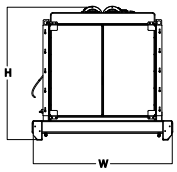
GENERAC | INDUSTRIAL POWER

DIMENSIONS AND WEIGHTS*

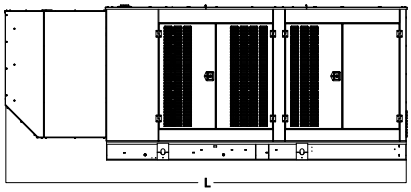
DEMAND RESPONSE READY

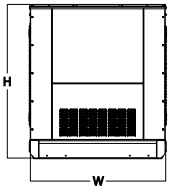




OPEN SET (Includes Exhaust Flex)

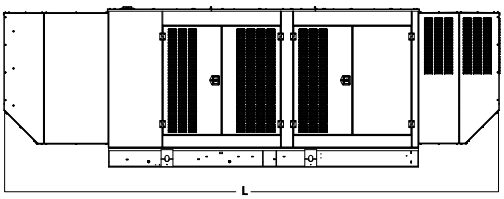
L x W x H - in (mm)	154.4 (3,922) x 71.0 (1,803) x 66.5 (1,689)
Weight - lbs (kg)	8,257 - 8,650 (3,745 - 3,923)

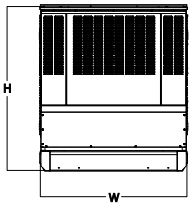




WEATHER PROTECTED ENCLOSURE

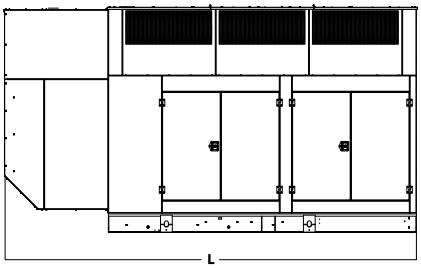
L x W x H - in (mm)	207.4 (5,268) x 71.0 (1,803) x 80.0 (2,032)
Weight - lbs (kg)	Steel: 10,055 - 10,840 (4,560 - 4,916) Aluminum: 9,357 - 9,753 (4,244 - 4,423)

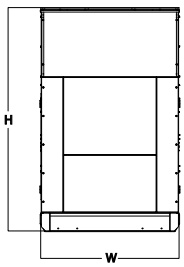




LEVEL 1 SOUND ATTENUATED ENCLOSURE

L x W x H - in (mm)	247.5 (6,287) x 71.0 (1,803) x 80.0 (2,032)
Weight - lbs (kg)	Steel: 11,155 - 11,847 (5,059 - 5,373) Aluminum: 9,788 - 10,185 (4,439 - 4,619)





LEVEL 2 SOUND ATTENUATED ENCLOSURE

L x W x H - in (mm)	207.4 (5,268) x 71.0 (1,803) x 114.1 (2,898)
Weight - lbs (kg)	Steel: 10,836 - 12,185 (4,914 - 5,526) Aluminum: 8,963 - 10,330 (4,065 - 4,685)

LEVEL 3 SOUND ATTENUATED ENCLOSURE

L x W x H - in (mm)	232.0 (5,893) x 76.9 (1,953) x 129.2 (3,282)
Weight - lbs (kg)	13,224 - 14,285 (5,997 - 6,478)

* All measurements are approximate and for estimation purposes only.

YOUR FACTORY RECOGNIZED GENERAC INDUSTRIAL DEALER

GENERATOR
SCREENED IN AT GROUND LEVEL - EAST SIDE OF BUILDING A

Specification characteristics may change without notice. Please contact a Generac Power Systems Industrial Dealer for detailed installation drawings.

SPEC SHEET

Generac Power Systems, Inc. | P.O. Box 8 | Waukesha, WI 53189
P: (262) 544-4811

Part No. 10000037607
Rev. B 11/15/19

MG250 | 14.2L | 250 kW

INDUSTRIAL SPARK-IGNITED GENERATOR SET

EPA Certified Stationary Emergency and Non-Emergency

GENERAC | INDUSTRIAL POWER

GENERATOR
SCREENED IN AT GROUND LEVEL - EAST SIDE OF BUILDING A

DEMAND RESPONSE READY

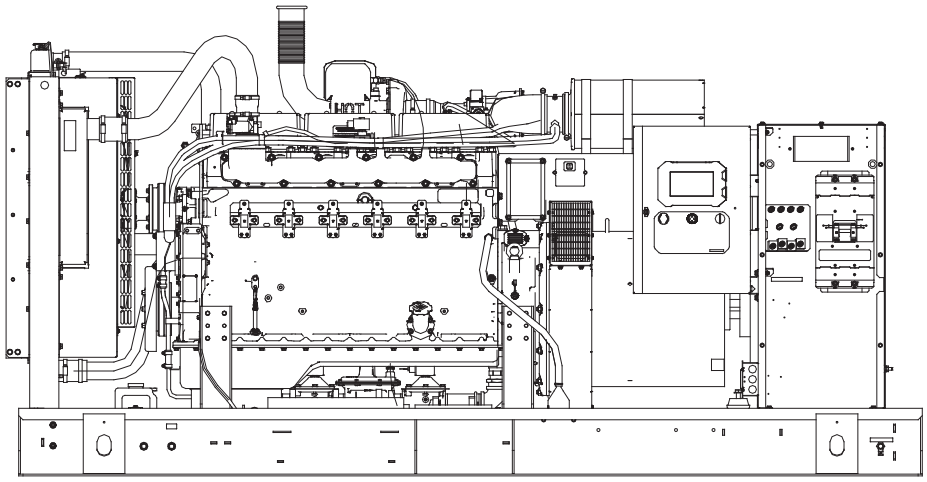
Standby Power Rating
250 kW, 313 kVA, 60 Hz

Demand Response Rating
250 kW, 313 kVA, 60 Hz

Prime Power Rating
225 kW, 281 kVA, 60 Hz

ISO 9001:2008

USA ENGINEERED & BUILT*
*Assembled in the USA using domestic and foreign parts



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SAE J1349

NFPA 37, 70, 99, 110

NEC700, 701, 702, 708

ISO 3046, 7637, 8528, 9001

NEMA ICS10, MG1, 250, ICS6, AB1

ANSI C62.41

IBC 2009, CBC 2010, IBC 2012, ASCE 7-05, ASCE 7-10, ICC-ES AC-156 (2012)

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MG250 | 14.2L | 250 kW

INDUSTRIAL SPARK-IGNITED GENERATOR SET

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STANDARD FEATURES

GENERATOR
SCREENED IN AT GROUND LEVEL - EAST SIDE OF BUILDING A

DEMAND RESPONSE READY

ENGINE SYSTEM

- Oil Drain Extension
- Air Cleaner
- Fan Guard (Open Set Only)
- Stainless Steel Flexible Exhaust Connection
- Factory Filled Oil and Coolant
- Radiator Duct Adapter (Open Set Only)
- Critical Silencer (Open Set Only)
- Oil Temperature Indication and Alarm

Fuel System

- NPT Fuel Connection on Frame
- Primary and Secondary Fuel Shutoff

Cooling System

- Closed Coolant Recovery System
- UV/Ozone Resistant Hoses
- Factory-Installed Radiator
- 50/50 Ethylene Glycol Antifreeze
- Radiator Drain Extension

Electrical System

- Battery Charging Alternator
- Battery Cables
- Battery Tray
- Rubber-Booted Engine Electrical Connections
- Solenoid Activated Starter Motor

ALTERNATOR SYSTEM

- UL2200 GENprotect™
- Motorized Main Line Circuit Breaker
- Class H Insulation Material
- 2/3 Pitch
- Skewed Stator
- Permanent Magnet Excitation
- Sealed Bearing
- Amortisseur Winding
- Full Load Capacity Alternator

GENERATOR SET

- Internal Genset Vibration Isolation
- Separation of Circuits - High/Low Voltage
- Separation of Circuits - Multiple Breakers
- Wrapped Exhaust Piping
- Standard Factory Testing
- 2 Year Limited Warranty (Standby and Demand Response Rated Units)
- 1 Year Limited Warranty (Prime Rated Units)
- Silencer Mounted in the Discharge Hood (Enclosed Units Only)

ENCLOSURE (If Selected)

- Rust-Proof Fasteners with Nylon Washers to Protect Finish
- High Performance Sound-Absorbing Material (Sound Attenuated Enclosures)
- Gasketed Doors
- Upward Facing Discharge Hood (Radiator and Exhaust)
- Stainless Steel Lift Off Door Hinges
- Stainless Steel Lockable Handles
- RhinoCoat™ - Textured Polyester Powder Coat Paint

CONTROL SYSTEM

Power Zone® Pro Sync Controller

Program Functions

- NFPA 110 Level 1 Compliant
- Engine Protective Functions
- Alternator Protective Functions
- Digital Engine Governor Control
- Digital Voltage Regulator
- Multiple Programmable Inputs and Outputs
- Remote Display Capability
- Remote Communication via Modbus® RTU, Modbus TCP/IP, and Ethernet 10/100
- Alarm and Event Logging with Real Time Stamping
- Expandable Analog and Digital Inputs and Outputs
- Remote Wireless Software Update Capable
- Wi-Fi®, Bluetooth®, BMS and Remote Telemetry
- Built-In Programmable Logic Eliminates the Need for External Controllers Under Most Conditions
- Ethernet Based Communications Between Generators
- Programmable I/O Channel Properties
- Built-In Diagnostics

Protections

- Low Oil Pressure
- Low Coolant Level
- High/Low Coolant Temperature
- Sensor Failure
- Oil Temperature
- Over/Under Speed
- Over/Under Voltage
- Over/Under Frequency
- Over/Under Current
- Over Load
- High/Low Battery Voltage
- Battery Charger Current
- Phase to Phase and Phase to Neutral Short Circuits (I^2T Algorithm)

7 Inch Color Touch Screen Display

- Resistive Color Touch Screen
- Sunlight Readable (1400 NITS)
- Easily Identifiable Icons
- Multi-Lingual
- On Screen Editable Parameters
- Key Function Monitoring
- Three Phase Voltage, Amperage, kW, kVA, and kVAr
- Selectable Line to Line or Line to Neutral Measurements
- Frequency
- Engine Speed
- Engine Coolant Temperature
- Engine Oil Pressure
- Engine Oil Temperature
- Battery Voltage
- Hourmeter
- Warning and Alarm Indication
- Diagnostics
- Maintenance Events/Information

PARALLELING CONTROL FEATURES

- Paralleling Control (Synchronizing)
- Reverse Power
- Loss of Synchronization Between Gensets
- Load and VAR Sharing

MG250 | 14.2L | 250 kW

INDUSTRIAL SPARK-IGNITED GENERATOR SET

EPA Certified Stationary Emergency and Non-Emergency

GENERAC | INDUSTRIAL POWER

CONFIGURABLE OPTIONS

DEMAND RESPONSE READY

ENGINE SYSTEM

- ○ Engine Coolant Heater
- ○ Baseframe Cover/Rodent Guard
- ○ 2 Stage Air Cleaner
- ○ Oil Heater
- ○ Air Filter Restriction Indicator
- ○ Radiator Stone Guard (Open Set Only)
- ○ Level 1 Fan and Belt Guards (Enclosed Units Only)

FUEL SYSTEM

- ○ NPT Flexible Fuel Line

ELECTRICAL SYSTEM

- ○ 10A UL Listed Battery Charger
- ○ Battery Warmer

ALTERNATOR SYSTEM

- ○ Alternator Upsizing
- ○ Anti-Condensation Heater
- ○ Tropical Coating

CIRCUIT BREAKER OPTIONS

- ○ Shunt Trip and Auxiliary Contact
- ○ Electronic Trip Breakers

GENERATOR SET

- ○ Demand Response Rating
- ○ Extended Factory Testing
- ○ 12 Position Load Center
- ○ Vapor Recovery Heater

ENCLOSURE

- ○ Weather Protected Enclosure
- ○ Level 1 Sound Attenuated
- ○ Level 2 Sound Attenuated
- ○ Level 2 Sound Attenuated with Motorized Dampers
- ○ Level 3 Sound Attenuated (Steel Only)
- ○ Steel Enclosure
- ○ Aluminum Enclosure
- ○ Up to 200 MPH Wind Load Rating (Contact Factory for Availability)
- ○ AC/DC Enclosure Lighting Kit
- ○ Enclosure Heaters (with Motorized Dampers Only)
- ○ IBC Certification
- ○ Door Open Alarm Switch

CONTROL SYSTEM

- ○ NFPA 110 Level 1 Compliant 21-Light Remote Annunciator
- ○ Remote Relay Assembly (8 or 16)
- ○ Remote E-Stop (Break Glass-Type, Surface Mount)
- ○ Remote E-Stop (Red Mushroom-Type, Surface Mount)
- ○ Remote E-Stop (Red Mushroom-Type, Flush Mount)
- ○ 10A Engine Run Relay
- ○ Ground Fault Annunciator
- ○ 120V GFCI and 240V Outlets
- ○ Damper Alarm Contacts (with Motorized Dampers Only)
- ○ 100 dB Alarm Horn
- ○ Permissive/Load Shed Module

WARRANTY (Standby Gensets Only)

- ○ 2 Year Extended Limited Warranty
- ○ 5 Year Limited Warranty
- ○ 5 Year Extended Limited Warranty
- ○ 7 Year Extended Limited Warranty
- ○ 10 Year Extended Limited Warranty

GENERATOR
SCREENED IN AT GROUND LEVEL - EAST SIDE OF BUILDING A

ENGINEERED OPTIONS

ENGINE SYSTEM

- ○ Fluid Containment Pan

ALTERNATOR SYSTEM

- ○ 2nd Breaker System

CONTROL SYSTEM

- ○ Battery Disconnect Switch

GENERATOR SET

- ○ Special Testing
- ○ Battery Box

MG250 | 14.2L | 250 kW

INDUSTRIAL SPARK-IGNITED GENERATOR SET

EPA Certified Stationary Emergency and Non-Emergency

GENERAC | INDUSTRIAL POWER

APPLICATION AND ENGINEERING DATA

DEMAND RESPONSE READY

ENGINE SPECIFICATIONS

General

Make	Generac
Cylinder #	6
Type	In-line
Displacement - in^3 (L)	864.71 (14.2)
Bore - in (mm)	5.31 (135)
Stroke - in (mm)	6.50 (165)
Compression Ratio	9.5:1
Intake Air Method	Turbocharged/Aftercooled
Number of Main Bearings	7
Connecting Rods	Steel Alloy
Cylinder Head	Cast Iron
Cylinder Liners	Ductile Iron
Ignition	Electronic
Piston Type	Aluminum
Crankshaft Type	Ductile Iron
Lifter Type	Solid
Intake Valve Material	Special Heat-Resistant Steel
Exhaust Valve Material	High Temp Steel Alloy
Hardened Valve Seats	High Temp Steel Alloy

Engine Governing

Governor	Electronic
Frequency Regulation (Steady State)	±0.25%

Lubrication System

Oil Pump Type	Gear
Oil Filter Type	Full-Flow Cartridge
Crankcase Capacity - qt (L)	36.2 (34.3)

Cooling System

Cooling System Type	Pressurized Closed Recovery
Fan Type	Pusher
Fan Speed - RPM	1,894
Fan Diameter - in (mm)	30 (762)

Fuel System

Fuel Type	Natural Gas
Carburetor	Down Draft
Secondary Fuel Regulator	Standard
Fuel Shut Off Solenoid	Standard
Operating Fuel Pressure - in H_2O (kPa)	7 - 11 (1.7 - 2.7)

Engine Electrical System

System Voltage	24 VDC
Battery Charger Alternator	57.5 A
Battery Size	See Battery Index 0161970SBY
Battery Voltage	(2) - 12 VDC
Ground Polarity	Negative

ALTERNATOR SPECIFICATIONS

Standard Model	K0250124Y21
Poles	4
Field Type	Revolving
Insulation Class - Rotor	H
Insulation Class - Stator	H
Total Harmonic Distortion	<5%
Telephone Interference Factor (TIF)	<50

Standard Excitation	Permanent Magnet
Bearings	Single Sealed Ball
Coupling	Direct via Flexible Disc
Prototype Short Circuit Test	Yes
Voltage Regulator Type	Full Digital
Number of Sensed Phases	All
Regulation Accuracy (Steady State)	±0.25%

GENERATOR
SCREENED IN AT GROUND LEVEL - EAST SIDE OF BUILDING A

MG250 | 14.2L | 250 kW

INDUSTRIAL SPARK-IGNITED GENERATOR SET

EPA Certified Stationary Emergency and Non-Emergency

GENERAC | INDUSTRIAL POWER

OPERATING DATA

DEMAND RESPONSE READY

POWER RATINGS - NATURAL GAS

	Standby/Demand Response		Prime	
Three-Phase 120/208 VAC @0.8pf	250 kW/313 kVA	Amps: 868	225 kW/281 kVA	Amps: 782
Three-Phase 277/480 VAC @0.8pf	250 kW/313 kVA	Amps: 376	225 kW/281 kVA	Amps: 339
Three-Phase 346/600 VAC @0.8pf	250 kW/313 kVA	Amps: 301	225 kW/281 kVA	Amps: 271

MOTOR STARTING CAPABILITIES (skVA)

skVA vs. Voltage Dip

277/480 VAC	30%	120/208 VAC	30%
K0250124Y21	630	K0250124Y21	506
K0300124Y21	790	K0300124Y21	609

FUEL CONSUMPTION RATES*

Natural Gas – scfh (m^3/hr)

Percent Load	Standby/Demand Response	Prime
25%	1,020 (28.9)	990 (28.0)
50%	1,620 (45.9)	1,260 (35.7)
75%	2,520 (71.4)	1,980 (56.1)
100%	3,180 (90.0)	2,700 (76.5)

* Fuel supply installation must accommodate fuel consumption rates at 100% load.

COOLING

		Standby/Demand Response	Prime
Air Flow (Fan Air Flow Across Radiator)	scfm (m^3/min)	10,078 (285.4)	10,078 (285.4)
Coolant Flow	gpm (Lpm)	90 (340.7)	90 (340.7)
Coolant System Capacity	gal (L)	15 (54.9)	15 (54.9)
Maximum Operating Ambient Temperature	°F (°C)	122 (50)	122 (50)
Maximum Operating Ambient Temperature (Before Derate)		See Bulletin No. 0199270SSD	
Maximum Radiator Backpressure	in H_2O (kPa)	0.5 (0.12)	0.5 (0.12)

COMBUSTION AIR REQUIREMENTS

	Standby/Demand Response	Prime
Flow at Rated Power - scfm (m^3/min)	506 (14.3)	455 (12.9)

ENGINE

		Standby/Demand Response	Prime
Rated Engine Speed	RPM	1,800	1,800
Horsepower at Rated kW**	hp	375	337
Piston Speed	ft/min (m/min)	1,950 (594)	1,950 (594)
BMEP	psi (kPa)	190 (1,313)	171 (1,182)

EXHAUST

		Standby/Demand Response	Prime
Exhaust Flow (Rated Output)	scfm (m^3/min)	1,703 (48)	1,517 (43)
Max. Backpressure (Post Silencer)	inHg (kPa)	0.75 (2.54)	0.75 (2.54)
Exhaust Temp (Rated Output - Post Silencer)	°F (°C)	1,357 (736)	1,340 (727)

** Refer to “Emissions Data Sheet” for maximum bHP for EPA and SCAQMD permitting purposes.

Deration – Operational characteristics consider maximum ambient conditions. Derate factors may apply under atypical site conditions.
Please contact a Generac Power Systems Industrial Dealer for additional details. All performance ratings in accordance with ISO3046, BS5514, ISO8528, and DIN6271 standards.
Standby - See Bulletin 0187500SSB
Demand Response - See Bulletin 10000018250
Prime - See Bulletin 0187510SSB

GENERATOR
SCREENED IN AT GROUND LEVEL - EAST SIDE OF BUILDING A

MG250 | 14.2L | 250 kW

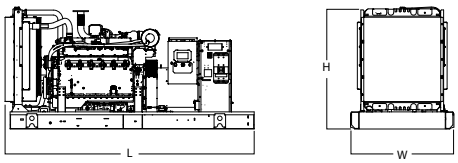
INDUSTRIAL SPARK-IGNITED GENERATOR SET

EPA Certified Stationary Emergency and Non-Emergency

GENERAC | INDUSTRIAL POWER

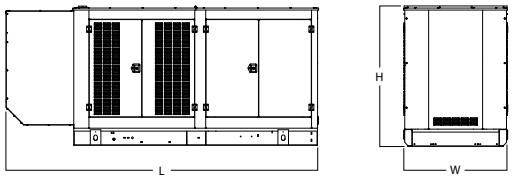
DIMENSIONS AND WEIGHTS*

DEMAND RESPONSE READY



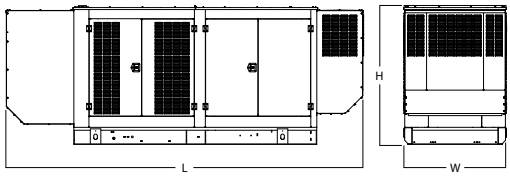
OPEN SET (Includes Exhaust Flex)

L x W x H - in (mm)	136.0 (3,454) x 57.1 (1,450) x 67.9 (1,725)
Weight - lbs (kg)	5,883 - 6,031 (2,668 - 2,735)



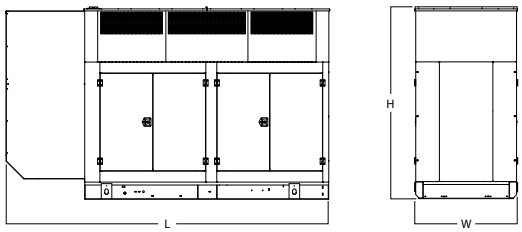
WEATHER PROTECTED ENCLOSURE

L x W x H - in (mm)	174.7 (4,437) x 57.5 (1,461) x 77.8 (1,976)
Weight - lbs (kg)	Steel: 7,448 - 7,596 (3,378 - 3,445) Aluminum: 6,654 - 6,801 (3,018 - 3,084)



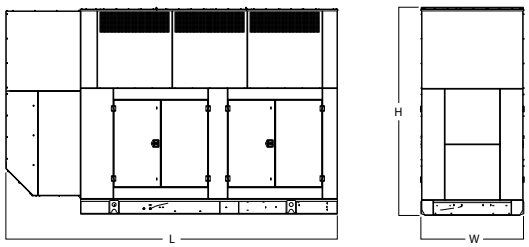
LEVEL 1 SOUND ATTENUATED ENCLOSURE

L x W x H - in (mm)	200.2 (5,085) x 57.5 (1,461) x 77.8 (1,976)
Weight - lbs (kg)	Steel: 7,911 - 8,059 (3,588 - 3,655) Aluminum: 6,853 - 7,000 (3,108 - 3,175)



LEVEL 2 SOUND ATTENUATED ENCLOSURE

L x W x H - in (mm)	180.6 (4,587) x 57.5 (1,461) x 111.3 (2,827)
Weight - lbs (kg)	Steel: 8,484 - 8,632 (3,848 - 3,915) Aluminum: 7,099 - 7,247 (3,220 - 3,287)



LEVEL 3 SOUND ATTENUATED ENCLOSURE

L x W x H - in (mm)	207.3 (5,265) x 63.7 (1,618) x 128.9 (3,274)
Weight - lbs (kg)	Steel: 10,840 - 10,990 (4,916 - 4,984)

* All measurements are approximate and for estimation purposes only.

YOUR FACTORY RECOGNIZED GENERAC INDUSTRIAL DEALER

GENERATOR
SCREENED IN AT GROUND LEVEL - EAST SIDE OF BUILDING A

Specification characteristics may change without notice. Please contact a Generac Power Systems Industrial Dealer for detailed installation drawings.

SPEC SHEET

Generac Power Systems, Inc. | P.O. Box 8 | Waukesha, WI 53189
P: (262) 544-4811

Part No. 10000039051
Rev. B 02/07/2020

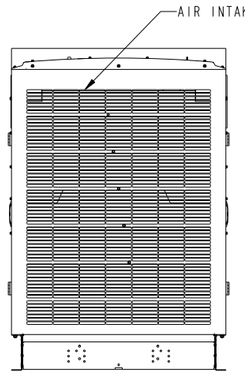
PTC® Creo® Parametric

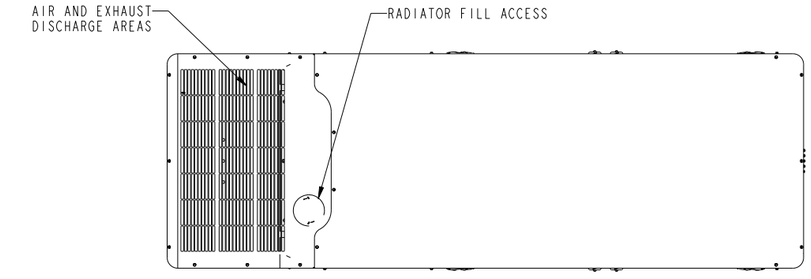
REL NO	LTR	NO	REVISION	DRN	CKD	APVD	DATE
ECO-152551	A	1	PRODUCTION_RELEASE	CG	NK	M_WICKMANN	14MAY15

NOTES:

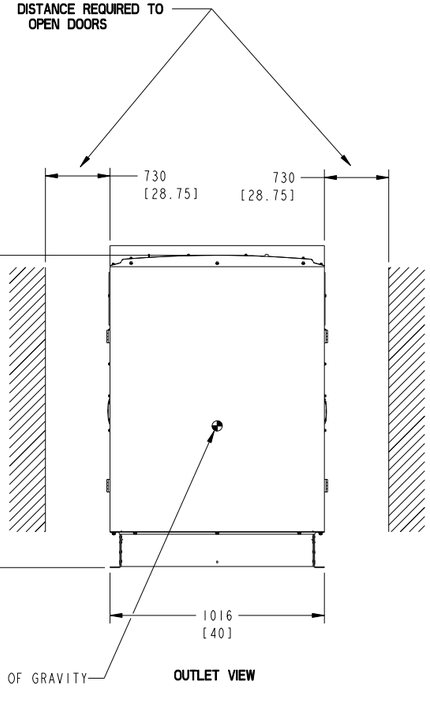
1. DIM [] IN INCHES
2. WHEN THE HOUSING INSTALLED ON AN OPEN GENERATOR SET, THE TOTAL WEIGHT WILL INCREASE BY 131.5 KG (290 LBS). THIS INCLUDES THE MUFFLER.
3. THE CENTER OF GRAVITY(CG) OF THE GENERATOR SET WHEN EQUIPPED WITH THIS HOUSING SHIFTS APPROXIMATELY 65mm (2.55 inch) TOWARDS THE AIR DISCHARGE END OF THE HOUSING AND 42MM (1.66 INCH) HIGHER FROM THE GROUND. COMPARED TO THE EQUIVALENT NON-HOUSED PRODUCT WITH THE F179 SKID. SEE HOUSING READY SKID BASE OUTLINE DRAWING FOR CG LOCATION OF NON HOUSED PRODUCT.

GENERATOR
SCREENED IN AT GROUND LEVEL - EAST SIDE OF BUILDING A

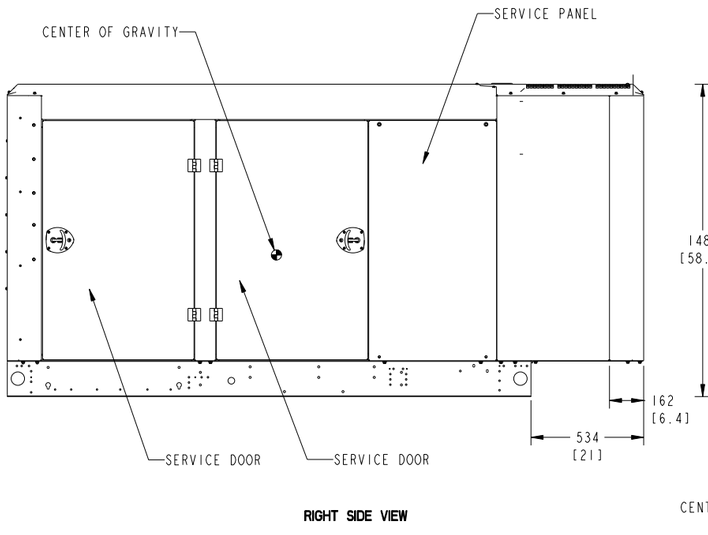




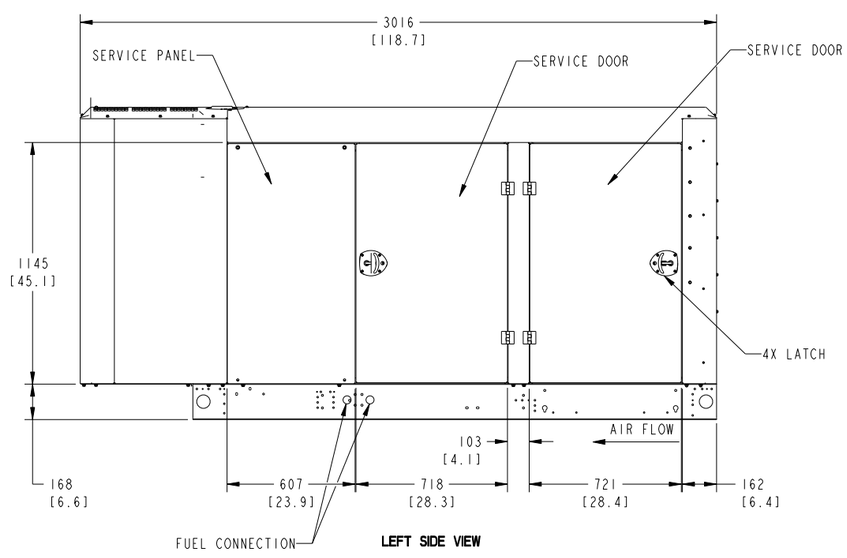
TOP VIEW



OUTLET VIEW



RIGHT SIDE VIEW



LEFT SIDE VIEW

F231-2 ENCLOSURE CONFIGURATION

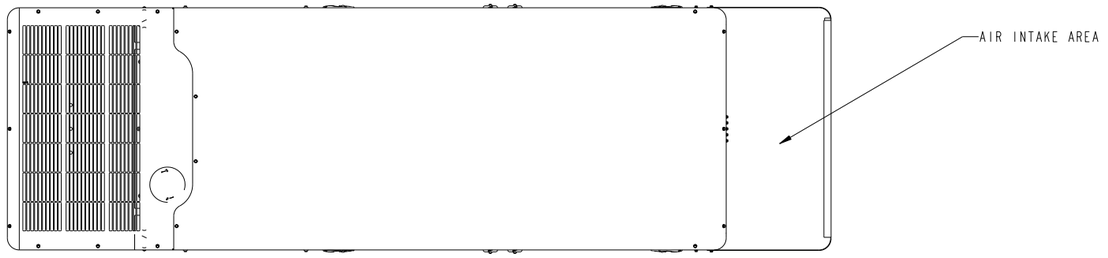
UNLESS OTHERWISE SPECIFIED, ALL DIMENSIONS ARE IN MILLIMETERS	SIM TO NONE	DRN C_GADE		CUMMINS POWER GENERATION	
DIM: X ± 1, .X ± 0.8, .XX± 0.38 — HOLE: 0.00- 4.99 +0.15/-0.08; 5.00- 9.99 +0.20/-0.10; 10.00-17.49 +0.25/-0.13; 17.50-24.99 +0.30/-0.13	DO NOT SCALE PRINT	CKD N_KASIBHOTLA		OUTLINE,ENCLOSURE	
ANG TOL: ± 1.0°	SCALE: ~3/32	APVD M_WICKMANN		SITE CODE	
- CONFIDENTIAL - PROPERTY OF CUMMINS POWER GENERATION GROUP		DATE 14MAY15	FIRST USED ON ARROW	PGF	DWG SIZE D — A051P365 — SHEET 1 OF 2 — DWG REV A
		FOR INTERPRETATION OF DIMENSIONING AND TOLERANCING, SEE ASME Y14.5M-1994			

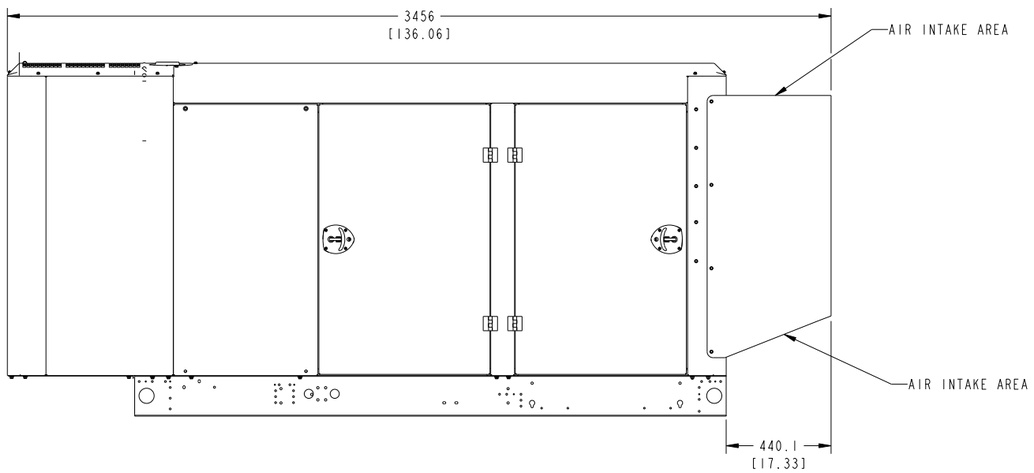
Drawing Name: A051P366 Revision: A
Part Name: A051P365 Revision: A
Sheet 1 of 3

PTC® Creo® Parametric

REL NO	LTR	NO	REVISION	DRN	CKD	APVD	DATE
ECO-152551	A	1	PRODUCTION_RELEASE	CG	NK	M_WICKMANN	14MAY15

GENERATOR
SCREENED IN AT GROUND LEVEL - EAST SIDE OF BUILDING A





F217-2 ENCLOSURE CONFIGURATION

REFER TO PAGE 1 (F231-2 ENCLOSURE FOR OTHER F217-2 ENCLOSURE DIMENSIONS.

UNLESS OTHERWISE SPECIFIED, ALL DIMENSIONS ARE IN MILLIMETERS	SIM TO NONE	DRN C_GADE		CUMMINS POWER GENERATION	
DIM: X ±1, .X ±0.8, .XX± 0.38 — HOLE: 0.00-4.99 +0.15/-0.08, 5.00-9.99 +0.20/-0.10, 10.00-17.49 +0.25/-0.13, 17.50-24.99 +0.30/-0.13	DO NOT SCALE PRINT	CKD N_KASIBHOTLA		OUTLINE,ENCLOSURE	
ANG TOL: ± 1.0° — SCALE: ~3/32	- CONFIDENTIAL - PROPERTY OF CUMMINS POWER GENERATION GROUP	APVD M_WICKMANN	SITE CODE		
		DATE 14MAY15	PGF	DWG SIZE D — A051P365	SHEET 2 OF 2 — DWG REV A
		FOR INTERPRETATION OF DIMENSIONING AND TOLERANCING, SEE ASME Y14.5M-1994 — FIRST USED ON ARROW			

Part A051P365 A

Description	Legacy Name	External Regulations	Application Status	Release Phase Code	Security Classification	Alternates
OUTLINE,ENCLOSURE	A051P365	None	Production Only	Production	Public	

Part Specifications :A051P365 A

Name	Description	Legacy Name
A030B356	SPECIFICATION,MATERIAL	CES10903
A051P366	DRAWING,ENGINEERING	A051P366

GENERATOR
SCREENED IN AT GROUND LEVEL - EAST SIDE OF BUILDING A

DOAS/RTU FAN SCHEDULE – Job#4122613

FAN UNIT NO.	TAG	DOAS/RTU MODEL #	BLOWER	RETURN AIR CFM	MAX OUTSIDE AIR CFM	TOTAL CFM	ESP.	RPM	H.P.	B.H.P.	ø	VOLT	MCA	MOCP	WEIGHT (LBS.)	SONES
1		CASRTU3-1.300-15-12.5T-DOAS	15P-3	0	2400	2400	0.500	1420	2.000	1.0910	3	208	65.2A	100A	2495	11

DOAS/RTU COOLING SCHEDULE

FAN UNIT NO.	TAG	COMPRESSOR			OUTDOOR FAN				INDOOR COIL		OUTSIDE AIR DB TEMP.	OUTSIDE AIR WB TEMP.	MIXED AIR DB TEMP.	MIXED AIR WB TEMP.	LEAVING DB TEMP.	LEAVING WB TEMP.	LEAVING DP TEMP.	TOTAL CAPACITY	SENSIBLE CAPACITY	LATENT CAPACITY	REHEAT LEAVING DB TEMP.	REHEAT LEAVING WB TEMP.	DESIRED REHEAT CAPACITY	MAX REHEAT CAPACITY	REHEAT LEAVING RELATIVE HUMIDITY	MOISTURE REMOVAL RATE	IEER
		TONNAGE	VOLTAGE	ø	MOTOR VOLTAGE	MOTOR ø	MOTOR FREQUENCY	MOTOR QTY	ROWS	FACE AREA																	
1		12.5	190-240	3	200-240	3	60	2	6	11.9 SQFT.	90.0°F	74.0°F	90.0°F	74.0°F	54.9°F	53.8°F	53.1°F	154.0 MBH	89.0 MBH	65.0 MBH	70.0°F	62.7°F	40.7 MBH	101 MBH	67	59.1 LBS/HR	21.3

DOAS/RTU HEATING SCHEDULE

FAN UNIT NO.	TAG	INPUT BTUs	OUTPUT BTUs	TEMP. RISE	REQUIRED INPUT GAS PRESSURE	GAS TYPE	BURNER EFFICIENCY(%)
1		300000	240000	79 deg F	7 in. w.c. - 14 in. w.c.	Natural	80

FAN OPTIONS

FAN UNIT NO.	TAG	OPTION (Qty. - Descr.)
1		1 - Single Point Electrical Connection for RTU. QNTY 1 750va Transformer Used. If a Non-DCV Prewire controls this unit, the #28, #47, "MA", or "E2" Option Prewire must be selected. Do not provide supply starter in prewire.
		1 - CASLink Building Monitoring System - Internet or Cellular Connection Required
		1 - RTU Size 3 Down Discharge
		1 - 2" MERV 13 Filters for Size 3 RTU. Qty 4.
		1 - 2" MERV 8 Filters for Size 3 RTU. Qty 4.
		1 - Overheat Stat
		1 - VFD factory mounted and wired in commercial control vestibule for RTU
		1 - 12.5 Ton Modulating Cooling Option, 208/230V. R410A Refrigerant, Variable Speed Compressor, ECM Condensing Fan(s).
		1 - RTU Fixed 100% OA Intake Control
		1 - RTU Size 3 No Return
		1 - Inlet Pressure Gauge, 0-35"
		1 - Manifold Pressure Gauge, 0 to 10" wc, 1 Furnace
		1 - Control Panel Enclosure Heater. Recommended for winter design temperature less than 0°F. PCB Controls
		1 - Size 3 RTU Curb Duct Hanger
		1 - 12.5 Ton Modulating Reheat Option. Discharge Relative Humidity Control.
		1 - Commercial Smoke Detector/Alarm Interlock (Supplied by Others)
		1 - Exhaust Contactor After Airflow Switch-Field Wired
		1 - Occupied Scheduling
		1 - VAV Package w/ Manual/DDC Control (571 VFD Included)

CURB ASSEMBLIES

NO.	ON FAN	WEIGHT	ITEM	SIZE
1	# 1	100 LBS	Curb	59.500"W x 91.000"L x 20.000"H Insulated

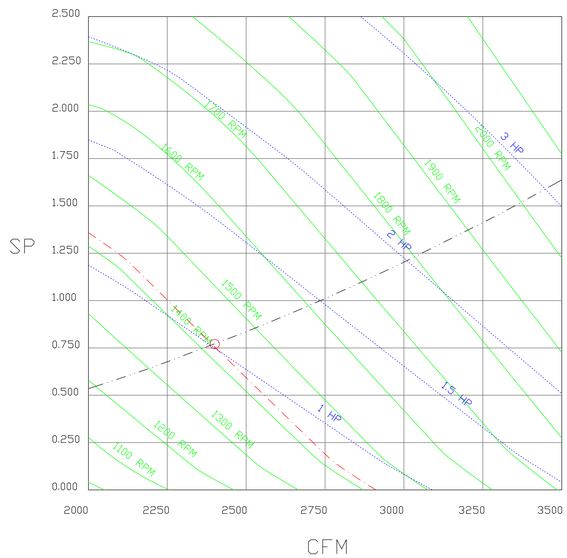
FAN SOUND DATA

FAN UNIT NO.	TAG	MOTOR	RPM	SOUND DATA			OCTAVE BAND SOUND DATA								
				LWA	SONES @ 5 ft	DBA @ 5 ft	DISTANCE (ft)	63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz
1		Supply	1420	73.5	11	62	5	71.3	69.4	73.7	70.6	66.7	66	62.8	58.1

FAN#1 - HEATER PERFORMANCE CURVES.

2400 CFM, 0.77 SP @ 1420 RPM and 1.091 BHP at 0 feet and -10 deg F

* Please note that these curves were adjusted for job specific temperature and altitude.



REVISIONS

	DESCRIPTION	DATE:
△		
△		
△		
△		

CAPTIVE-AIRE
www.captiveaire.com
Detroit Mechanical
PO Box 924, Royal Oak, MI, 48068 PHONE: (248) 658-0509 FAX: EMAIL: reg123@captiveaire.com

ACAD

DATE: 12/16/2019

DWG.#: 4122613

DRAWN BY:

SCALE: 3/4" = 1'-0"

MASTER DRAWING

SHEET NO. 1

Model: CASRTU Specifications

SECTION 23 74 33
FACTORY FABRICATED PACKAGED, 100% OUTDOOR, HEATING AND COOLING MAKEUP AIR UNITS

SPECIFICATIONS
TAG: DOAS-1

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes packaged heating and cooling units capable of supplying up to 100 percent outdoor air.

1.2 SUBMITTALS

A. The manufacturer assumes no liability for the use or results of use of this document. This specification is to be reviewed by the engineer to confirm requirements of the project and building codes are met.

B. As the manufacturer continues product development, it reserves the right to change design and specifications without notice.

1.3 SEISMIC DESIGN

A. Should project be located within a seismic zone requiring special provisions for support and restraint of equipment, components, and piping, see Section 23 00 01 - Seismic, Wind, and Flood Load Design for additional requirements.

1.4 WIND LOAD DESIGN

A. Refer to Section 23 00 01, Seismic, Wind, Flood Load Design for additional requirements.

B. Mani Dade rated up to ±150psf per TAS 201, 202 & 203 paired with 20" curb or shorter.

1.5 QUALITY ASSURANCE

A. All models shall be ETL listed and comply with safety standards UL 1995, and CSA Std. C22.2, No. 236-11. Units outfitted with indirect fired heaters shall also comply with ANSI Z83.8-2013, and CSA 2.6-2013.

1.6 Warranty

A. All units shall be provided with the following standard warranties:

1. 10-Year (non-prorated) parts warranty covering the entire unit when accompanied by a company provided service plan. 5-Year (non-prorated) parts warranty covering the entire unit otherwise.
2. 25-year (non-prorated) parts warranty for SS heat exchanger on indirect fired units.

B. This warranty shall not apply if:

1. The equipment is not installed by a qualified installer per the manufacturer's installation instructions shipped with the product.
2. The equipment is not installed in accordance with federal, state and local codes and regulations.
3. The equipment is misused or neglected, or not maintained per the manufacturer's maintenance instructions.
4. The equipment is not operated within its published capacity.
5. The invoice is not paid within the terms of the sales agreement.

C. The manufacturer shall not be liable for incidental and consequential losses and damages potentially attributable to malfunctioning equipment. Should any part of the equipment prove to be defective in material or workmanship within the 10 year period, upon examination by the manufacturer, such part will be repaired or replaced by manufacturer at no charge. The buyer shall pay all labor costs incurred in connection with such repair or replacement. Equipment shall not be returned without manufacturer's prior authorization and all returned equipment shall be shipped by the buyer, freight prepaid to a destination determined by the manufacturer.

PART 2 _ PRODUCTS

2.1. GENERAL

A. Supply single zone one piece packaged units that are complete as per the following specification, deliver all capacities scheduled, and conform to design indicated herein. Alternate layouts or dimensional changes will not be accepted.

2.2. CABINET

A. Unit(s) shall be constructed of minimum 20ga. G-90 galvanized steel riveted together via structural pop-rivets. All metal shall be CNC bent for precise assembly.

1. Rigging Provisions: The unit shall have a structural base constructed of minimum 14ga. G-90 galvanized steel, and include full sized fork pockets and lifting points on all four sides.
2. Roof Construction: The lids shall be fabricated by forming a double-standing, self-locking seam that requires no additional support. Roof shall be pitched to allow for proper drainage.
3. Exterior Wall Construction: All exterior walls shall consist of a double wall, G-90 galvanized steel construction insulated with 2in. thick, foil-faced, R13 closed cell foam.
4. Service Access Doors: All door jambs shall be gasketed around their perimeter, and allow for doors to be mounted via removable, stainless steel hinges with stainless steel rivets, and self-compressing latches. Each compartment shall have removable access panels to allow for ease of service and maintainability. Electrical cabinet access doors shall have a door hold installed to prop doors open. All doors shall have stainless steel latches which are pad lockable. Electrical cabinet doors shall be outfitted with schematic/manual pouches formed into the door, along with wiring diagram attached to the indoor of the door from the factory.

B. Entire interior and exterior casing shall be constructed of minimum 20 GA G90 galvanized steel with no painting, and shall have surpassed a salt spray corrosion test as per ASTM B 117.

C. Entire unit shall be Mani-Dade wind rated up to ±150psf per TAS 201, 202 & 203 on any units utilizing a 20" or shorter factory provided roof curb.

2.3. Airflow Configurations

A. Unit shall be configurable for both down (vertical) discharge through base of unit, or side discharge through the cabinet. Unit shall also be configurable to both down (vertical) return or side return into the cabinet.

B. Unit intake airflow configuration shall be through use of a fresh/outdoor and return air damper.

1. Damper: Shall exceed AMCA Class 1A standard for low leakage. Damper assembly shall be a single assembly, and outfitted with an integral bird screen and louver/gutter system to divert any drainage through the base of the unit - intake air hood not required.
2. Actuator: A single direct drive damper actuator shall be used with spring return to ensure that the outdoor air section closes when not powered.

2.4. SUPPLY AIR BLOWER AND MOTOR

A. All supply fans shall be direct drive (belt-driven not acceptable) variable speed plenum fans.

B. Blower Motor: Motor shall be a premium efficiency motor available as:

1. Open Drip Proof (ODP) or Totally Enclosed Fan Cooled (TEFC) motor driven by a Variable Frequency Drive.
2. Electronically Commutated Motor (ECM).

C. Fans to be selected at or near efficiency peak. (Submit fan curves.)

D. Blower and motor assembly shall be dynamically balanced. The entire blower and motor assembly shall be mounted on rubber vibration isolators. Wheels balanced as per AMCA 204-96, Balance Quality and Vibration Levels for Fans.

2.5. REFRIGERATION SYSTEM

A. Unit shall utilize a variable speed inverter duty scroll compressor with the following features:

1. Modulation: Compressor shall be capable of compressor speed modulation from 15%-100% on 8, 10, & 12.5 Ton units, and 25%-100% on 15, 20, 22, 25, & 30 Ton units.
2. Refrigerant: Unit shall be factory charged with R410A refrigerant.
3. Vibration Isolation: Compressor shall be mounted on rubber vibration isolators to reduce transmission of vibration to the building structure.
4. Internal Overload Protection: Compressor shall include internal thermal overload production to protect against excessive motor temperatures.
5. Crankcase Heater: Compressor shall include a crankcase heater to protect against liquid flood-back and elimination of oil foaming on startup. The crankcase heater must remain powered when compressor is not in operation.
6. Oil Management: Unit shall utilize both passive and active oil return management using Oil Level Sensor and scheduled oil boosts.
7. Monitored Envelope: Unit shall monitor all critical refrigeration points to ensure compressor does not operate outside of safe operating envelope.
8. Throttling Logic: Unit shall allow for high head pressure monitoring throttle mode for high ambient operation, and low suction pressure throttle mode for low capacity operation or any conditions resulting in low suction pressure.
9. Pump-Down: Active pump-down mode with discharge line check valve to protect against liquid migration into compressor during idle times.
10. Defrost mode in optional Heat Pump: When outdoor coils are deemed at risk of freezing, the unit shall simultaneously turn on auxiliary heat while running the heat pump in "cooling" mode to help defrost outdoor coils as needed while still maintain desired leaving air temperatures.

B. The unit shall be outfitted with the following:

1. Indoor Coil: Indoor coil shall be a high efficiency 5-7 row coil design with aluminum fins mechanically bonded to copper tubes. Coil is staggered to increase turbulence, reduce the coil bypass factor, and ultimately the time the air stays within the coil.
2. Electronic Expansion Valve: Each refrigeration circuit will be outfitted with an electronic expansion valve metering device which can be throttled from 0-100% open to allow for precise superheat control.
3. Indoor Coil Drain Pan: The indoor coil shall be outfitted with a sloped stainless steel drain pan. This pan shall be insulated along the entire base to prevent condensation, and outfitted with a safety overflow switch which will automatically shut down cooling operation prior to water overflowing the drain pan in the event of a drain clog. The entire drain pan shall be 20 GA Stainless Steel construction and wrap beneath the entire coil with flashing on entering side of coil to ensure capture of all condensate. Drain pan discharge pipe shall also be stainless steel construction. Drain pan shall be pitched to exceed ASHRAE 62.1 standard.
4. Base of the condensing coil cabinet shall be pitched away from the unit as a safety to ensure all draining exits away from the curb.
5. Optional Hot Gas Reheat Coil: The unit shall include an optional copper tube and aluminum fin hot gas reheat coil mounted downstream of the indoor coil. This coil shall be controlled via fully modulating hot gas reheat valve to provide precise reheat temperature control. This coil shall include the addition of an evaporative coil leaving condition sensor to maintain a coil dew point. This also prevents operation of a dehumidification call when intake dew point conditions are found to be below space dew point conditions, preventing wasted energy.
6. Outdoor (Condenser) Coil: Outdoor coil shall be a high efficiency coil design with aluminum fins mechanically bonded to copper tubes. The coil shall be downward sloped to protect coil from hail damage. Optional hail guards may also be outfitted to the outdoor coil for added protection from hail bouncing off of the roof of the unit and into the coil.
7. Outdoor Fans: The outdoor coil shall have a vertical discharge outfitted with quiet, efficient, fully modulating Electronically Commutated Motor (ECM) condensing fans. These fans shall modulate to maintain a temperature differential between outside air and the outdoor coil.

C. To help mitigate any long-term potential for leaks or hardware failures, the unit shall be outfitted with the following protection measures:

1. Suction line accumulator for added protection against liquid entering suction line of compressor.
2. Bi-flow, low pressure drop, filter drier.
3. Electronic Expansion Valve (EEV) for precise superheat control. EEV shall open partially allowing system pressure equalization prior to activation of the compressor.
4. On optional heat pump units, use of a single 3-way reheat valve to prevent obstructions due to valve failure.
5. Protective rubber sleeves installed on all distribution lines of indoor coil to prevent wear from rubbing.
6. All refrigeration ports shall be short-stub assembly and any access port with a transducer or switch is mounted vertically to mitigate risk of bent/cracked stub joints.
7. Refrigeration circuit shall be mechanically CNC pre-bent tubing wherever possible with minimal brazed joints to minimize points for potential refrigerant leaks.
8. Factory tested for leaks via high pressure nitrogen decay and helium tracer gas testing.
9. Suction line temperature sensor failure detection.
10. Preventative failure alerts through a manufacturer provided, cloud based, cellular remote monitoring system.

2.6. HEATING SYSTEM

A. The gas burner shall be an indirect-fired, push-through type, using (natural) (LP) gas at an inlet-supply pressure to the unit of 7"w.c. minimum (Nat. Gas, 11"w.c. minimum LP Gas).

Burner shall be a tubular in-shot fired design capable of using natural or LP type gas. Each burner ignition shall be of the direct-spark design with remote flame sensing at inlet of the last firing tube of the gas manifold.

B. Direct-sparking sequence shall last through the complete duration of the trial for ignition period for guaranteed light-off. Burner shall always be lit at maximum gas flow and combustion airflow for guaranteed light-off. Each burner ignition module shall have LED indicators for troubleshooting and a set of exposed prongs for testing flame indication signal.

C. All furnaces shall be controlled by an electronic "Inferno-type fully modulating control system capable of achieving 80% combustion efficiency over the entire gas firing range of the unit.

D. Each furnace shall have:

1. A minimum turndown ratio of 6:1 for natural gas and 5:1 for LP gas while maintaining a constant 80% efficiency (90% for high efficiency furnace option). No cold air bypass of the heat exchanger.
2. Each furnace heat exchanger shall be a bent-tube style design made entirely of type 409 stainless steel.
3. Stainless steel Quick Seal Connection for gas connection.
4. Manifold and input gas pressure gauges.
5. Factory piped condensate drain to exterior of cabinet.
6. A combustion flue to be installed on adjacent side as combustion intake with integrated high velocity wind cap.
7. A blocked vent safety airflow switch with high temperature silicone tubing operating off of absolute pressure measured inside of the power-vent blower housing.
8. A high temperature auto-recycling limit with a maximum non-adjustable set point.
9. A manual reset high temperature flame roll out switch with a non-adjustable set point.
10. Each furnace component shall have a removable post and panel that allows the furnace to be easily removed for service and maintainability.
11. A power-vent assembly for exhausting flue gases with a PSC or ECM type motor that is securely mounted and easily accessible/removable for service.
12. A 0-10"w.c. gas pressure gauge installed on the gas manifold.

E. Each electric heater shall have:

1. SCR electric inserts for side or discharge supply.
2. Electric coils are controlled using SCR controls. SCR is a time proportioning type controller that modulates the heater and supplies the exact amount of power to match the heat demand with a 10:1 turndown per stage with full modulation between minimum turndown and max output.

2.7. FILTERS

A. Provide filters as part of unit. All filters shall be furnished and installed to meet the performance requirements set forth in the schedule and as specified under another section of this work.

B. All filters shall be installed on tracks for easy removal from the unit.

C. Up to 3 layers of outdoor air filtration installed. Unit shall ship with a 2" washable metal mesh outdoor air filter. Mixed air shall have optional 2" MERV-8 and MERV-13 filters , 4" MERV-15 or 4" MERV-17 HEPA filter banks factory installed.

D. Unit shall have an optional adjustable pressure differential sensor for the filter bank to alert in the event of a clogged filter.

2.8. Electrical

A. All controls shall be pre-wired and housed in an insulated electrical cabinet within the unit to protect against risk of condensation.

B. All direct fired and cooling only units shall be provided with single point electrical connection.

C. Unit shall be provided with a door safety switch that de-energizes the supply fan when the door is opened.

D. Unit shall be provided with a factory mounted averaging supply air temperature sensor to allow for accurate discharge temperature readings within unit when a downstream sensor is not installed. Field mounted and wired discharge air sensors will not be accepted.

E. Unit shall be provided with a factory mounted averaging intake air temperature sensor to allow for accurate intake temperature reading regardless of how the DA/RA dampers are positioned.

F. The electrical cabinet shall be outfitted with the following:

1. LED electrical cabinet service light with automatic activation upon door switch.
2. Color wiring schematics, laminated to the interior wall of the cabinet doors.
3. Factory mounted disconnect with unit bottom knockouts.
4. A LED backlit, LCD Human-Machine Interface (HMI) shall be mounted within the unit's control cabinet to allow for all set points configuration and refrigeration system monitoring at the unit.
5. Up to 4 additional space mounted HMIs available. Additional HMIs shall allow for full programming capabilities and are outfitted with integral temperature and humidity sensors. Additional HMIs shall be capable of being individually averaged for space temperature/humidity readings. All HMIs shall be wired using standard CAT5/6 cables.
6. Optional 120V, 15A unit powered or unpowered convenience outlet.

G. All sensors shall be wired back to the main control board that continuously monitors all critical components and makes decisions based on pre-determined logic to accurately control the following:

1. PID logic to control heater modulation ensuring precise discharge/space temperature control.
2. PID logic to control compressor speed to provide precise control over evaporative coil temperatures, leaving dew point, and discharge/space temperatures.
3. PID logic for Outdoor Fan modulation to maintain an optimal outdoor coil temperature.
4. PID logic for Electronic Expansion Valve (EEV) position to maintain a precise superheat temperature
5. PID logic for Modulating Reheat valve to limit supply air temperature and relative humidity based off of space or discharge conditions.

2.9. CONTROLS

A. Unit shall be outfitted with a control board to allow for full control of the entire unit.

B. Provide air flow switch on the supply fan system to sense air flow with available set of contacts for connection to BMS for airflow alerts.

C. All unit controls shall be compatible with BACnet and LonWorks based building management systems.

D. All units shall be outfitted with CASLink cloud based monitoring, which monitors every point of operation. Provides configurable automated fault alert e-mails, and remote control capabilities.

E. Integrated cellular module to provide remote connection to monitoring services to view both real time and historical unit operation. Data shall be stored a minimum of 3 years on the cloud. Data sample rate shall be a maximum of 60 seconds.

F. Temperature Control System

1. Low-Ambient Cooling: Unit is factory outfitted with logic allowing for low-ambient operation of the DX system down to 15F outdoor temperatures purely through software utilizing the standard factory modulating components.
2. Discharge Temp Control (Heating)
   Unit modulates the burner flame (current supply in the case of electric heating) to accurately maintain the desired discharge temperature set point and compensate for fluctuations in entering air temperature, air volume and % of DA using heating PID controls designed specifically for the DOAS.
3. Discharge Temp Control (Cooling)
   Unit modulates the compressor frequency to accurately maintain the desired discharge temperature set point and compensate for fluctuations in entering air temperature, air volume and % of DA using proprietary cooling PID controls designed specifically for the DOAS.
4. Discharge Temp Control (Heat Pump)
   Unit modulates the compressor frequency to accurately maintain the desired discharge temperature set point and compensate for fluctuations in entering air temperature, air volume and % of DA using heating PID controls designed specifically for the DOAS. Minimum and maximum discharge set points can be set to limit the temperature entering the space. When ambient temperatures drop below a user configurable minimum outdoor air temperature set point, or the unit is not able to maintain a user configurable minimum discharge temp for 5 minutes time, the heat pump will initiate its backup heat source. Initiation of backup heater operation shall ensure discharge temps are maintained prior to disabling heat pump to make sure discharge temps are never impacted during changeover. An optional additional HMI or room thermostat can be used to determine the space temperature. In the case that no temperature sensor is available in the space, the unit will use an internal return temperature sensor.
5. Discharge Humidity Control (Dehumidification)
   Unit modulates the compressor frequency to accurately maintain a desired evaporative coil dew point measured via a coil mounted temperature sensor between the evaporative and hot gas reheat coils. A fully modulating hot gas reheat valve shall utilize excess waste heat from the condensing section feed the hot gas reheat coil with the precise amount of heat needed to accurately reheat the airstream in order to maintain a desired discharge temperature compensating for fluctuations in entering air temperature, air volume and % of DA using proprietary dehumidification PID controls designed specifically for the DOAS.
6. Space Temp Control (Heating)
   Unit modulates the burner flame (current supply in the case of electric heating) to accurately maintain the desired space temperature set point and compensate for fluctuations in entering air temperature, air volume and % of DA using heating PID controls designed specifically for the DOAS. Minimum and maximum discharge set points can be set to limit the temperature entering the space. An optional additional HMI or room thermostat can be used to determine the space temperature. In the case that no temperature sensor is available in the space, the unit will use an internal return temperature sensor.
7. Space Temp Control (Cooling)
   Unit modulates the compressor frequency to accurately maintain the desired space temperature set point and compensate for fluctuations in entering air temperature, air volume and % of DA using cooling (heating when in heat pump mode) PID controls designed specifically for the DOAS. Minimum and maximum discharge set points can be set to limit the temperature entering the space. An optional additional HMI or room thermostat can be used to determine the space temperature. In the case that no temperature sensor is available in the space, the unit will use an internal return temperature sensor.
8. Space Temp Control (Heat Pump)
   Unit modulates the compressor frequency to accurately maintain the desired space temperature set point and compensate for fluctuations in entering air temperature, air volume and % of DA using heating PID controls designed specifically for the DOAS. Minimum and maximum discharge set points can be set to limit the temperature entering the space. When ambient temperatures drop below a user configurable minimum outdoor air temperature set point, or the unit is not able to maintain a user configurable minimum discharge temp for 5 minutes time, the heat pump will initiate its backup heat source. Initiation of backup heater operation shall ensure discharge temps are maintained prior to disabling heat pump to make sure discharge temps are never impacted during changeover. An optional additional HMI or room thermostat can be used to determine the space temperature. In the case that no temperature sensor is available in the space, the unit will use an internal return temperature sensor.
9. Space Humidity Control (Dehumidification)
   Unit modulates the compressor frequency to accurately maintain a desired evaporative coil dew point measured via a coil mounted temperature sensor between the evaporative and hot gas reheat coils. A fully modulating hot gas reheat valve shall utilize excess waste heat from the condensing section feed the hot gas reheat coil with the precise amount of heat needed to accurately reheat the airstream in order to maintain a desired space temperature compensating for fluctuations in entering air temperature, air volume and % of DA using proprietary dehumidification PID controls designed specifically for the DOAS.
10. Advanced Total Unit Economizer: The control system is outfitted standard, without need for any additional hardware, with an Advanced Total Unit Economizer which will take maximum advantage of as much energy available in the outdoor air conditions in order to run the compressor the minimum amount required at any given incoming air conditions. If the outdoor enthalpy (temperature and relative humidity) permits, the unit will be capable of completely modulating and shutting off compressor to provide "Free? cooling and dehumidification as the outdoor air conditions allow.

G. Activation Controls:

1. Activate Based on Intake (Heating)
   Unit will activate heating when the intake temperature drops below the desired set point.
2. Activate Based on Intake (Cooling)
   Unit will activate cooling when the intake temperature rises above the desired set point.
3. Activate Based on Intake (Dehumidification)
   Unit will activate dehumidification when the intake conditions rise above the desired intake set point, with activation set points configured to a Dew Point, Relative Humidity or a combination of Dew Point/Relative Humidity.
4. Activate Based on Space (Heating)
   Unit will activate heating when the space temperature drops below the desired set point.
5. Activate Based on Space (Cooling)
   Unit will activate cooling when the space temperature rises above the desired set point.
6. Activate Based on Space (Dehumidification)
   Unit will activate dehumidification when the space set point rises above the desired space set point, with activation set points configured to a Dew Point, Relative Humidity or a combination of Dew Point/Relative Humidity.
7. Activate Based on Both (Heating)
   Unit will activate heating when the space AND intake temperature drop below the desired set point.
8. Activate Based on Both (Cooling)
   Unit will activate cooling when the space AND intake temperature rise above the desired set point.
9. Activate Based on Both (Dehumidification)
   Unit will activate dehumidification when the space and intake set point rise above the desired space and intake set point, with activation set points configured to a Dew Point, Relative Humidity or a combination of Dew Point/Relative Humidity.
10. Activate Based on Either (Heating)
    Unit will activate heating when the space OR intake temperature drops below the desired set point.
11. Activate Based on Either (Cooling)
    Unit will activate cooling when the space OR intake temperature rises above the desired set point.
12. Activate Based on Either (Dehumidification)
    Unit will activate dehumidification when the space or intake set point rises above the desired space or intake set point, with activation set points configured to a Dew Point, Relative Humidity or a combination of Dew Point/Relative Humidity.
13. Activate Based on Stat (Heating)
    Unit will activate heating when the space thermostat sends a 24V signal to W and G on the main control board. Unit will modulate to maintain a constant discharge heat set point.
14. Activate Based on Stat (Cooling)
    Unit will activate cooling when the space thermostat sends a 24V signal to Y and G on the main control board. Unit will modulate to maintain a constant discharge cool set point.

2.10. ROOF CURB

A. Unit shall be factory assembled, and constructed of 18GA galvanized steel, with optional 16GA available.

B. Curb shall be fully insulated with 1" acoustical and thermal insulation.

C. Curb shall be factory outfitted with duct support hangers.

2.11. VARIABLE FREQUENCY DRIVES

A. Provide Variable Frequency Drive for the compressor as part of the AC unit. VFD shall be furnished and installed to meet the performance set forth in the schedule and as specified under another section of this work.

1. Accessories to be furnished and mounted by the drive manufacturer and contained in a single enclosure. (The use of more than one enclosure is not acceptable).

B. Provide Variable Frequency Drive for speed control on all non-ECM direct drive supply fans.

C. All VFDs shall provide the following inherent protections:

1. Phase protection
2. Brownout protection
3. Overload/Overheat protection
4. Soft starts to protect bearings/hardware.
5. Low & High voltage & over-torque protections.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions under which packaged units are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions, drawings, written specifications, manufacturer's installation manual and all applicable building codes.

3.3 CONNECTIONS

A. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate the general arrangement of piping, fittings, and specialties. Install piping to allow service and maintenance.

B. Duct installation requirements are specified in other Division 23 Sections. Drawings indicate the general arrangement of ducts.

C. Electrical: Conform to applicable requirements in Division 26 Sections.

3.4 SYSTEM START-UP

A. System start up is performed by a factory trained Service Technician

END OF SECTION 23 74 33

Fan shall be model CASRTU as manufactured by CaptiveAire Systems.

Rev #1, 5-28-19 MAP

REVISIONS		
	DESCRIPTION	DATE:
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CAPTIVEAIRE
Detroit Mechanical
www.captiveaire.com
PO Box 924, Royal Oak, MI, 48068 PHONE: (248) 658-0509 FAX: EMAIL: reg123@captiveaire.com

CASRTU

DATE: 12/16/2019

DWG.#: 4122613

DRAWN BY:

SCALE: 3/4" = 1'-0"

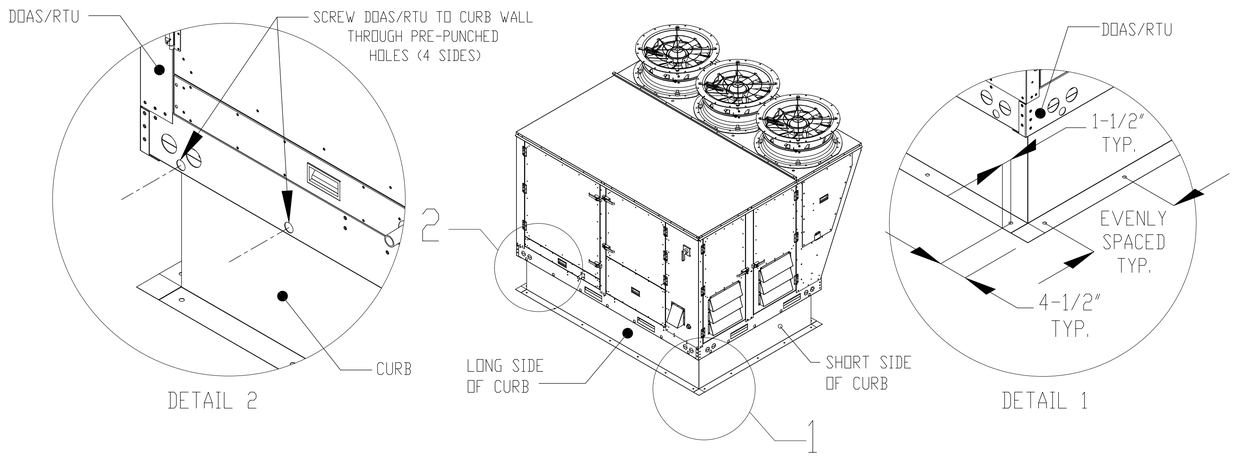
MASTER DRAWING

SHEET NO. 2

TYPICAL DOAS/RTU ROOF MOUNTING INSTALLATION INSTRUCTIONS

1. Secure the curb to the roof framing members by drilling 1/4" pilot holes in the curb flanges at locations shown in the diagram below. Using 3/8" x 2" zinc plated steel lag bolts, and zinc plated washers, screw through the curb flanges and into the roof framing members. A minimum of (5) lag bolts on each short side, and (7) lag bolts on each long side is required.

2. Secure the unit base to the side walls of the curb using (24) 1/4"-14 x 2" self-drilling, steel zinc plated screws. Pre-punched holes have been provided for each screw location.



ROOF TOP FRESH AIR UNIT
SCREENED-IN ON ROOF TOP ALL BUILDINGS

REVISIONS

	DESCRIPTION	DATE:
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CAPTIVEAIRE
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ACD 0

DATE: 12/16/2019

DWG.#: 4122613

DRAWN BY:

SCALE: 3/4" = 1'-0"

MASTER DRAWING

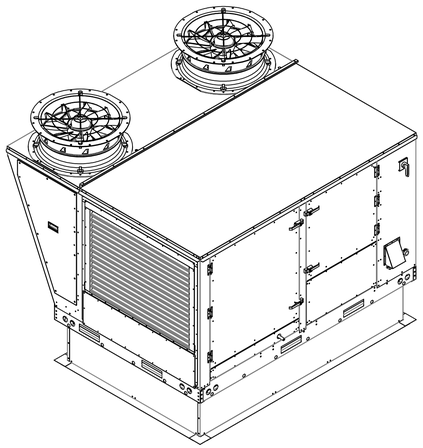
SHEET NO. 3

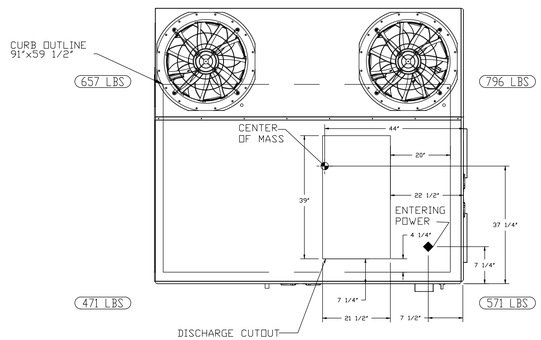
FAN #1 CASRTU3-I.300-15-12.5T-DOAS - HEATER

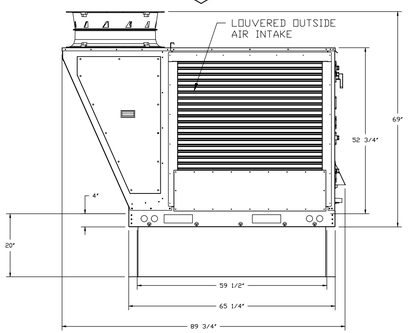
NOTES:

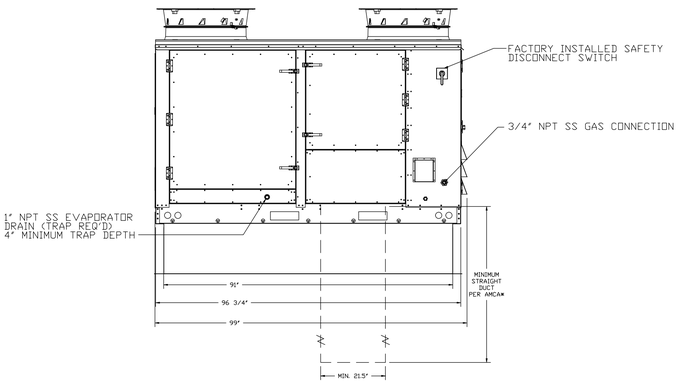
1. DO NOT OBSTRUCT OUTSIDE AIR INLET, OUTSIDE AIR COIL OR OUTSIDE AIR FAN.
2. ( ) DENOTES CORNER WEIGHT.
3. ROOF OPENING MUST BE 2" SMALLER THAN CURB DIMENSIONS IN BOTH DIRECTIONS.

*NOTE: SUPPLY DUCT MUST BE INSTALLED TO MEET SMACNA STANDARDS. A MINIMUM STRAIGHT DUCT LENGTH MUST BE MAINTAINED DOWNSTREAM OF UNIT DISCHARGE AS OUTLINED IN AMCA PUBLICATION 201. DO NOT RELY ON UNIT TO SUPPORT DUCT IN ANY WAY. FAILURE TO PROPERLY SIZE DUCTWORK MAY CAUSE SYSTEM EFFECTS AND REDUCE PERFORMANCE OF THE EQUIPMENT. SUGGESTED STRAIGHT DUCT SIZE IS 21.5" x 39"









OPTIONS

1. SINGLE POINT ELECTRICAL CONNECTION FOR RTU. QNTY 1 750VA TRANSFORMER USED. IF A NON-DCV PREWIRE CONTROLS THIS UNIT, THE #28, #47, "MA", OR "E2" OPTION PREWIRE MUST BE SELECTED. DO NOT PROVIDE SUPPLY STARTER IN PREWIRE.
2. CASLINK BUILDING MONITORING SYSTEM - INTERNET OR CELLULAR CONNECTION REQUIRED
3. RTU SIZE 3 DOWN DISCHARGE
4. 2" MERV 13 FILTERS FOR SIZE 3 RTU. QTY 4.
5. 2" MERV 8 FILTERS FOR SIZE 3 RTU. QTY 4.
6. OVERHEAT STAT
7. VFD FACTORY MOUNTED AND WIRED IN COMMERCIAL CONTROL VESTIBULE FOR RTU
8. 12.5 TON MODULATING COOLING OPTION, 208/230V. R410A REFRIGERANT, VARIABLE SPEED COMPRESSOR, ECM CONDENSING FAN(S).
9. RTU FIXED 100% OA INTAKE CONTROL
10. RTU SIZE 3 NO RETURN
11. INLET PRESSURE GAUGE, 0-35"
12. MANIFOLD PRESSURE GAUGE, 0 TO 10" WC, 1 FURNACE
13. CONTROL PANEL ENCLOSURE HEATER. RECOMMENDED FOR WINTER DESIGN TEMPERATURE LESS THAN 0°F. PCB CONTROLS
14. SIZE 3 RTU CURB DUCT HANGER
15. 12.5 TON MODULATING REHEAT OPTION. DISCHARGE RELATIVE HUMIDITY CONTROL.
16. COMMERCIAL SMOKE DETECTOR/ALARM INTERLOCK (SUPPLIED BY OTHERS)
17. EXHAUST CONTACTOR AFTER AIRFLOW SWITCH-FIELD WIRED
18. OCCUPIED SCHEDULING
19. VAV PACKAGE W/ MANUAL/DDC CONTROL (571 VFD INCLUDED)

ROOF TOP UNIT
SCREENED-IN ON ROOF TOP ALL BUILDINGS

REVISIONS		
	DESCRIPTION	DATE:
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ACD

DATE: 12/16/2019

DWG.#: 4122613

DRAWN BY:

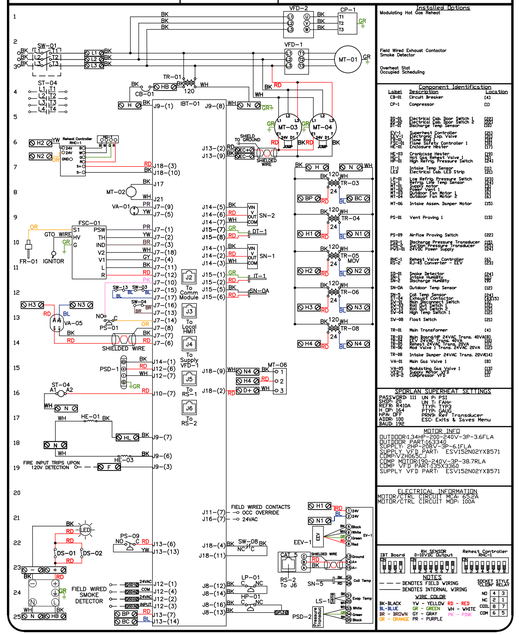
SCALE: 1/2" = 1'-0"

MASTER DRAWING

SHEET NO. 4

RTU Unit Wiring

JOB	4122613 - ACD
DRAWING NUMBER	RTU4122613-1
SHIP DATE	12/16/2019
MODEL	CASRTU3-1300-15-12.5T-DOAS



Installed Options

Modulating Hot Gas Reheat

Field Wired Exhaust Contactor
Smoke Detector

Overhead Stat
Occupied Scheduling

Component Identification

Label	Description	Section
CB-01	Circuit Breaker	(6)
CP-1	Compressor	(6)
DS-01	Supervisory Controller	(8888)
DS-02	Display Interface	(8888)
EEV-1	Electronic Exp Valve Controller 1	(8888)
FSC-01	Flame Safeguard Control	(8888)
GTO	Ignition Module Relay	(8888)
HE-01	Electric Heat Stage 1	(8888)
HE-03	Electric Heat Stage 2	(8888)
LP-01	Low Pressure Switch Supply Fan	(8888)
LS-1	Limit Switch Outdoor Air Damper	(8888)
MT-01	Supply Motor	(8888)
MT-02	Outdoor Air Damper Motor	(8888)
PS-01	Vent Proving 1	(8888)
PS-09	Airflow Proving Switch	(8888)
PSD-1	Discharge Pressure Transducer	(8888)
PSD-2	Suction Pressure Transducer	(8888)
SN-1	Return Air Temp Sensor	(8888)
SN-2	Supply Air Temp Sensor	(8888)
SN-3	Ambient Temp Sensor	(8888)
SN-4	Outdoor Air Temp Sensor	(8888)
SN-5	Smoke Detector	(8888)
SW-08	Airflow Proving Switch	(8888)
SW-09	Filter Switch	(8888)
TR-01	Main Transformer	(4)
TR-02	24V Transfrmr 24VAC Trans 40VA(E)	(8888)
TR-03	24V Transfrmr 24VAC Trans 40VA(E)	(8888)
TR-04	24V Transfrmr 24VAC Trans 40VA(E)	(8888)
TR-05	24V Transfrmr 24VAC Trans 40VA(E)	(8888)
TR-06	24V Transfrmr 24VAC Trans 40VA(E)	(8888)
TR-07	24V Transfrmr 24VAC Trans 40VA(E)	(8888)
TR-08	24V Transfrmr 24VAC Trans 40VA(E)	(8888)
VA-01	Modulating Hot Gas Valve 1	(8)
VA-04	Outdoor Air Damper Actuator	(8888)
VA-05	Hot Gas Valve	(8)

SMARTLAN SUPERHEAT SETTINGS

PASSWORD 111 (At 0 min)
SCT's Blank
H.P. SP. 275
LOW SP. 50
Vilter 342 Transducer
ENGLISH Units & Stored Menu

MOTOR INFO

OUTDOOR:134HP-200/240V-3P-3.6FLA
QUANTITY: 2@7.5HP/208-230V
MANUFACTURER: TECO-WESTINGHOUSE
SUPPLY VFD PART#: ESV152N02YXB571
INDOOR:
MANUFACTURER: CENTURY-38.7FLA
MANF VFD PART#:CSV340-38.7FLA
SUPPLY VFD PART#: ESV152N02YXB571

ELECTRICAL INFORMATION

MOTOR CONTROL CIRCUIT
MOTOR/CTRL CIRCUIT MCP: 100A

NOTES

- — — DENOTES FIELD WIRING
——— DENOTES INTERNAL WIRING

WIRE COLOR

BK - BLACK TW - YELLOW
BL - BLUE GR - GREEN
BR - BROWN GY - GRAY
OR - ORANGE PR - PURPLE
RD - RED PK - PINK
WH - WHITE

RTU VFD Wiring

JOB	4122613 - ACD
DRAWING NUMBER	RTUVFD4122613-1
SHIP DATE	12/16/2019
MODEL	CASRTU3-1300-15-12.5T-DOAS

SUPPLY DRIVE PARAMETER SETTINGS*

P100 (Start Source) = 01 (Terminal Strip)
P130 (TB-30 Output) = 1
P194 (Password) = 225
P410 (Modbus Address) = 21

1 Adjust manually on all drives
P103 - VFD Max Frequency
P107 - 00 (If 120 or 208 VAC)
or 01 (If 230, 480 or 575 VAC)
2 P108 - Motor FLA x 100 / Drive Output Rating
P167 - Reference Bus Sheet
3 IT MAY BE REQUIRED TO FULLY POWER DOWN THE DRIVE AND 4 TURN BACK ON IN ORDER TO INITIATE NEW PARAMETER SETTINGS.
5 **Min. and Max. Frequency Settings override all other speeds/parameters. Do not adjust these on the VFD. Min. and 6 Max. Frequency should be adjust on the RTU HMI.

COMPRESSOR DRIVE PARAMETER SETTINGS

MUST BE CONFIGURED BEFORE STARTUP:

9 0-02 = 16031 Power RV
0-40 = (2) Password
0-60 = (1) LCP Read only
0-66 = (1) LCP Read only
1-13 = VZH065
11 3-15 = (0) No Function
3-16 = (0) No Function
3-41 = 200.00s
12 3-42 = 200.00s
3-51 = 30.00s
3-52 = 30.00s
13 8-01 = (2) Ctrl Word Only
8-03 = 10 Seconds
8-04 = (1) Stop
8-30 = (2) Modbus RTU
14 8-31 = 1
8-32 = 19200
8-33 = (0) Even Parity, 1 Stop Bit
15 28-00 = Disable
28-11 = 19k
28-12 = 168h
16 *Must be programmed using software
17
18
19
20 SCADA
21 MODBUS ETHERNET
22 NOTE:- Multiple RTU's can be wired to one module using the RJ45 converter.
23

SMV 571 SERIES VARIABLE FREQUENCY DRIVE
VFD-1

TERMINAL	FUNCTION
1	Digital Input<Start/Stop)
11	Internal DC Supply for External Devices
2	Analog Common
30	Analog Output<Configurable with P150.P155

DTS-01 NOTE TW YW

All external control wires to motor speed control must be 18 AWG twisted shielded control cables and must not be run in the same conduit or raceway with any high power wiring. Ground Shielded Cable at the drive chassis ONLY.

Connect To J4 on IBT Board — RJ45 — To Comm Link Board to MODBUS CONVERTER

RS-1 RJ-45 Connector Comp VFD (11)

P0. II OF THE DRIVE MANUAL DESCRIBES THE PROPER INSTALLATION PROCEDURE

P0. I9 OF THE DRIVE MANUAL DESCRIBES THE PROPER GROUNDING PROCEDURE OF THE DRIVE

P0. E3 OF THE DRIVE MANUAL DESCRIBES THE PARAMETER SETTINGS OF THE DRIVE

*NOTE: THE DEFAULT PASSWORD FROM THE FACTORY REQUIRED TO PROGRAM THE DRIVE IS "1009".

GR	PE	Ground Terminal
BK/YW	L1	3 Phase Input or Single Phase Input
BK/GR	L2	3 Phase Input or Single Phase Input
BK/BU	L3 (NO)	3 Phase Input (Neutral for 120v)
BK	U	3 Phase AC Motor
BK	V	3 Phase AC Motor
BK	W	3 Phase AC Motor

VZH SERIES COMPRESSOR VFD
VFD-2

TERMINAL	FUNCTION
13	24+
37	Pressure Switch In
1	Relay 1 to all solenoid
2	Relay 1 to all solenoid
61	COM RS-485
68	N RS-485
69	P RS-485
95	INPUT Ground
L1 (91)	3 Phase Input
L2 (92)	3 Phase Input
L3 (93)	3 Phase Input
T1 (96)	Compressor
T2 (97)	Compressor
T3 (98)	Compressor
99	Compressor Ground

CAT 5 RS-1 — SHIELDED WIRE — SHIELD — Connect to J5 on IBT Board

From SW-01 To Compressor Terminals: 11 BK L1 (91); 10 BK L2 (92); 9 BK L3 (93); 8 BK T1 (96); 7 BK T2 (97); 6 BK T3 (98); GR Compressor Ground

IBT-01
J2 To Comm Module
J3 To LOOP PART
J4 To Supply VFD
J5 To RS-1
J6 To RS-2

IBT Board — RJ45 — MODBUS ETHERNET — FIELD WIRED CONNECTION — To Comm Link Board

Installed Options

Component Identification

Label	Description	Section
DTS-01	Blower Door Switch	(11)
MT-01	Supply Motor	(18)
RS-1	RJ-45 Convertor Comp VFD	(11)
SW-01	Main Disconnect Switch	(13)
VFD-1	Supply Motor VFD	(11)
VFD-2	Compressor VFD	(18)

MOTOR INFO

OUTDOOR:134HP-200/240V-3P-3.6FLA
QUANTITY: 2@7.5HP/208-230V
MANUFACTURER: TECO-WESTINGHOUSE
SUPPLY VFD PART#: ESV152N02YXB571
INDOOR:
MANUFACTURER: CENTURY-38.7FLA
MANF VFD PART#:CSV340-38.7FLA
SUPPLY VFD PART#: ESV152N02YXB571

ELECTRICAL INFORMATION

MOTOR CONTROL CIRCUIT
MOTOR/CTRL CIRCUIT MCP: 100A

NOTES

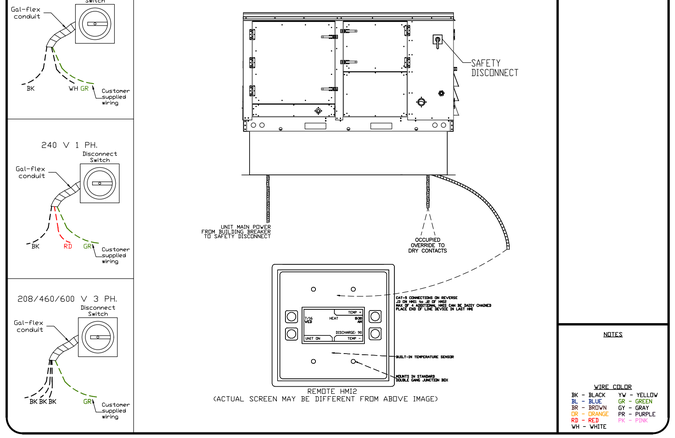
——— DENOTES FIELD WIRING
——— DENOTES INTERNAL WIRING

WIRE COLOR

BK - BLACK TW - YELLOW
BL - BLUE GR - GREEN
BR - BROWN GY - GRAY
OR - ORANGE PR - PURPLE
RD - RED PK - PINK
WH - WHITE

RTU Installation Wiring

JOB	ACD
DRAWING NUMBER	INST4122613-1
SHIP DATE	12/16/2019
MODEL	CASRTU3-1300-15-12.5T-DOAS



Installed Options

OCCUPIED OVERRIDE

NOTES

WIRE COLOR

BK - BLACK TW - YELLOW
BL - BLUE GR - GREEN
BR - BROWN GY - GRAY
OR - ORANGE PR - PURPLE
RD - RED PK - PINK
WH - WHITE

ROOF TOP FRESH AIR UNIT
SCREENED-IN ON ROOF TOP ALL BUILDINGS

REVISIONS

	DESCRIPTION	DATE:
△		
△		
△		
△		

CAPTIVE-AIRE
www.captiveaire.com
Detroit Mechanical
PO Box 924, Royal Oak, MI. 48068 PHONE: (248) 658-0509 FAX: EMAIL: reg123@captiveaire.com

ACD 0

DATE: 12/16/2019

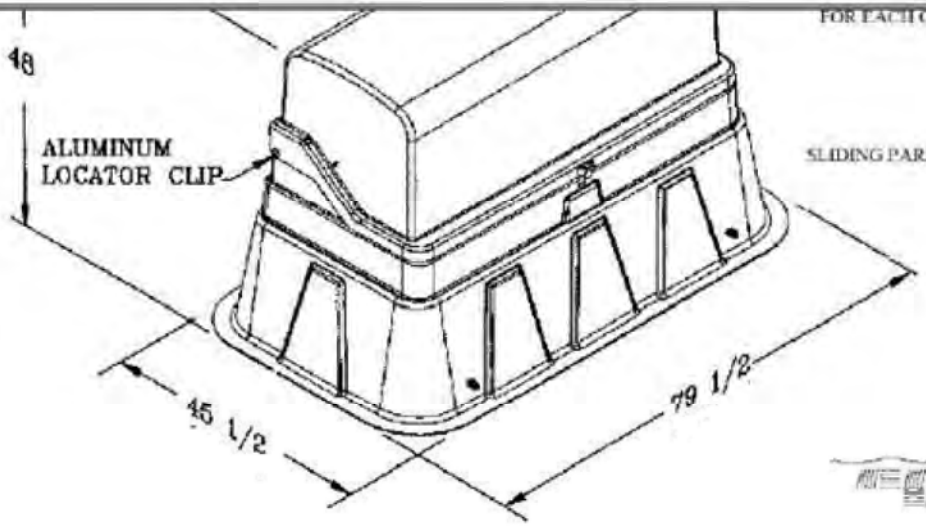
DWG.#: 4122613

DRAWN BY:

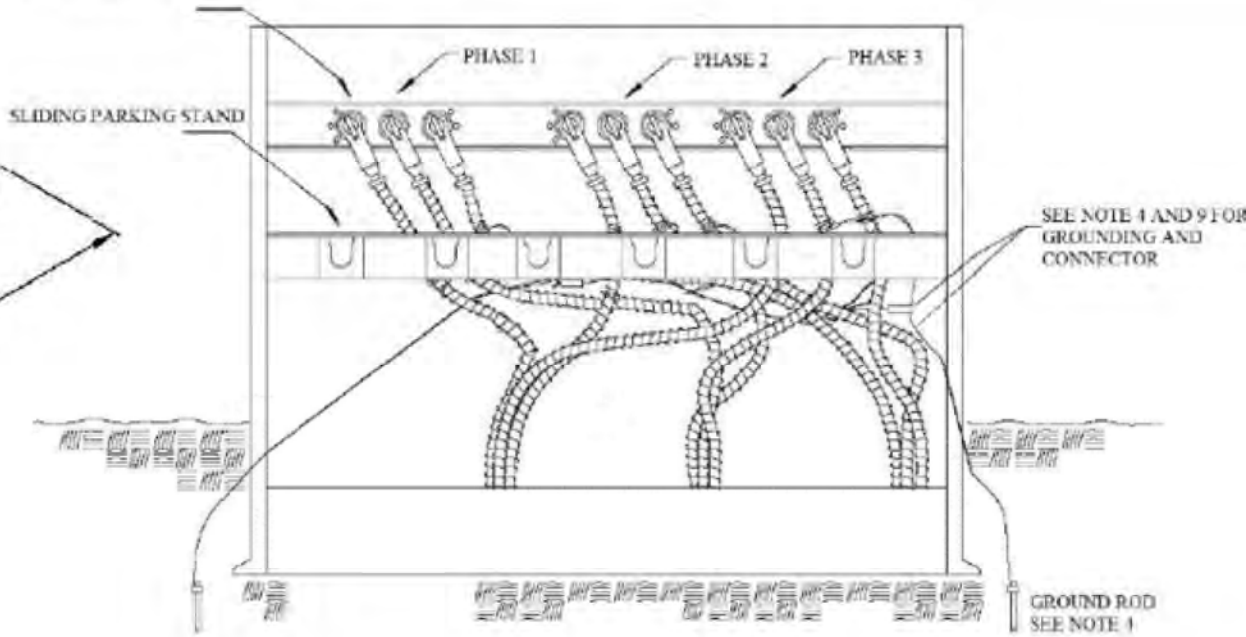
SCALE: 3/4" = 1'-0"

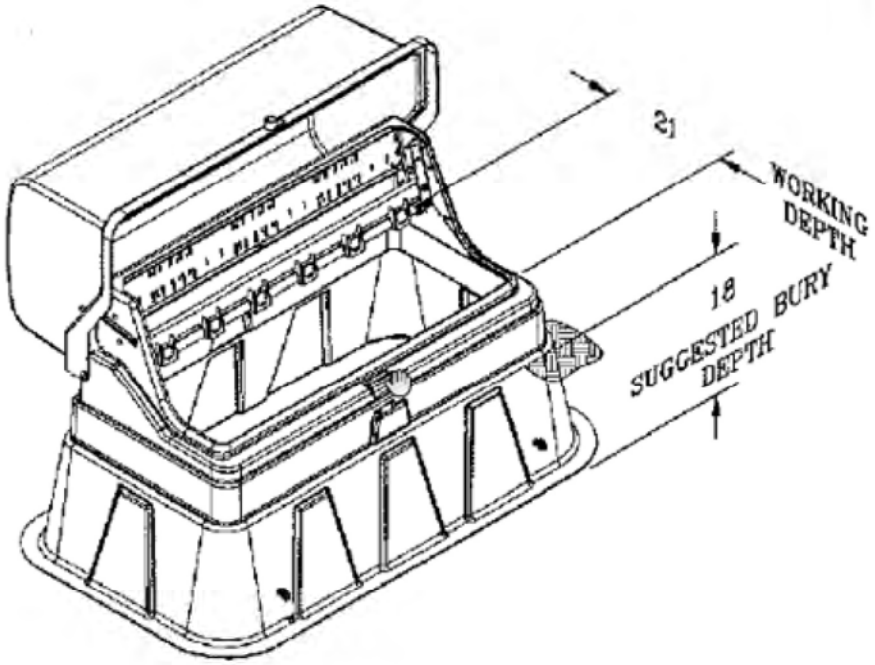
MASTER DRAWING

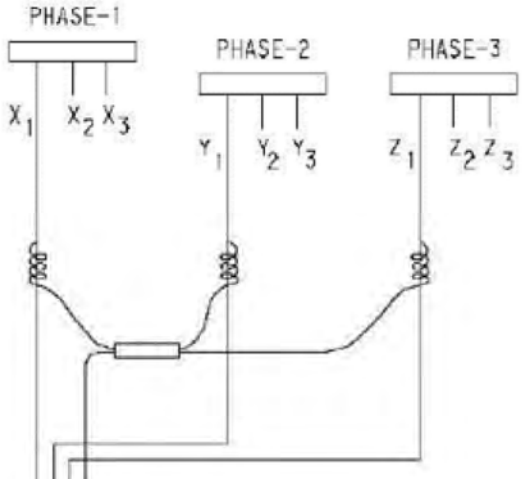
SHEET NO. 5



FOR EACH CABINET







NOTES:

1. BIND THE CONCENTRIC NEUTRAL OF EACH CABLE AT A HEIGHT OF 8" (MAX) FROM THE BOTTOM OF THE CABINET.

2. USE FEED-THROUGH RATED 8.3/14.4 KV, FD. NO. 761-0515 SEE

Pad-Mounted Transformers

Contents

GROUND-MOUNTED
TRANSFORMER BY DTE

Typical Pad-Mounted Transformer

17

Three-Phase Pad-Mounted Transformers

Typical Pad-Mounted Transformer

Introduction

Eaton's three-phase pad-mounted transformer is offered in a variety of designs and configurations. The following pages describe the standard designs and the common options that are available.

Some special designs and options may require additional engineering, factory coordination, unusual application requirements or special manufacturing needs.

Higher impedances limit secondary fault currents such that coordination with secondary low voltage molded-case circuit breakers is usually possible. (Low impedances are also available if required for paralleling, and so on.)

Standard color is pad-mounted green [Munsell® Green (#7GY3.29/1.5)]. ANSI #24, 61 and 70 are available as options.

Application

Liquid-filled, three-phase, commercial pad-mounted distribution transformers are designed for servicing such underground distribution loads as shopping centers, schools, institutions, data centers, and industrial plants. They are also heavily utilized for step-up applications in renewable energy installations.They are available in both deadfront and livefront and construction, for radial or loop-feed applications, with or without taps.

Industry Standards

Pad-mounted transformers meet industry standards: IEEE® C57.12.00, IEEE C57.12.34, IEEE C57.12.28, IEEE C57.12.29, IEEE C57.12.70, IEEE C57.12.80, IEEE C57.12.90, IEEE C57.91, DOE 10 CFR Part 431 and NEMA®.

Ratings

- 45–10,000 kVA
- High voltages (primary):

4160 Grd. Y/2400 through 43,800 GY/25,300 Grd. Y/19,920	2400Δ through 46,000Δ

- HV Taps: 2–2-1/2% above and below normal, or 4–2-1/2% below normal
- Standard BIL levels:

kV Class	BIL (kV)
1.2	30
2.5	45
5.0	60
8.7	75
15.0	95
25.0 Grd. Y Only	125
25.0	150
34.5 Grd. Y Only	150
34.5	150
46	250

- Low voltages (secondary). All voltages through 15 kV class
- UL listing and/or classification available
- Factory Mutual Approval available

Design Impedances

Impedances are supplied to meet IEEE C57.12.34 standards. Customer-specified impedances are available. (Subject to IEEE/ANSI ±7.5% impedance tolerance.)

- Nominal impedance per IEEE C57.12.34:

kVA	%Z
45	2.70–5.75
75	2.7–5.75
112-1/2	3.1–5.75
150	3.1–5.75
225	3.1–5.75
300	3.1–5.75
500	4.35–5.75
750	5.75
1000	5.75
1500	5.75
2000	5.75
2500	5.75
3000	5.75
3750	5.75
5000–10,000	6.0–6.5

Note: Subject to NEMA/IEEE ±7.5% impedance tolerance.

Note: Non-standard design impedance may be obtained by contacting Eaton.

Application Limitations

The transformers described herein are designed for the application conditions normally encountered on electric power distribution systems. As such, they are suitable for use under the "usual service conditions" described in IEEE Standard C57.12.00 general requirements for liquid-immersed distribution, power and regulating transformers. Transformers required for step-up applications should be specified as such.

Consult Eaton for unusual service conditions such as:

- Abnormal environmental conditions
- Unusual transient voltages present on the source voltage
- Frequent or planned through-fault duty
- Planned overloading unless in strict accordance with the IEEE loading guide (C57.91)
- Motors whose horsepower rating is greater than half the transformer kVA rating
- Unusual frequency of impact loading may occur when supplying welding apparatus, electric arc furnaces or motors with cyclical loads
- Loads involving abnormal harmonic or DC current that may result where appreciable load currents are controlled by solid-state or similar devices

These lists do not purport to cover all unusual conditions and applicable limitations. Other "unusual service conditions" are described in IEEE Standard C57.12.00.

Table 17.0-1. Temperature Guarantees

Description	Ambient ①	Rise ②③
Standard	30 °C	65 °C
Optional	30 °C	55 °C
Optional	30 °C	75 °C ④

① 30 °C average ambient temperature of cooling air not to exceed 40 °C maximum over any 24-hour period.

② Degree rise is the average winding temperature rise by resistance.

③ A dual temperature rating of 55 °C/65 °C or 65 °C/75 °C adds 12% additional continuous capacity to the base kVA rating of the transformer. 55 °C/75 °C adds 22%.

④ Requires transformer to be filled with Envirotemp™ FR3™ fluid.

Note: Altitudes not to exceed 3300 ft (1006 m). Unit deration or special designs are required above 3300 ft (1006 m).

Fluids—Liquid Dielectric

The choice of fluid, mineral oil or less flammable natural esther fluid (Envirotemp FR3) is made based upon site conditions and proximity to facility walls, windows and flammable structures, environmentally sensitive areas, and when considering extended transformer insulation life.

Note: For additional information about transformer applications and types of insulating fluids, see **Tab 14**.

PEAK Transformers (Continued)

The example below illustrates the potential footprint change in three-phase pad-mounted transformers.

Table 17.0-12. PEAK Transformer Comparison

Description	Mineral Oil	PEAK 75 °C	PEAK 65/75 °C	PEAK 55/75 °C
Three-phase load capacity	IEEE Std C57.91-2011 standard	IEEE Std C57.91-2011 standard	+12% continuous (above base kVA rating)	+22% continuous (above base kVA rating)
Life extension	1x	3–4x	8x (when operating at base kVA rating)	8x (when operating at base kVA rating)
Enhanced fire safety	—	■	■	■
Environmentally preferred	—	■	■	■
First price	Lowest	Lower	Low	Low
Lifetime cost of ownership	Low	Lower	Lowest	Lower
Bioremediation cost	High	Moderate	Moderate	Moderate

Note: All values are design dependent.

GROUND-MOUNTED TRANSFORMER BY DTE

17

Layout Dimensions

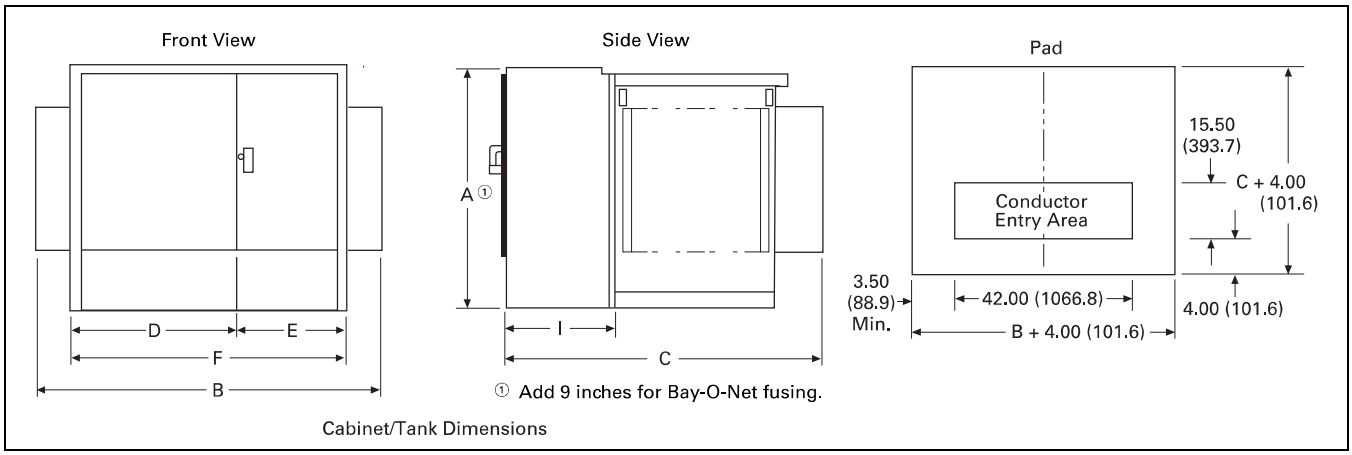


Figure 17.0-12. Pad-Mounted Transformer—Dimensions in Inches (mm)

Table 17.0-13. Dimensions with DOE Efficiency at 65 Degree AWR

kVA	A	B	C	D	E	F	I	Gallons	Approximate Weight	DOE 2016 Efficiency
45	50	68	39	42	26	68	20	115	2150	98.92%
75	50	68	39	42	26	68	20	125	2350	99.03%
112.5	50	68	39	42	26	68	20	135	2600	99.11%
150	50	68	49	42	26	68	20	150	2900	99.16%
225	50	72	53	42	30	72	20	170	3400	99.23%
300	50	72	55	42	30	72	20	190	3950	99.27%
500	50	72	61	42	30	72	20	240	5300	99.35%
750	64	72	63	42	30	72	20	300	7150	99.40%
1000	64	72	64	42	30	72	20	350	8950	99.43%
1500	73	89	71	42	30	72	24	400	11,450	99.48%
2000	73	101	75	42	30	72	24	525	13,800	99.51%
2500	73	101	99	42	30	72	24	600	16,750	99.53%

Note: The reference dimensions in this table cover the following: livefront and deadfront configurations, loop feed and radial feed, mineral oil and FR3 filled units.

Dimensional Variations

Height Variations

1. Add 9.00 inches (228.6 mm) to the height when using bayonet fusing on all kVA ratings.
2. Less flammable natural esther fluid requires deeper tanks on some transformer ratings.
   a. Add 2.00 inches (50.8 mm) to the depth of kVA ratings 75–1500. Add 8.00 inches (203.2 mm) to the depth of kVA ratings 2000 and 2500.

GROUND-MOUNTED
TRANSFORMER BY DTE

Dimensions are approximate—not for construction.

Technical Data

Table 17.0-14. Liquid Filled <34.5 kV Primary 55 °C Temp. Rise

kVA	No Load at 75 °C Ref. Temp. (Watts)	Load Loss at 100% Load and 75 °C Ref. Temp. (Watts)	Total Losses at 100% Load and 85 °C (Watts)	60–150 kV HV BIL Total Losses at 50% Load and 55 °C LL Ref. Temp. and 20 °C NL Ref. Temp. per DOE (Watts)
75	175	960	1135	413
112.5	250	1250	1500	562
150	300	1630	1930	696
225	330	2500	2830	942
300	520	2600	3120	1164
500	730	4900	5630	1889
750	1100	6200	7300	2567
1000	1500	6700	8200	3221
1500	1900	10,000	11,900	4375
2000	2600	12,000	14,600	5429
2500	2800	15,000	17,800	6408
3000	3800	16,000	19,800	—

Note: Losses offered are typical only, not guaranteed.

Table 17.0-15. Liquid Filled <34.5 kV Primary 65 °C Temp. Rise

kVA	No Load at 85 °C Ref. Temp. (Watts)	Load Loss at 100% Load and 85 °C Ref. Temp. (Watts)	Total Losses at 100% Load and 85 °C (Watts)	60–150 kV HV BIL Total Losses at 50% Load and 55 °C LL Ref. Temp. and 20 °C NL Ref. Temp per DOE (Watts)
75	190	950	1140	413
112.5	260	1300	1560	562
150	320	1600	1920	696
225	400	2300	2700	942
300	500	3000	3500	1164
500	700	5000	5700	1889
750	1000	6500	7500	2567
1000	1300	8500	9800	3221
1500	1900	10,500	12,400	4375
2000	2100	14,500	16,600	5429
2500	2700	15,500	18,200	6408
3000	4000	18,000	22,000	—

Note: Losses offered are typical only, not guaranteed.

Table 17.0-16. Envirotemp FR3 <34.5 kV Primary 55 °C Temp. Rise

kVA	No Load at 75 °C Ref. Temp. (Watts)	Load Loss at 100% Load and 75 °C Ref. Temp. (Watts)	Total Losses at 100% Load and 85 °C (Watts)	60–150 kV HV BIL Total Losses at 50% Load and 55 °C LL Ref. Temp. and 20 °C NL Ref. Temp. per DOE (Watts)
75	175	960	1135	413
112.5	250	1250	1500	562
150	300	1630	1930	696
225	330	2500	2830	942
300	520	2600	3120	1164
500	730	4900	5630	1889
750	1100	6200	7300	2567
1000	1500	6700	8200	3221
1500	1900	10,000	11,900	4375
2000	2600	12,000	14,600	5429
2500	2800	15,000	17,800	6408
3000	3800	16,000	19,800	—

Note: Losses offered are typical only, not guaranteed.

Table 17.0-17. Envirotemp FR3 <34.5 kV Primary 65 °C Temp. Rise

kVA	No Load at 85 °C Ref. Temp. (Watts)	Load Loss at 100% Load and 85 °C Ref. Temp. (Watts)	Total Losses at 100% Load and 85 °C (Watts)	60–150 kV HV BIL Total Losses at 50% Load and 55 °C LL Ref. Temp. and 20 °C NL Ref. Temp per DOE (Watts)
75	190	950	1140	413
112.5	260	1300	1560	562
150	320	1600	1920	696
225	400	2300	2700	942
300	500	3000	3500	1164
500	700	5000	5700	1889
750	1000	6500	7500	2567
1000	1300	8500	9800	3221
1500	1900	10,500	12,400	4375
2000	2100	14,500	16,600	5429
2500	2700	15,500	18,200	6408
3000	4000	18,000	22,000	—

Note: Losses offered are typical only, not guaranteed.

Table 17.0-18. DOE 2016 Transformer Efficiencies Three-Phase Liquid Filled Transformers

Three-Phase kVA	% Efficiency ①
15	98.65
30	98.83
45	98.92
75	99.03
112.5	99.11
150	99.16
225	99.23
300	99.27
500	99.35
750	99.40
1000	99.43
1500	99.48
2000	99.51
2500	99.53

① Based on transformer operating at 50% of nameplate base kVA.

GROUND-MOUNTED TRANSFORMER BY DTE

17

Layout Dimensions

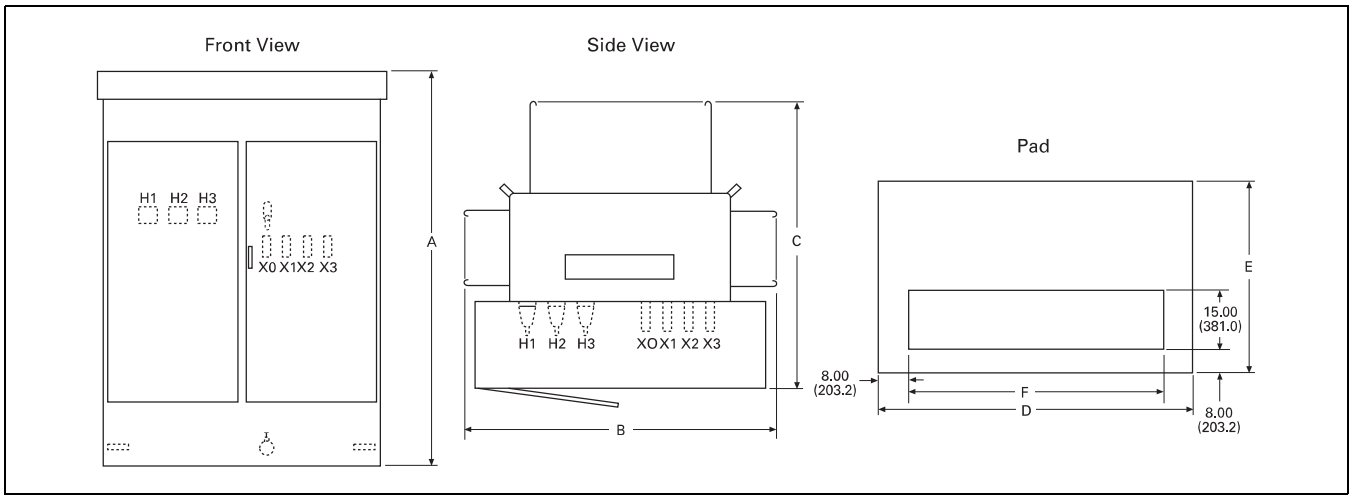


Figure 17.0-13. Pad-Mounted Transformer (3000–5000 kVA)—Dimensions in Inches (mm)

Table 17.0-19. Standard Unit, Oil-Immersed Rated 65 °C Rise, 3000–5000 kVA—Dimensions in Inches (mm)

kVA	Transformer			Pad			Approximate Weight Lb (kg)	Gallons (Liters) of Oil
	A	B	C ①	D	E ②	F		
15 kV Class, Delta Connected HV-HV 95 kV BIL, LV 30 kV BIL ③								
3000	76.00 (1930.4)	119.00 (3022.6)	100.00 (2540.0)	74.00 (1879.6)	72.00 (1828.8)	58.00 (1473.2)	12,900 (5851)	385 (1457)
3750	80.00 (2032.0)	82.00 (2082.8)	111.00 (2819.4)	79.00 (2006.6)	83.00 (2108.2)	63.00 (1600.2)	20,000 (9072)	540 (2044)
5000	78.00 (1981.2)	137.00 (3479.8)	108.00 (2743.2)	76.00 (1930.4)	80.00 (2032.0)	60.00 (1524.0)	21,500 (9752)	565 (2139)
15 kV Class, Wye Connected HV-HV 95 kV BIL, LV 30 kV BIL ③								
3000	74.00 (1879.6)	117.00 (2971.8)	102.00 (2590.8)	78.00 (1981.2)	74.00 (1879.6)	62.00 (1574.8)	15,000 (6804)	390 (1476)
3750	97.00 (2463.8)	81.00 (2057.4)	101.00 (2565.4)	81.00 (2057.4)	77.00 (1955.8)	65.00 (1651.0)	21,800 (9888)	550 (2082)
5000	91.00 (2311.4)	119.00 (3022.6)	108.00 (2743.2)	84.00 (2133.6)	80.00 (2032.0)	68.00 (1727.2)	22,000 (9979)	585 (2214)
25 kV Class, Delta Connected HV-HV 150 kV BIL, LV 30 kV BIL ③								
3000	83.00 (2108.2)	84.00 (2133.6)	101.00 (2565.4)	86.00 (2184.4)	74.00 (1879.6)	70.00 (1778.0)	15,400 (6985)	515 (1949)
3750	96.00 (2438.4)	84.00 (2133.6)	98.00 (2489.2)	86.00 (2184.4)	78.00 (1981.2)	70.00 (1778.0)	20,100 (9117)	650 (2461)
5000	101.00 (2565.4)	101.00 (2565.4)	107.00 (2717.8)	84.00 (2133.6)	79.00 (2006.6)	68.00 (1727.2)	22,900 (10,387)	670 (2536)
25 kV Class, Wye Connected HV-HV 125 kV BIL, LV 30 kV BIL ③								
3000	84.00 (2133.6)	80.00 (2032.0)	102.00 (2590.8)	80.00 (2032.0)	74.00 (1879.6)	64.00 (1625.6)	16,300 (7394)	450 (1703)
3750	93.00 (2362.2)	85.00 (2159.0)	99.00 (2514.6)	84.00 (2133.6)	78.00 (1981.2)	68.00 (1727.2)	21,200 (9616)	575 (2177)
5000	90.00 (2286.0	110.00 (2794.0)	108.00 (2743.2)	84.00 (2133.6)	80.00 (2032.0)	68.00 (1727.2)	23,100 (10,478)	605 (2290)
35 kV Class, Delta Connected HV-HV 200 kV BIL, LV 30 kV BIL								
3000	86.00 (2184.4)	86.00 (2184.4)	101.00 (2565.4)	78.00 (1981.2)	73.00 (1854.2)	62.00 (1574.8)	15,700 (7121)	420 (1590)
3750	86.00 (2184.4)	82.00 (2082.8)	102.00 (2590.8)	82.00 (2082.8)	76.00 (1930.4)	66.00 (1676.4)	19,800 (8981)	525 (1987)
5000	102.00 (2590.8)	122.00 (3098.8)	106.00 (2692.4)	83.00 (2108.2)	78.00 (1981.2)	67.00 (1701.8)	22,600 (10,251)	580 (2196)
35 kV Class, Wye Connected HV-HV 125 kV BIL, LV 30 kV BIL								
3000	82.00 (2082.8)	86.00 (2184.4)	101.00 (2565.4)	78.00 (1981.2)	73.00 (1854.2)	62.00 (1574.8)	15,700 (7121)	420 (1590)
3750	91.00 (2311.4)	82.00 (2082.8)	102.00 (2590.8)	82.00 (2082.8)	76.00 (1930.4)	66.00 (1676.4)	19,800 (8981)	525 (1987)
5000	92.00 (2336.8)	122.00 (3098.8)	106.00 (2692.4)	83.00 (2108.2)	78.00 (1981.2)	67.00 (1701.8)	22,600 (10,251)	580 (2196)
35 kV Class, Delta Connected HV-HV 150 kV BIL, LV 30 kV BIL								
3000	84.00 (2133.6)	84.00 (2133.6)	100.00 (2540.0)	86.00 (2184.4)	74.00 (1879.6)	70.00 (1778.0)	15,400 (6985)	530 (2006)
3750	84.00 (2133.6)	84.00 (2133.6)	101.00 (2565.4)	86.00 (2184.4)	77.00 (1955.8)	70.00 (1778.0)	19,300 (8754)	630 (2385)
5000	92.00 (2336.8)	122.00 (3098.8)	106.00 (2692.4)	81.00 (2057.4)	78.00 (1981.2)	65.00 (1651.0)	20,500 (9299)	600 (2271)
35 kV Class, Wye Connected HV-HV 150 kV BIL, LV 30 kV BIL								
3000	80.00 (2032.0)	84.00 (2133.6)	104.00 (2641.6)	86.00 (2184.4)	76.00 (1930.4)	70.00 (1778.0)	17,100 (7756)	500 (1893)
3750	86.00 (2184.4)	87.00 (2209.8)	107.00 (2717.8)	86.00 (2184.4)	79.00 (2006.6)	70.00 (1778.0)	20,600 (9344)	560 (2120)
5000	95.00 (2413.0)	105.00 (2667.0)	107.00 (2717.8)	85.00 (2159.0)	79.00 (2006.6)	69.00 (1752.6)	23,800 (10,795)	625 (2366)
35 kV Class, Wye Connected HV-HV 200 kV BIL, LV 30 kV BIL								
3000	88.00 (2235.2)	104.00 (2641.6)	99.00 (2514.6)	107.00 (2717.8)	83.00 (2108.2)	91.00 (2311.4)	19,800 (8981)	720 (2725)
3750	90.00 (2286.0)	104.00 (2641.6)	104.00 (2641.6)	107.00 (2717.8)	90.00 (2286.0)	91.00 (2311.4)	24,400 (11,068)	840 (3180)
5000	101.00 (2565.4)	102.00 (2590.8)	106.00 (2692.4)	107.00 (2717.8)	90.00 (2286.0)	89.00 (2260.6)	28,600 (12,973)	920 (3483)

① Standard compartment depth is 22.00 inches (558.8 mm) except 200 kV BIL has a depth of 30.00 inches (762.0 mm). Depth may be altered by the addition of switching and fusing.

② Extends under base of transformer only. Does not include rear coolers.

③ Standard low voltages are 480Y and 480 delta (through 3750 kVA only). Low voltage above 3750 kVA must be 2400 V or above.

Dimensions are approximate—not for construction.

GROUND-MOUNTED TRANSFORMER BY DTE

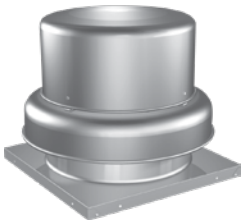
GREENHECK
Building Value in Air.

Document 471558
Model G and GB
Downblast Centrifugal Roof Exhaust

Installation, Operation and Maintenance Manual

Please read and save these instructions for future reference. Read carefully before attempting to assemble, install, operate or maintain the product described. Protect yourself and others by observing all safety information. Failure to comply with these instructions will result in voiding of the product warranty and may result in personal injury and/or property damage.

Direct Drive Downblast Centrifugal Exhaust



These fans are specifically designed for roof mounted applications exhausting relatively clean air. The maximum continuous operating temperature is 130°F *(54ºC)*. Direct drive models are made with nominal wheel diameter ranging from 8 to 30 inches *(203 to 762 mm)* (060-300 unit sizes). Each fan shall bear a permanently affixed manufacturer's embossed metal nameplate containing the model number and individual serial number. All fans are UL/cUL Listed Standard 705.

Belt Drive Downblast Centrifugal Exhaust

These fans are specifically designed for roof mounted applications exhausting relatively clean air. The maximum continuous operating temperature is 180°F *(82ºC)*. Belt drive models are made with nominal wheel diameters ranging from 11 to 54 inches *(279 to 1372 mm)* (097-540 unit sizes). Each fan shall bear a permanently affixed manufacturer's embossed nameplate containing the model number and individual serial number. All fans are UL/cUL Listed Standard 705.

General Safety Information

Only qualified personnel should install this fan. Personnel should have a clear understanding of these instructions and should be aware of general safety precautions. Improper installation can result in electric shock, possible injury due to coming in contact with moving parts, as well as other potential hazards. Other considerations may be required if high winds or seismic activity is present. If more information is needed, contact a licensed professional engineer before moving forward.

1. Follow all local electrical and safety codes, as well as the National Electrical Code (NEC) and the National Fire Protection Agency (NFPA), where applicable. Follow the Canadian Electric Code (CEC) in Canada.
2. The rotation of the wheel is critical. It must be free to rotate without striking or rubbing any stationary objects.
3. Motor must be securely and adequately grounded.
4. Do not spin fan wheel faster than max cataloged fan RPM. Adjustments to fan speed significantly affects motor load. If the fan RPM is changed, the motor current should be checked to make sure it is not exceeding the motor nameplate amps.
5. Do not allow the power cable to kink or come in contact with oil, grease, hot surfaces or chemicals. Replace cord immediately if damaged.
6. Verify that the power source is compatible with the equipment.
7. Never open access doors to a duct while the fan is running.

DANGER
Always disconnect, lock and tag power source before installing or servicing. Failure to disconnect power source can result in fire, shock or serious injury.
CAUTION
When servicing the fan, motor may be hot enough to cause pain or injury. Allow motor to cool before servicing.
CAUTION
Precaution should be taken in explosive atmospheres.
DANGER
Pour écarter les risques d'incendie, de choc électrique ou de blessure grave, veiller à toujours débrancher, verrouiller et étiqueter la source de courant avant l'installation ou l'entretien.
ATTENTION
Lors de toute intervention sur la soufflante, le moteur peut être suffisamment chaud pour provoquer une douleur voire une blessure. Laisser le moteur refroidir avant toute maintenance.
ATTENTION
Faire preuve de précaution dans les atmosphères explosives.

Receiving

Upon receiving the product, check to ensure all items are accounted for by referencing the delivery receipt or packing list. Inspect each crate or carton for shipping damage before accepting delivery. Alert the carrier of any damage detected. The customer will make notification of damage (or shortage of items) on the delivery receipt and all copies of the bill of lading which is countersigned by the delivering carrier. If damaged, immediately contact your representative. Any physical damage to the unit after acceptance is not the responsibility of the manufacturer.

Unpacking

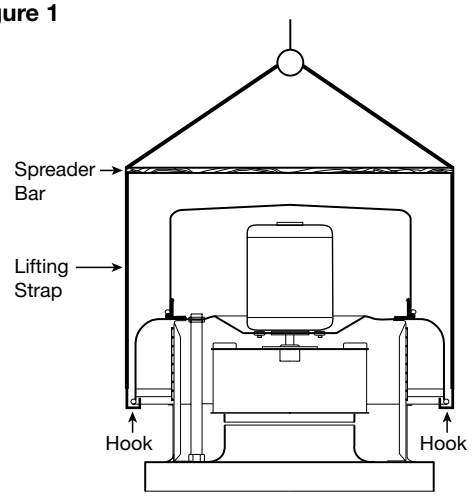
Verify that all required parts and the correct quantity of each item have been received. If any items are missing, report shortages to your local representative to arrange for obtaining missing parts. Sometimes it is not possible that all items for the unit be shipped together due to availability of transportation and truck space. Confirmation of shipment(s) must be limited to only items on the bill of lading.

Handling

Belt and Direct Drive Units

Lift Direct Drive unit on to the roof utilizing hooks under the lip of the shroud. Evenly space the hooks around the shroud using a minimum of four lifting straps. Use a spreader bar to ensure the straps do not come in contact with the unit (see Figure 1).

Figure 1



When lifting a belt drive unit on to the roof, use either the four lifting points on the drive frame or the two lifting points on the bearing plate if present (see Figure 2 for lifting points). Access to the drive frame is accomplished by removing the screws identified in Figure 3. The cover can then be removed and placed on a flat surface in an area protected from strong winds.

When direct and/or belt drive unit is on the roof, move fan to desired location using lifting points and fasten securely through mounting holes in base. Shims may be necessary depending upon roofing material thickness.

The motor amperage and voltage ratings must be checked for compatibility to supply voltage prior to final electrical connection. For direct and/or belt drive installations, the electrical supply should be routed through the conduit chase located between the curb cap and the bottom of the motor compartment. Wiring must conform to local and national codes.

Figure 2

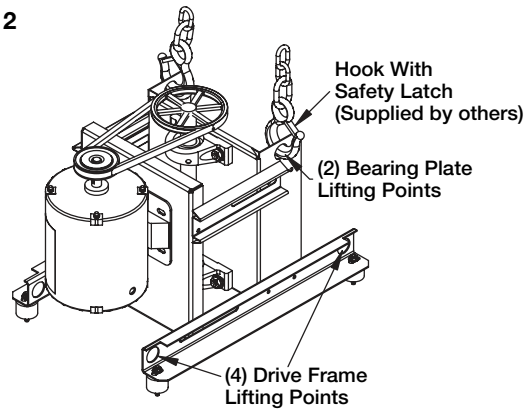
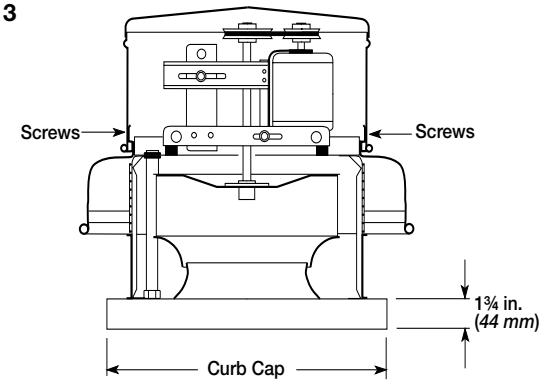


Figure 3



Storage

Fans are protected against damage during shipment. If the unit cannot be installed and operated immediately, precautions need to be taken to prevent deterioration of the unit during storage. The user assumes responsibility of the fan and accessories while in storage. The manufacturer will not be responsible for damage during storage. These suggestions are provided solely as a convenience to the user.

Indoor - The ideal environment for the storage of fans and accessories is indoors, above grade, in a low humidity atmosphere which is sealed to prevent the entry of blowing dust, rain or snow. Temperatures should be evenly maintained between 30° to 110°F *(-1° to 43°C)* (wide temperature swings may cause condensation and "sweating" of metal parts). All accessories must be stored indoors in a clean, dry atmosphere.

Remove any accumulations of dirt, water, ice or snow and wipe dry before moving to indoor storage. To avoid "sweating" of metal parts, allow cold parts to reach room temperature. To dry parts and packages, use a portable electric heater to get rid of any moisture buildup. Leave coverings loose to permit air circulation and to allow for periodic inspection.

The unit should be stored at least 3½ inches *(89 mm)* off the floor on wooden blocks covered with moisture proof paper or polyethylene sheathing. Aisles between parts and along all walls should be provided to permit air circulation and space for inspection.

Outdoor - Fans designed for outdoor applications may be stored outdoors, if absolutely necessary. Roads or aisles for portable cranes and hauling equipment are needed.

The fan should be placed on a level surface to prevent water from leaking into the fan. The fan should be elevated on an adequate number of wooden blocks so that it is above water and snow levels and has enough blocking to prevent it from settling into soft ground. Locate parts far enough apart to permit air circulation, sunlight and space for periodic inspection. To minimize water accumulation, place all fan parts on blocking supports so that rain water will run off.

Do not cover parts with plastic film or tarps as these cause condensation of moisture from the air passing through heating and cooling cycles.

Fan wheels should be blocked to prevent spinning caused by strong winds.

Inspection and Maintenance During Storage

While in storage, inspect fans once per month. Keep a record of inspection and maintenance performed.

If moisture or dirt accumulations are found on parts, the source should be located and eliminated. At each inspection, rotate the wheel by hand ten to fifteen revolutions to distribute lubricant in motor. If paint deterioration begins, consideration should be given to touch-up or repainting. Fans with special coatings may require special techniques for touch-up or repair.

Machined parts coated with rust preventive should be restored to good condition promptly if signs of rust occur. Immediately remove the original rust preventive coating with petroleum solvent and clean with lint-free cloths. Polish any remaining rust from surface with crocus cloth or fine emery paper and oil. Do not destroy the continuity of the surfaces. Thoroughly wipe clean with Tectyl® 506 (Ashland Inc.) or the equivalent. For hard to reach internal surfaces or for occasional use, consider using Tectyl® 511M Rust Preventive, WD-40® or the equivalent.

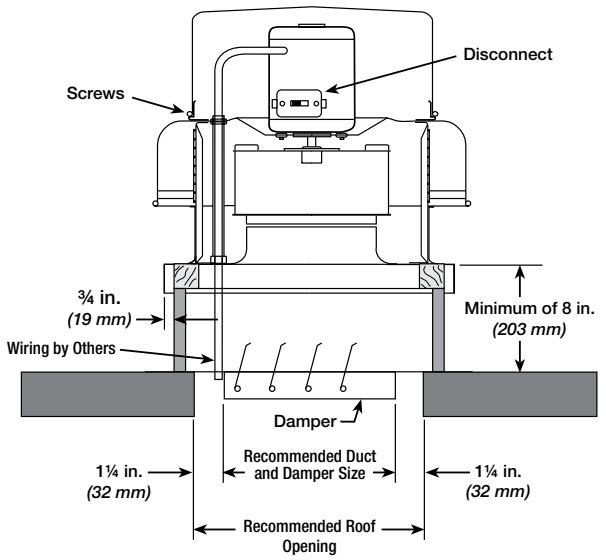
Removing From Storage

As fans are removed from storage to be installed in their final location, they should be protected and maintained in a similar fashion until the fan equipment goes into operation.

Dimensional Data

Direct Drive

Figure 4 - Typical Roof Mounting Installation



Model Size	Curb Cap	Damper	Roof Opening	**Approx. Weight
060, 070	17 *(432)*	8 *(203)*	10½ *(267)*	18 *(8)*
080, 090, 095	17 *(432)*	10 *(254)*	12½ *(318)*	26 *(12)*
097, 098, 099	19 *(483)*	12 *(305)*	14½ *(368)*	57 *(26)*
100, 103*, 100HP, 103HP*	19 *(483)*	12 *(305)*	14½ *(368)*	62 *(28)*
120, 123*	19 *(483)*	12 *(305)*	14½ *(368)*	65 *(30)*
130, 133*	19 *(483)*	12 *(305)*	14½ *(368)*	66 *(30)*
140, 143*, 140HP, 143HP*	22 *(559)*	16 *(406)*	18½ *(470)*	76 *(35)*
160, 163*	22 *(559)*	16 *(406)*	18½ *(470)*	80 *(36)*
180, 183*	30 *(762)*	18 *(457)*	20½ *(521)*	119 *(54)*
200, 203*, 200HP	30 *(762)*	18 *(457)*	20½ *(521)*	130 *(59)*
240	34 *(864)*	24 *(610)*	26½ *(673)*	158 *(72)*
300	40 *(1016)*	30 *(762)*	32½ *(826)*	320 *(145)*

- All dimensions are in inches *(millimeters)*.

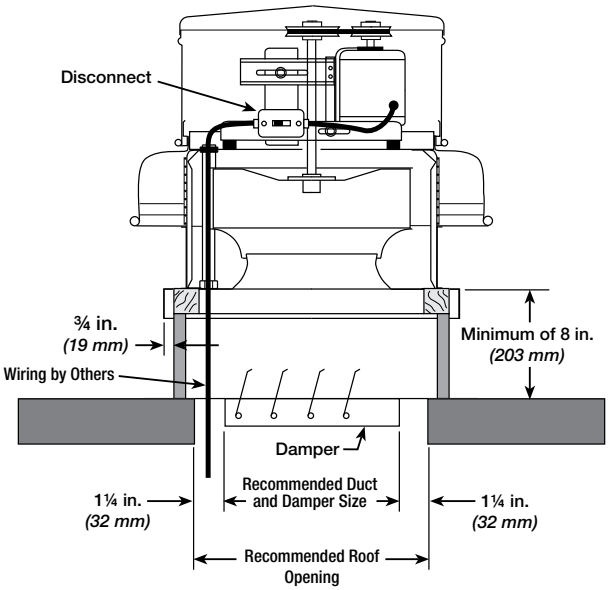
* Previous size, no physical product change with new size

** Approximate weight shown in pounds *(kilograms)* is the largest cataloged open drip proof motor.

- "Curb Cap" is the inside dimension of the curb cap.
- The roof curb should be 1½ in. *(38 mm)* less than the curb cap to allow for roofing and flashing.
- Roof opening is a square dimension

Belt Drive

Figure 5 - Typical Roof Mounting Installation



Model Size	Curb Cap	Damper	Roof Opening	**Approx. Weight
071*, 097, 081*, 098, 091*, 099	19 *(483)*	12 *(305)*	14½ *(368)*	58 *(26)*
100, 101*, 100HP, 101HP*	19 *(483)*	12 *(305)*	14½ *(368)*	63 *(29)*
120, 121*	19 *(483)*	12 *(305)*	14½ *(368)*	66 *(30)*
130, 131*	19 *(483)*	12 *(305)*	14½ *(368)*	67 *(30)*
140, 141*, 140HP, 141HP*	22 *(559)*	16 *(406)*	18½ *(470)*	83 *(38)*
160, 161*, 160HP, 161HP*	22 *(559)*	16 *(406)*	18½ *(470)*	89 *(40)*
180, 180HP	30 *(762)*	18 *(457)*	20½ *(521)*	125 *(57)*
200, 200HP	30 *(762)*	18 *(457)*	20½ *(521)*	138 *(63)*
220, 220HP, 240, 240HP	34 *(864)*	24 *(610)*	26½ *(673)*	158 *(72)*
260	40 *(1016)*	30 *(762)*	32½ *(826)*	305 *(138)*
300, 300HP	40 *(1016)*	30 *(762)*	32½ *(826)*	320 *(145)*
330	46 *(1168)*	36 *(914)*	38½ *(978)*	385 *(175)*
360, 360HP	46 *(1168)*	36 *(914)*	38½ *(978)*	403 *(183)*
420	52 *(1321)*	42 *(1067)*	44½ *(1130)*	495 *(225)*
480	52 *(1321)*	48 *(1219)*	50½ *(1283)*	623 *(283)*
500	64 *(1626)*	54 *(1372)*	56½ *(1435)*	687 *(312)*
540	64 *(1626)*	54 *(1372)*	56½ *(1435)*	748 *(339)*

- All dimensions are in inches *(millimeters)*.

* Previous size, no physical product change with new size

** Approximate weight shown in pounds *(kilograms)* is the largest cataloged open drip proof motor.

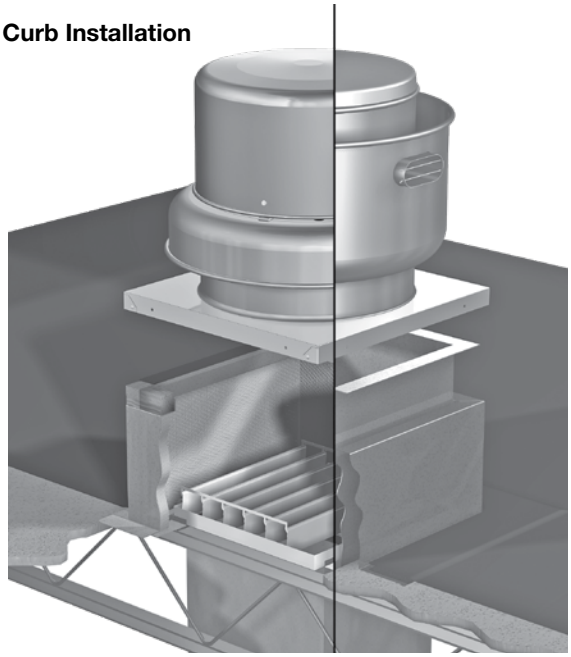
- "Curb Cap" is the inside dimension of the curb cap.
- The roof curb should be 1½ in. *(38 mm)* less than the curb cap to allow for roofing and flashing.
- Roof opening is a square dimension

Installation

Typical Roof Mounting Installation

1. On the roof surface, cut an appropriate sized hole and follow manufacturer's instructions on curb installation. Caulk and flash the curb to ensure a water tight seal.

Roof Curb Installation



2. If unit is equipped with a backdraft damper, it should be installed now.
3. Remove motor cover. Access to the motor compartment is accomplished by removing the screws as shown in Figure 3, page 2.
4. On **belt drive** fans, use the lifting lugs on the drive frame or bearing plate to lift and place the unit on top of roof curb. Refer to Figure 2, page 2.
5. On **direct drive** fans, lift and place the unit on top of roof curb using hooks under the lip of the shroud. Refer to Figure 1, page 2.
6. Secure fan to curb using a minimum of eight lag screws, metal screws or other suitable fasteners. Shims may be required depending upon curb installation and roofing material.
7. Verify power line wiring is de-energized before connecting fan motor to power source.
8. Connect power supply wiring to the motor as indicated on the motor nameplate or terminal box cover. Check the power source for compatibility with the requirements of your equipment.
9. Check fan wheel for free rotation, recenter if necessary. Check setscrew(s) for tightness.
10. Check all fasteners for tightness.
11. Mount and wire safety disconnect switch under motor cover. Wire control switches at ground level, refer to Figure 6.
12. Replace motor cover.

Typical Wiring Diagram

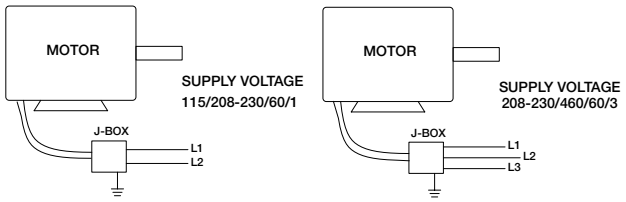


Figure 6

Vari-Green Wiring

For Vari-Green wiring, refer to the Vari-Green Motor and Controls Installation, Operation and Maintenance Manual for complete wiring and operation instructions.

IMPORTANT

Installation, troubleshooting and parts replacement are to be performed only by qualified personnel. Consult and follow all applicable national, state and local codes. They will supercede this document.

Pre-Starting Checks

1. Check all fasteners and setscrews for tightness. The wheel should rotate freely and be aligned as shown in Figure 7.

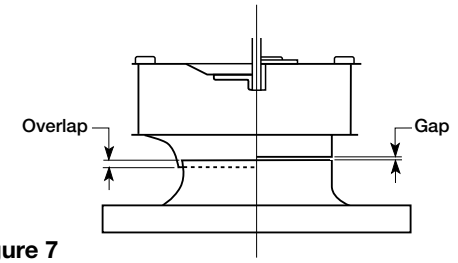


Figure 7

Model Type		Size	Overlap in. *(mm)*	Gap in. *(mm)*
Direct	Belt			
X	—	060-095	—	3/32 *(2)*
X		097-163	1/4 *(6)*	—
	X	071-161	1/4 *(6)*	—
X	X	180-240	3/8 *(10)*	—
X	—	300	1/2 *(13)*	—
—	X	260-540	1/2 *(13)*	—

2. Wheel position is preset and the unit is test run at the factory. Movement may occur during shipment and realignment may be necessary.
3. **Belt Drive**: Centering wheel across the inlet can be accomplished by loosening the bolts holding the drive frame to the vibration isolators and repositioning the drive frame.

   Direct and Belt Drive: If further alignment is needed, loosen shroud bolts and move shroud and motor to align wheel over inlet properly.

   Wheel and inlet cone overlap can be adjusted by loosening the setscrews in the wheel hub and moving the wheel to the desired position. For both **direct and belt drive** models with wheel hubs and shaft pulleys utilizing a tapered bushing interface, reference page 8 for the tapered bushing removal and move the wheel to the desired position.

   Fan RPM should be checked and verified with a tachometer.
4. Check wheel rotation (viewing from the shaft side) by momentarily energizing the unit. Rotation should be clockwise as shown in Figure 8 and correspond to rotation decal on the unit.

   If wheel rotation is incorrect, reverse two of the wiring leads or check motor wiring for single phase. Fan RPM should be checked and verified with a tachometer.

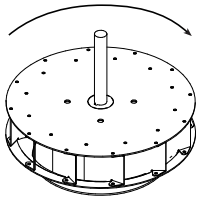


Figure 8

WARNING

Correct direction of wheel rotation is critical. Reversed rotation will result in poor air performance, motor overloading and possible motor burnout.

AVERTISSEMENT

La turbine doit impérativement tourner dans le bon sens. Une rotation en sens inverse entraînerait de mauvaises performances de soufflage, une surcharge du moteur voire un grillage du moteur.

IMPORTANT

The fan has been checked for mechanical noises at the factory prior to shipment. If mechanical noise should develop, suggested corrective actions are offered in the Troubleshooting section.

IMPORTANT

Over tightening belts will cause excessive bearing wear and noise. Too little tension will cause slippage at startup and uneven wear.

Belt Drive Pre-Starting Belt Tension Checks

5. Always loosen tension enough to install belts without stretching. Do not force belt(s) see Figure 9. Forcing belts will break the cords and cause belt failure.

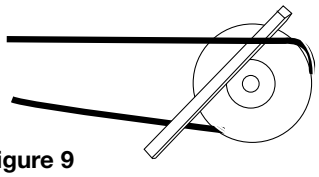


Figure 9

6. For units with two groove pulleys, adjust so the tension is equal in both belts.
7. If adjustments are made, it is very important to check the pulleys for proper alignment. Misaligned pulleys lead to excessive belt wear, vibration, noise and power loss, see Figure 10.

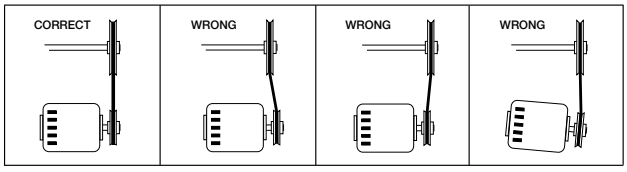


Figure 10

8. Belt tension can be adjusted by loosening four fasteners on the drive frame, see Figure 11. The motor plate slides on the slotted adjusting arms and drive frame angles in the same manner.

   Four (4) fasteners in total.

   Identical fasteners on opposing side must also be loosened.

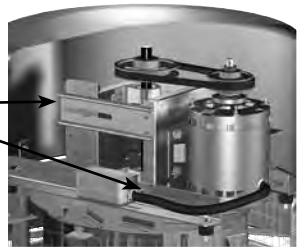


Figure 11

9. **Sizes 097-160:** Belts should be tensioned just enough to prevent slippage at full load. Belts should have a slight bow on the slack side while running at full load, see Figure 12a.

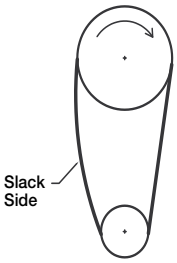


Figure 12a

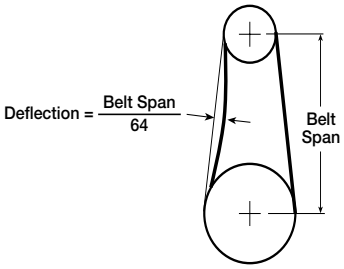


Figure 12b

   Sizes 180-540: Belt tension should be adjusted to allow 1/64 in. *(0.397 mm)* of deflection per inch of belt span. For example, a 15 in. *(381 mm)* belt span should have 15/64 in. *(5.95 mm)* (or about 1/4 in. *(6 mm)*) of deflection with moderate thumb pressure at mid-point between pulleys, see Figure 12b.

10. The adjustable motor pulley is factory set for the RPM specified. Speed can be increased by closing or decreased by opening the adjustable motor pulley.
11. Any increase in speed represents a substantial increase in the horsepower required by the unit.
12. Motor amperage should always be checked to avoid serious damage to the motor when speed is varied.

Operation

1. Before starting up or operating fan, check all fasteners for tightness. In particular, check the setscrews in the wheel hub (or the tapered bushing and pulleys if applicable).
2. While in the OFF position or before connecting the fan to power, turn the fan wheel by hand to be sure it is not striking the venturi or any obstacle.
3. Start the fan and shut it off immediately to check rotation of the wheel with directional arrow in the motor compartment, see Figure 8.
4. When the fan is started, observe the operation and check for any unusual noises.
5. With the system in full operation and all ductwork attached, measure current input to the motor and compare with the nameplate rating to determine if the motor is operating under safe load conditions.
6. Keep inlets and approaches to fan clean and free from obstruction.

IMPORTANT

Adjust (tighten) belt tension after the first 24-48 hours of operation.

Inspection

Inspection of the fan should be conducted at the first 30 minute and 24 hour intervals of satisfactory operation.

30 Minute Interval: Inspect bolts, setscrews and motor mounting bolts. Adjust and tighten as necessary.

24 Hour Interval: Check all internal components. On belt drive units only, inspect belt alignment and tension. Adjust and tighten as necessary.

Maintenance

DANGER

Disconnect and secure to the “off” position all electrical power to the fan prior to inspection or servicing. Failure to comply with this safety precaution could result in serious injury or death.

DANGER

Pour écarter les risques de blessure grave ou de mort, débrancher et verrouiller l’alimentation électrique en position « Arrêt » avant tout contrôle ou entretien.

WARNING

This unit should be made non-functional when cleaning the wheel or housing (fuses removed, disconnect locked off).

AVERTISSEMENT

L’appareil doit être rendu non opérationnel lors du nettoyage de la turbine ou du caisson (fusibles retirés, sectionneur verrouillé).

IMPORTANT

Uneven cleaning of the wheel will produce an out of balance condition that will cause vibration in the fan.

Installation and maintenance are to be performed only by qualified personnel who are familiar with local codes and regulations and who are experienced with this type of equipment.

Motor maintenance is generally limited to cleaning and lubrication (where applicable). Cleaning should be limited to exterior surfaces only. Removing dust buildup on motor housing ensures proper motor cooling.

Greasing of motors is only intended when fittings are provided. Many fractional horsepower motors are permanently lubricated and should not be lubricated after installation. Motors supplied with grease fittings should be greased in accordance with manufacturer’s recommendations. Where motor temperatures do not exceed 104°F *(40°C)*, the grease should be replaced after 2,000 hours of running time as a general rule.

Wheels require very little attention when moving clean air. Occasionally, oil and dust may accumulate causing imbalance. When this occurs, the wheel and housing should be cleaned to ensure smooth and safe operation.

All fasteners should be checked for tightness each time maintenance checks are performed prior to restarting unit.

A proper maintenance program will help these units deliver years of dependable service.

Tapered Bushing Hub Installation and Removal

For wheel hubs and shaft pulleys utilizing a tapered bushing interface, follow this procedure for installation and removal. There are two possible setups for the tapered bushing, both have the same procedure, but orientation of the hub varies.

Tapered Bushing Removal:

1. If present, loosen the setscrew holding the bushing and shaft key in place.
2. Loosen and remove the socket head cap screws which fasten the bushing to the hub as shown in the section views and examples of Figures 13-16.

Standard Mounting	Reverse Mounting

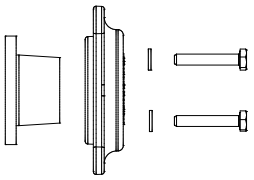
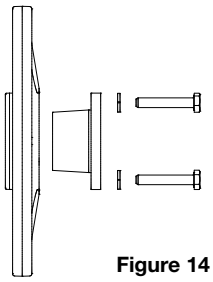
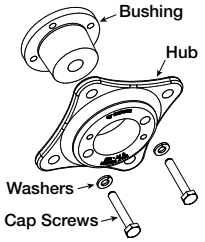
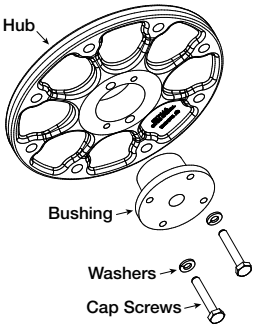

	

Figure 13	**Figure 14**
	
	
Figure 15 Standard Bushing Orientation	**Figure 16** Reverse Bushing Orientation

3. **Standard Mounting:** Take the two socket head cap screws that were removed and install them into the visibly threaded holes on the wheel hub.
   Reverse Mounting: Install the two socket head cap screws into the visibly threaded holes of the bushing flange.
4. Once both socket head cap screws are installed, tighten them an eighth of a turn at a time, alternating between the two until the hub comes loose from the bushing.

Bushing Installation:

1. Clean all surfaces of hub and bushing to remove any oil or residue present. Do not use any lubricant to install bushing into the hub. For both standard and reverse mounting styles, the socket head cap screws are adjustable from the inlet of the fan.
2. **Standard Mounting:** Slide the bushing and shaft key onto the fan shaft followed by the wheel and hub assembly. If present, use the keyway setscrew to hold the shaft key and bushing in place but DO NOT overtighten as this can damage the bushing. Align the unthreaded holes of the hub with the threaded holes of the tapered bushing.
   Reverse Mounting: Slide the wheel and hub assembly on to the fan shaft followed by the bushing and shaft key. If present, use the keyway setscrew to hold the shaft key and bushing in place but DO NOT overtighten as this can damage the bushing. Align the unthreaded holes of the tapered bushing with the threaded holes of the hub.
3. Install the two bushing socket head cap screws into the aligned holes by hand (or without excessive torque) until the heads of the socket head cap screws are seated against the mating surface.
4. Adjust the height of the wheel in the fan relative to the inlet venturi then tighten the two socket head cap screws an eighth turn at a time in an alternating fashion and reach a torque of 10 ft-lbs.

Belt and Bearing Maintenance

1. Belts tend to stretch after a period of time. They should be checked periodically for wear and tightness. When replacing belts, use the same type as supplied with the unit.
2. Matched belts should always be used on units with multi-groove pulleys.
3. For belt replacement, loosen the tensioning device enough to allow removal of the belt by hand.
4. Once installed, adjust belts as shown in "Pre-Starting Checks."
5. To ensure tightness, check pulley setscrews. Proper keys must be in keyways.
6. Fan RPM should not be readjusted. Only use pulleys of identical size and type when replacing pulleys.
7. Shaft bearings can be classified in two groups: relubricating and non-relubricating. All non-relubricating bearings on belt drive fans are factory lubricated and require no further lubrication under normal use (between -20º to 180ºF *(-29º to 82ºC)* in a relatively clean environment).
8. On belt drive fans, the standard cast pillow block bearings are factory lubricated and are provided with external grease fittings. Annual lubrication is recommended, or more frequently if needed. See Table 2. Do not over-grease. Use only one or two shots of lubricant with a hand gun. Maximum hand gun rating is 40 psi. Rotate bearings during lubrication where good safety practice permits. Caution should be employed to prevent over packing or contamination.
9. Units installed in hot, humid or dirty locations should be equipped with special bearings. These bearings will require frequent lubrication. Caution should be employed to prevent over packing or contamination.
10. Grease fittings should be wiped clean. The unit should be in operation while lubricating bearings. Extreme care should be used around moving parts.
11. Grease should be pumped in very slowly until a slight bead forms around the seal. A high grade lithium base grease should be used. See Table 3.
12. During the first few months of operation, check bearing setscrews periodically to ensure tightness.
13. If unit is to be left idle for an extended period, remove belts and store in a cool, dry place to avoid premature belt failure.

Bearing Lubrication Schedule

NOTE: If unusual environment conditions exist (extreme temperature, moisture or contaminants) more frequent lubrication is required.

A good quality lithium base grease, conforming to NLGI Grade 2 consistency, such as those listed in Table 3 may be used.

Table 2: Suggested Fan Bearing Lubrication Intervals

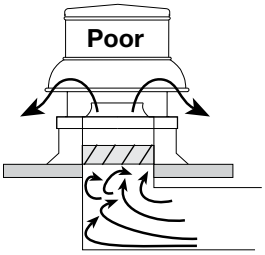
Interval (months)	Type of Service
1 to 3	Heavy duty in dirty, dusty locations; high ambient temperatures; moisture laden atmosphere; vibration.
3 to 6	12 to 24 hours per day, heavy duty, or if moisture is present
6 to 12	8 to 16 hours per day in clean, relatively dry atmosphere
12 to 18	Infrequent operation or light duty in clean atmosphere

Table 3: Grease Manufacturers

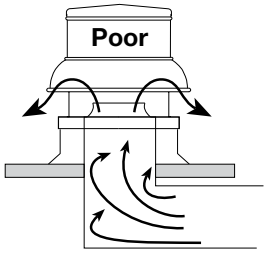
Manufacturer	Grease (NLGI #2)
U.S. Electric Motors	Grease No. 83343
Chevron U.S.A. Inc	Chevron SRI Grease #2
Mobil Oil Corporation	Mobilith
	Mobil 532
Texaco, Inc.	Premium BRB #2
	Texaco Multifak #2
Amoco Oil Co.	Rykon Premium #2
Exxon	Unirex N2
Shell	B Shell Alvania #2

Fan Inlet Connections

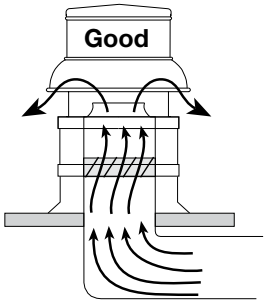
In order to ensure proper fan performance, caution must be exercised in fan placement and connection to the ventilation system. Obstructions, transitions, poorly designed elbows, improperly selected dampers, etc., can cause reduced performance, excessive noise and increased mechanical stress. For performance to be as published, the system must provide uniform and stable airflow into the fan.



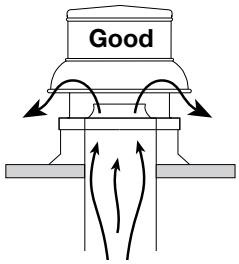
Dampers must open fully. Use motorized dampers in low airflow applications to reduce losses.



Avoid sharp turns or entrance conditions which cause uneven flow. Use turning vanes in elbows to reduce adverse effects.



Provide uniform airflow at fan inlet and through the damper to ensure optimum performance. Curb cap should be three wheel diameters from the radius. Use turning vanes in duct when possible.



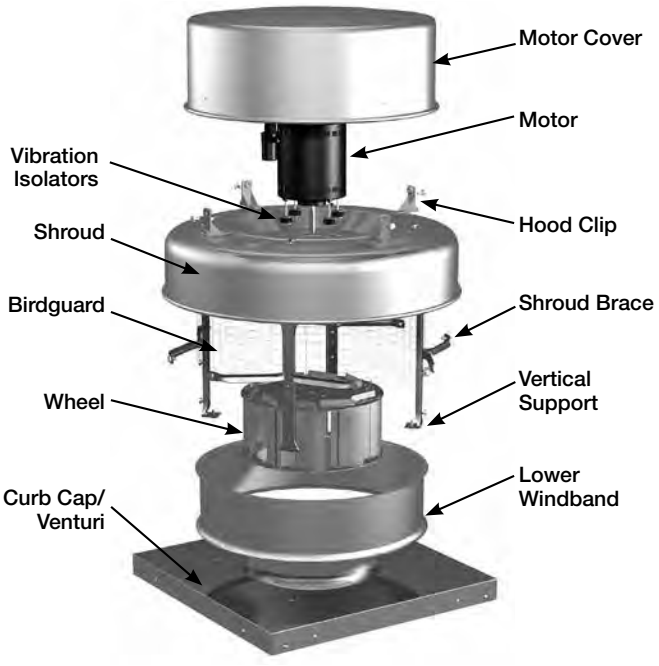
Provide uniform airflow at fan inlet to ensure optimum performance.

Parts List

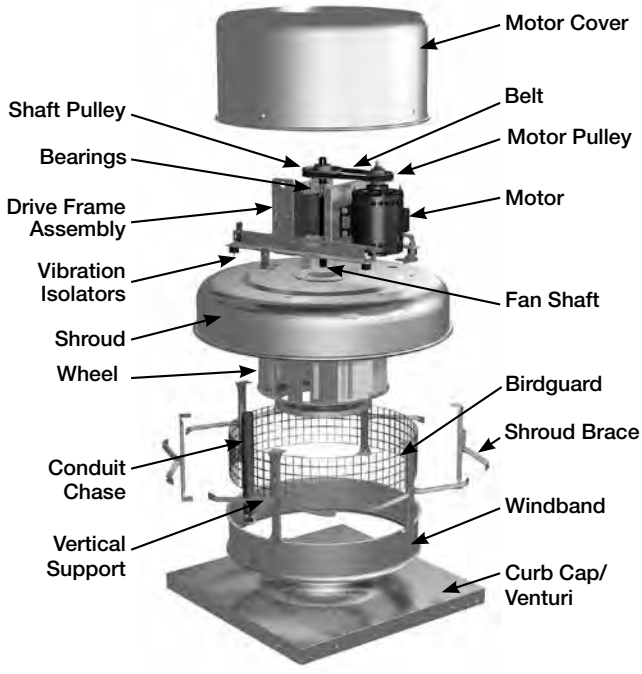
Each fan bears a manufacturer's nameplate with model number and serial number. This information will assist the local representative and the factory in providing service and replacement parts. Before taking any corrective action, make certain unit is not capable of operation during repairs.

CAUTION
A fan manufactured with an explosion resistant motor does not certify the entire unit to be explosion proof. Refer to UL Listing mark for the fans approved usage.
CAUTION
La présence d'un moteur antidéflagrant sur un ventilateur ne garantit pas que tout l'appareil est antidéflagrant. Pour connaître les emplois autorisés de l'appareil, voir son marquage de conformité UL.

Direct Drive



Belt Drive



Troubleshooting

WARNING

Before taking any corrective action, make certain unit is not capable of operation during repairs.

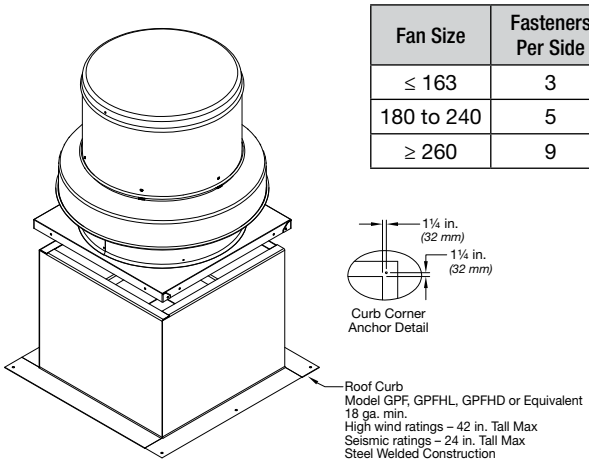
AVERTISSEMENT

Avant d'entreprendre toute action corrective, s'assurer que l'appareil ne pourra pas fonctionner durant les réparations.

PROBLEM	CAUSE	CORRECTIVE ACTION
Excessive noise or vibration	Wheel rubbing inlet	Adjust wheel and/or inlet cone. Tighten wheel hub or bearing collars on shaft.
	V-belt drive	Tighten pulleys on motor/fan shaft. Adjust belt tension. Align pulleys properly, see page 6, Figures 9 and 10. Replace worn belts or pulleys.
	Bearings	Replace defective bearing(s). Lubricate bearings. Tighten collars and fasteners.
	Wheel unbalance	Clean all dirt off wheel. Check wheel balance, rebalance in place if necessary.
	Belts too tight or too loose	Adjust tension, see page 7, Figure 12a-b.
	Wheel improperly aligned and rubbing	Center wheel on inlet, see page 6, Figure 7.
	Loose drive or motor pulleys	Align and tighten. See "Pre-Starting Checks", see page 6 and 7.
	Foreign objects in wheel or housing	Remove objects, check for damage or unbalance.
	Fan base not securely anchored	Secure properly.
	Motor hood loose and rattling	Tighten fasteners to secure the motor hood.
	Defective or loose motor bearings	Replace motor with same frame size, RPM-HP.
High horsepower	Fan	Check rotation of wheel, see page 6, Figure 8. Reduce fan speed.
	Duct system	Resize ductwork. Check proper operation of face and bypass dampers. Check filters and access doors.
Fan does not operate	Electrical supply	Check fuses/circuit breakers. Check for switches off. Check for correct supply voltage.
	Drive	Check for broken belts. Tighten loose pulleys or belts.
	Motor	Ensure motor is correct horsepower and not tripping overload protector.
Motor overloads or overheats	Lubrication	Check for excessive or insufficient grease in the bearing.
	Mechanical	Replace damaged bearing. Relieve excessive belt tension. Align bearings. Check for bent shaft.
	Belt slippage	Adjust tension or replace bad belts, see pages 6 and 7.
	Over/Under line voltage	Contact power company.
	Incorrect wheel rotation	Check motor wiring, see page 5, Figure 4. Confirm wheel rotation, see page 6, Figure 8.
	Wheel RPM too high	Check drives or slow down fan by opening variable pitch pulley on motor shaft.
	Undersized motor	Check motor ratings with catalog speed and air capacity chart.
	Motor wired incorrectly	Check motor wiring to wiring diagram located on fan motor.
Reduced airflow	System resistance too high	Check system: Proper operation of backdraft or control dampers, obstruction in ductwork, clean dirty filters.
	Unit running backwards	Correct as shown on page 6, Figure 8.
	Excessive dirt buildup on wheels	Clean wheel.
	Improper wheel alignment	Center wheel on inlet, see "Pre-Starting Checks" on page 6.
	Dampers closed	Inspect and repair.
	Blocked duct/clogged filter	Clean or replace.
	Belt slippage	Replace and adjust tension.
	Speed too slow	Check for correct drives.

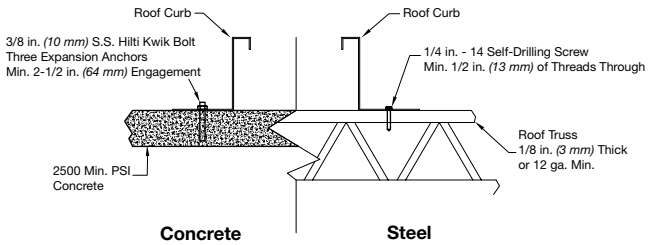
Mounting for Severe Duty Installations

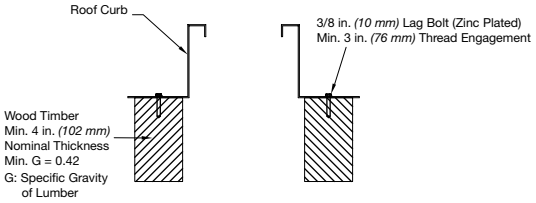
Fan to Curb Mounting: 5/16-inch self-drilling fasteners are to be installed on each side of fan with one fastener 4 inches from each edge and one fastener in the center. Fasteners are to be equally spaced.



Fan Size	Fasteners Per Side
≤ 163	3
180 to 240	5
≥ 260	9

Curb to Deck Mounting: Fasteners need to be located on all four sides of the curb.





Timber Anchoring

	High Wind Ratings					Seismic Ratings		
				Fasteners			Fasteners	
	Fan Size	Curb Cap Size	Self-Drilling Screw Size	Per Side	Total	Fan Size	Per Side	Total
Concrete	≤ 143	17x17 to 22x22 *(432x432 to 559x559 mm)*	3/8"	3	12	060-300	2	8
	> 143	26x26 to 40x40 *(660x660 to 1016x1016 mm)*		3	12	330-540	3	12
Steel	≤ 143	17x17 to 22x22 *(432x432 to 559x559 mm)*	1/4" - 14	3	12	060-300	2	8
	> 143	26x26 to 40x40 *(660x660 to 1016x1016 mm)*		4	16	330-540	3	12
Timber	≤ 143	17x17 to 22x22 *(432x432 to 559x559 mm)*	3/8"	3	12	060-300	2	8
	> 143	26x26 to 40x40 *(660x660 to 1016x1016 mm)*		4	16	330-540	3	12

All dimensions are in inches *(millimeters)*.

NOTE: Installation instructions for seismic ratings are only recommendations.

Final design must be determined by Structural Engineer of Record (SEOR) including requirements for curb construction, mounting of unit to curb and mounting of curb to structure.

Our Commitment

As a result of our commitment to continuous improvement, Greenheck reserves the right to change specifications without notice.

Specific Greenheck product warranties are located on greenheck.com within the product area tabs and in the Library under Warranties.

Greenheck Centrifugal Roof Downblast Exhaust Fans catalog provides additional information describing the equipment, fan performance, available accessories, and specification data.

AMCA Publication 410-96, Safety Practices for Users and Installers of Industrial and Commercial Fans, provides additional safety information. This publication can be obtained from AMCA International, Inc. at www.amca.org.

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Date:

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For: ☐ File ☐ Resubmit ☐ Approval ☐ Other _____

Architect: GC:

Engr: Mech:

Rep:
(Company) (Project Manager)

ARUN024GSS4

Multi V™ S Heat Pump

2.0 Ton Outdoor Unit

LG Life's Good

Performance:

Cooling Mode:

Rated Capacity (Btu/h)	24,000
Power Input[1] (kW)	1.52

Heating Mode:

Rated Capacity (Btu/h)	27,000
Power Input[1] (kW)	2.02

Rated Capacity is based on the following conditions:

Cooling
Indoor: 80°F DB / 67°F WB
Outdoor: 95°F DB

Heating:
Indoor: 70°F DB
Outdoor: 47°F DB / 43°F WB

Electrical:

Power Supply (V/Hz/Ø)	208-230V / 60 / 1
MOP (A)	30
MCA (A)	19.6
Rated Amps (A)	
Compressor (A)	15.3
Fan (A) x Qty.	0.5 x 1

Piping:

Refrigerant Charge (lbs)	4
Liquid Line (in, OD)	Ø3/8 Flare
Vapor Line (in, OD)	Ø5/8 Flare

Standard Features:

- Night Quiet Operation
- Fault Detection and Diagnosis

Optional Accessories:

☐ Low Ambient Baffle Kit - ZLABGP04A (1 required)

☐ Drain Pan Heater - PQSH1200

***Installation of an optional Low Ambient Wind Baffle Kit will allow operation down to -9.9°F in cooling mode.**

Operating Range:

Cooling (°F DB)*	23 - 122
Heating (°F WB)	-4 to +61

Unit Data:

Refrigerant Type	R410A
Refrigerant Control	EEV
Max Number of Indoor Units[2]	4
Sound Pressure[3] dB(A)	50
Net Unit Weight (lbs)	159
Shipping Weight (lbs)	176
Communication Cable[4] (No x AWG)	2 x 18
Heat Exchanger Coating	GoldFin™

Compressor:

Type	DC Inverter Starting
Quantity	1
Oil / Type	PVE/FVC68D

Fan:

Type	Axial Flow Fan
Quantity	1
Motor / Drive	Brushless Digitally Controlled/Direct
Air Flow Rate (CFM)	2,119

Notes:

1. For AHRI rating, refer to the AHRI website http://www.ahridirectory.org.
2. The combination ratio must be between 50 – 130%.
3. Sound Pressure levels are tested in an anechoic chamber under ISO Standard 3745.
4. Communication cable between ODU, IDU(s), and Central Controller must be a minimum of 2-conductor, 18 AWG, twisted, stranded, and shielded. Ensure the communication cable shield is properly grounded to the ODU chassis only. Do not ground the communication cable at any other point. Wiring must comply with all applicable local and national codes.
5. Nominal data is rated 0 ft above sea level, with 25 ft of refrigerant line per indoor unit and a 0 ft level difference between outdoor and indoor units. All capacities are net with a combination ratio between 95-105%.
6. Power wiring cable size must comply with the applicable local and national codes.
7. The voltage tolerance is ± 10%.

ROOF TOP CONDENSER
SCREENED-IN ON ROOF TOP ALL BUILDINGS

Inverter

AHRI CERTIFIED® www.ahridirectory.org
Unitary Small HP
AHRI Standard 210/240
Certification applies only when the complete system is listed with AHRI.

Job Name/Location: _____

ARUN024GSS4

Multi V™ S Heat Pump

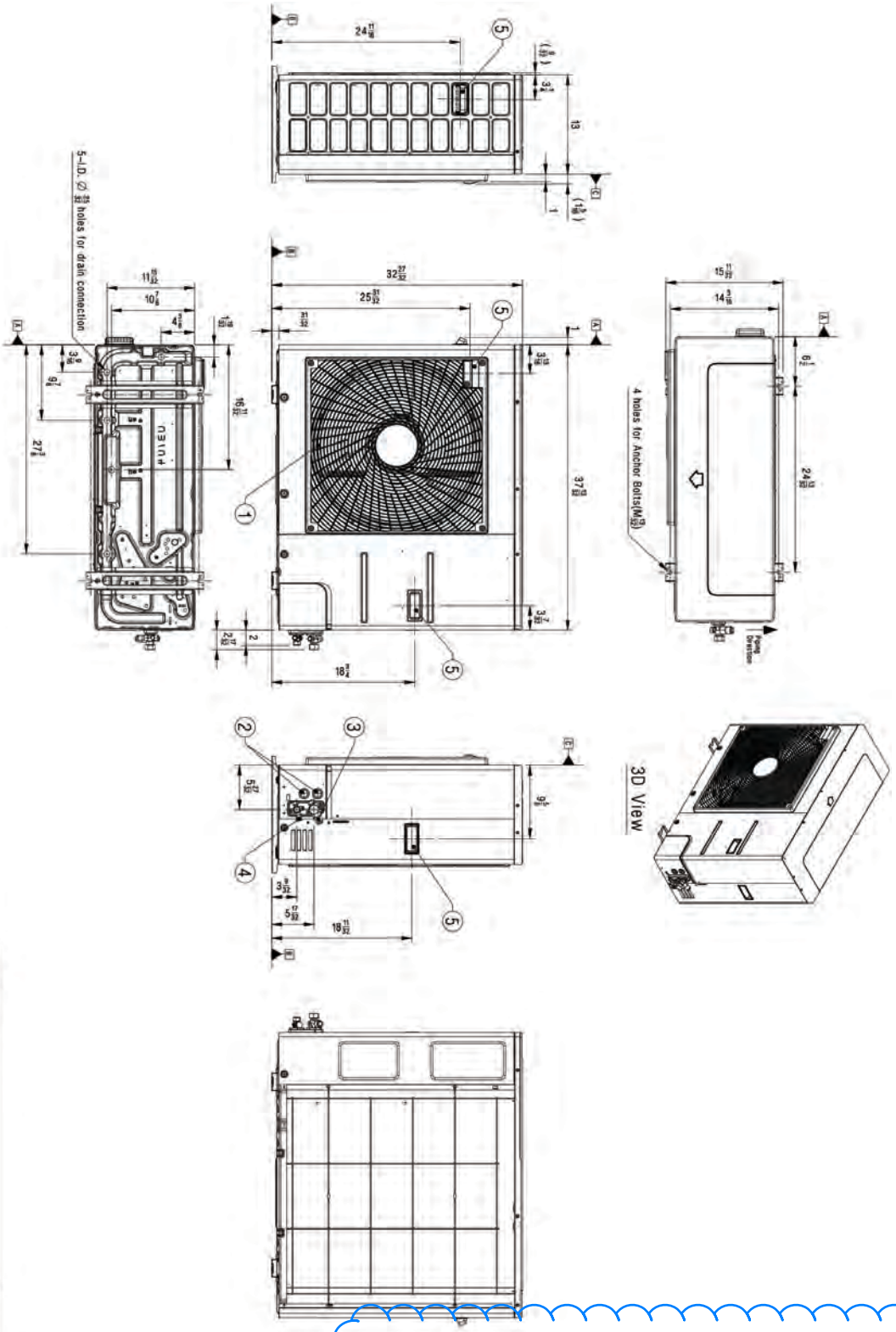
2.0 Ton Outdoor Unit

LG Life's Good

Tag No.: _____

Date: _____

PO No.: _____



Symbols

Piping Direction

Datum line

Note

1. Unit should be installed in compliance with the installation manual in the product box.
2. Unit should be grounded in accordance with the local regulations or applicable national codes.
3. All electrical components and materials to be supplied from the site must comply with the local regulations or international codes.
4. Electric characteristics chapter should be considered for electrical work and design. Especially the power cable and circuit breaker should be selected in accordance with that.

No.	Part Name	Description
1	Air Outlet	–
2	Power and communication cable Hole	–
3	Gas Pipe Connection	Flare joint
4	Liquid Pipe Connection	Flare joint
5	Handle	–

[Unit: inch]

ROOF TOP CONDENSER
SCREENED-IN ON ROOF TOP ALL BUILDINGS

Job Name/Location: _____

ARUN024GSS4

Multi V™ S Heat Pump

2.0 Ton Outdoor Unit

LG Life's Good

Tag No.: _____

Date: _____

PO No.: _____

AHRI Data:

AHRI Certified Reference Number	Indoor Type	AHRI Certified Ratings - Cooling Capacity (95°F)	AHRI Certified Ratings - EER (95°F)	AHRI Certified Ratings - SEER	AHRI Certified Ratings - High Heating Capacity (47°F)	AHRI Certified Ratings - Low Heating Capacity (17°F)	AHRI Certified Ratings - HSPF
10070562	Non-Ducted Indoor Units	24,000	10.70	17.00	27,000	18,000	10.00
10070563	Ducted Indoor Units	24,000	12.20	15.80	27,000	17,000	8.60
10271658	Mixed Ducted and Non-Ducted Indoor Units	24,000	11.45	16.40	27,000	17,500	9.30

ROOF TOP CONDENSER
SCREENED-IN ON ROOF TOP ALL BUILDINGS

Trane Precedent Gas/Electric Packaged Rooftop

Unit Overview - YSC036G3*M***P0B0A1B000A0000000000000000

Application	Unit Size	Supply Fan		External Dimensions (in.)			Weight		EER	IEER/SEER	Elevation
		Airflow	External Static Pressure	Height	Width	Length	Minimum	Maximum			
DX cooling, gas heat	3 Ton (036)	1200 cfm	0.726 in H2O	3.41 ft	3.69 ft	5.82 ft	472.0 lb	747.0 lb	12.0 EER	14.00	

Unit Features

Fresh Air Selection	Low Leak Econ-comp enthalpy 0-100%/BR 3p

Unit Electrical

Voltage/phase/hertz	208-230/60/3
MCA	20.00 A
MOP	30.00 A

ROOF TOP UNIT
SCREENED-IN ON ROOF TOP ALL BUILDINGS

Cooling Section

Entering Dry Bulb	77.80 F	**Capacity**	
Entering Wet Bulb	67.60 F	**Gross Total**	37.50 MBh
Ambient Temp	95.00 F	**Gross Sensible**	25.96 MBh
Leaving Coil Dry Bulb	57.80 F	**Net Total**	35.80 MBh
Leaving Coil Wet Bulb	57.80 F	**Net Sensible**	24.26 MBh
Leaving Unit Dry Bulb	60.08 F	**Fan Motor Heat**	1.70 MBh
Leaving Unit Wet Bulb	58.67 F	**Refrig Charge-circuit 1**	3.2 lb
Refrigeration System Options			
Leaving Dew Point	57.81 F		

Heating Section

Heat Type	Gas Heat
Heating Stages	2
Output Heating Capacity	81.00 MBh
Output Heating Capacity with Fan	82.71 MBh
Heating EAT	60.00 F
Heating LAT	122.70 F
Heating Temp Rise	62.70 F

Fan Section

Indoor Fan Data		**Outdoor Fan Data**	
Type	FC Centrifugal	**Type**	Propeller
Drive Type	Direct	**Fan Quantity**	1
Evap Fan FLA	5.70 A	**Drive Type**	Direct
Indoor Fan Performance		**Outdoor Fan Performance**	
Airflow	1200 cfm	**Condenser Fan FLA**	1.10 A
Design ESP	0.726 in H2O		
Component SP	0.210 in H2O		
Total SP	0.952 in H2O		
Supply Motor Horsepower	0.750 hp		
Indoor Motor Operating Power	0.57 bhp		
Indoor Motor Power	0.42 kW		
Indoor RPM	1061 rpm		
Indoor Fan FLA	1.10 A		

Compressor Section

Power	2.45 kW
Circuit 1 RLA	10.40 A
Circuit 2 RLA	0.00 A

Accessories

Roof curb	yes

Acoustics

Sound Path	63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz
Ducted Discharge	90 dB	73 dB	68 dB	61 dB	59 dB	55 dB	52 dB	45 dB
Ducted Inlet	89 dB	73 dB	62 dB	54 dB	50 dB	47 dB	45 dB	39 dB
Outdoor Noise	79 dB	85 dB	79 dB	79 dB	77 dB	71 dB	67 dB	58 dB

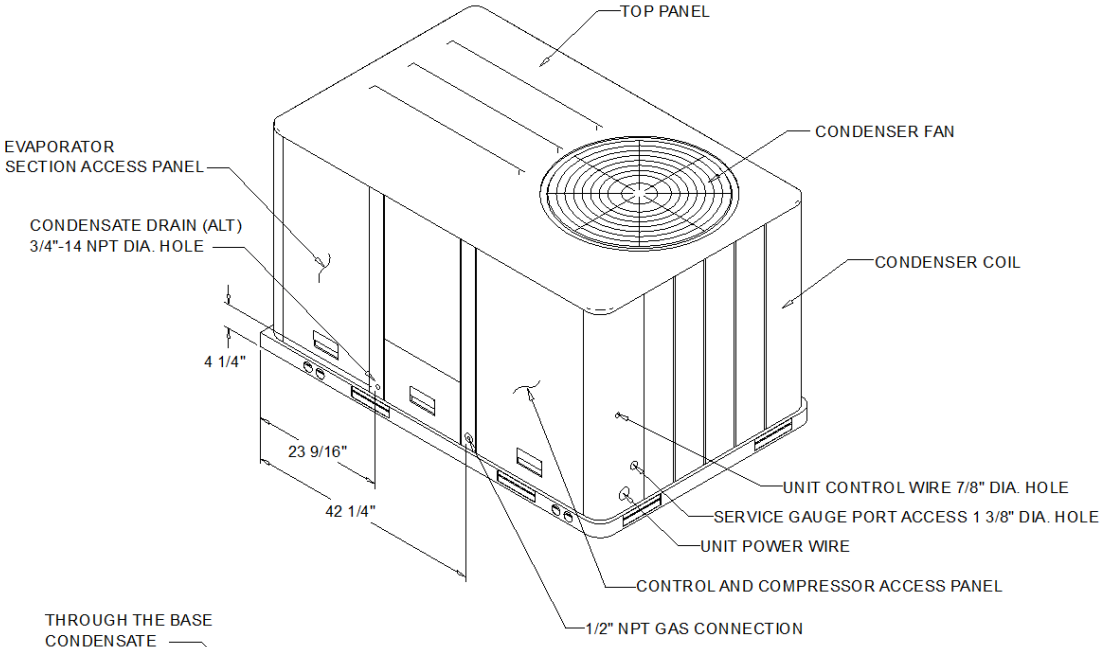
Note:Ducted Inlet and Ducted Discharge Sound Power Levels are in accordance with AHRI 260.

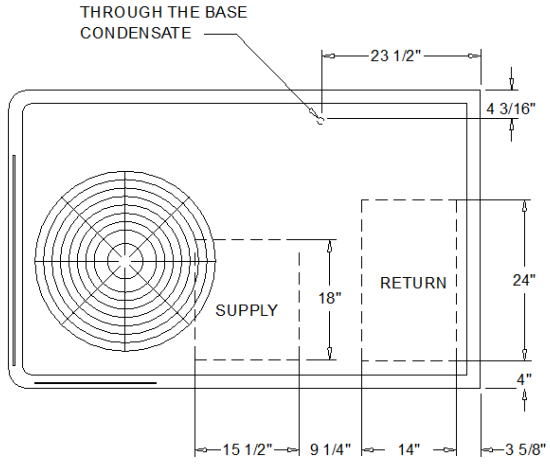
Note:Outdoor Sound Power Levels are in accordance with AHRI 270.

Warranty

Labor (first year)	1st Year Labor warranty

ROOF TOP UNIT
SCREENED-IN ON ROOF TOP ALL BUILDINGS



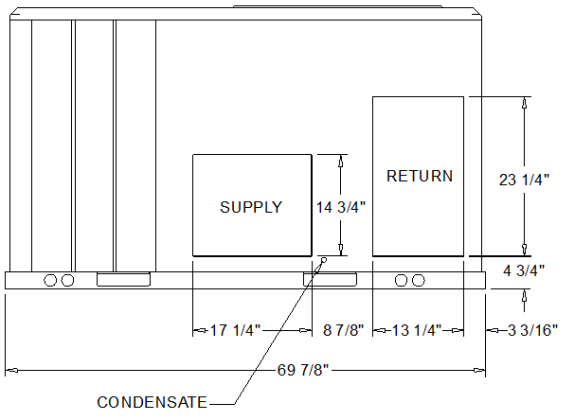


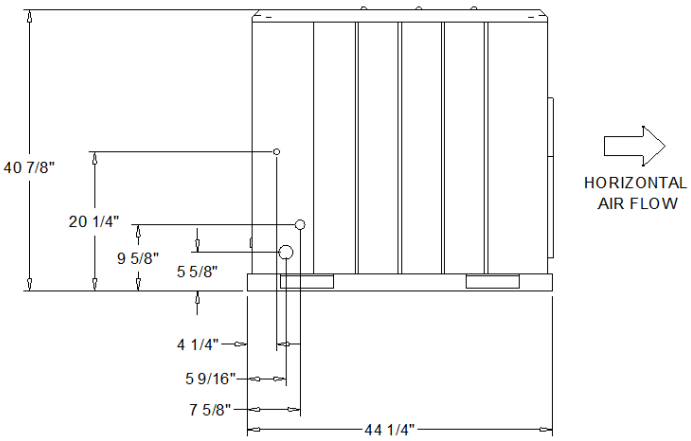
NOTES:
1. THRU -THE -BASE GAS AND ELECTRICAL IS NOT STANDARD ON ALL UNITS.
2. VERIFY WEIGHT, CONNECTION, AND ALL DIMENSION WITH INSTALLER DOCUMENTS BEFORE INSTALLATION

ROOF TOP UNIT
SCREENED-IN ON ROOF TOP ALL BUILDINGS

PLAN VIEW UNIT

DIMENSION DRAWING

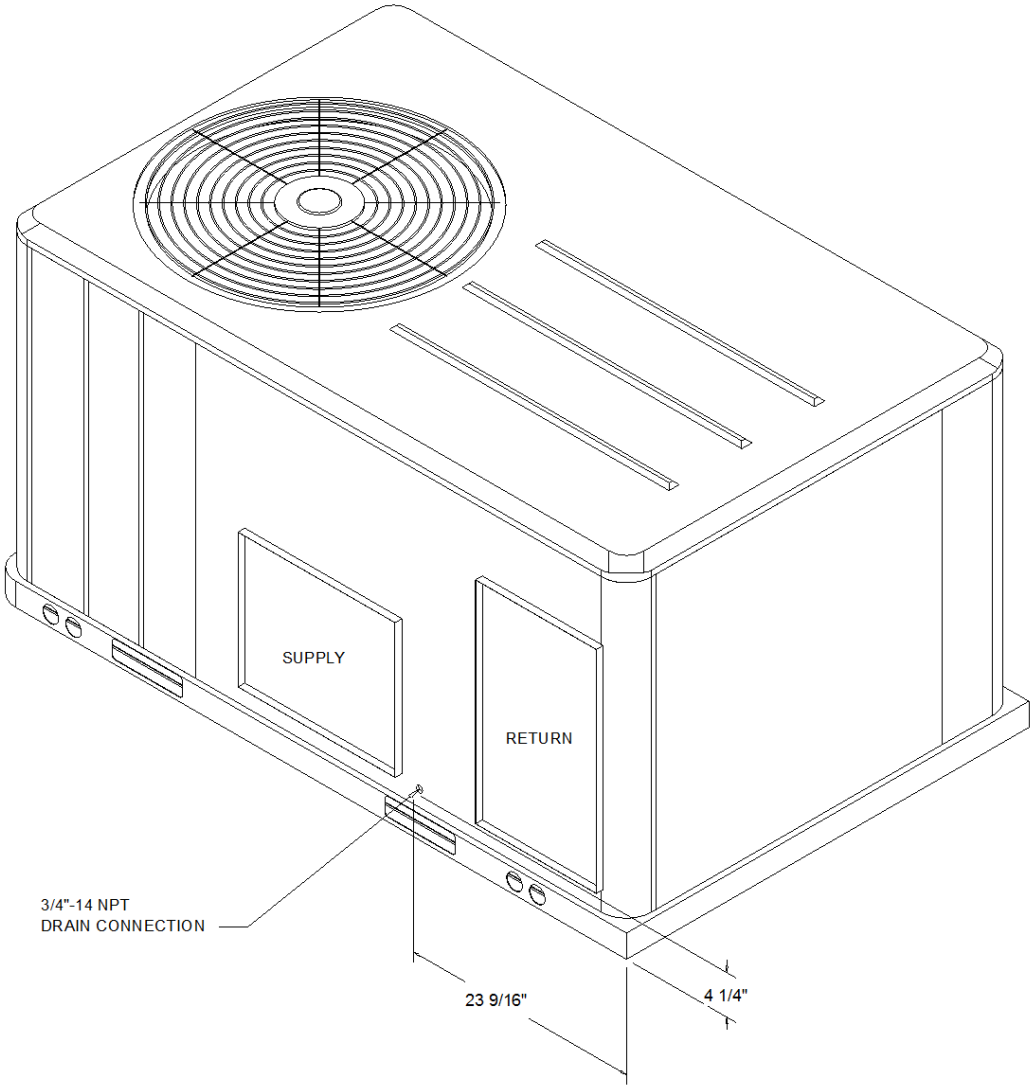




PACKAGED GAS / ELECTRICAL

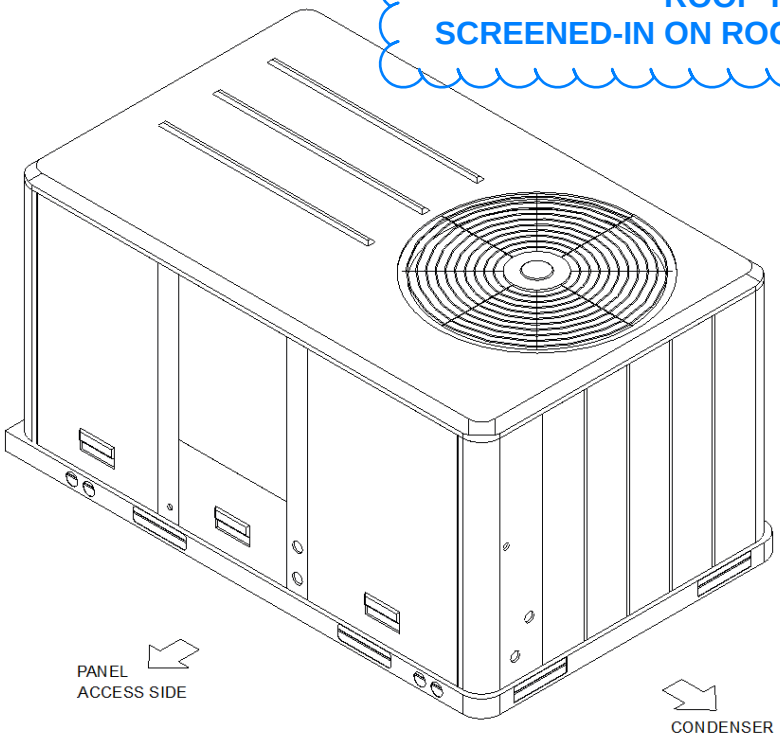
DIMENSION DRAWING

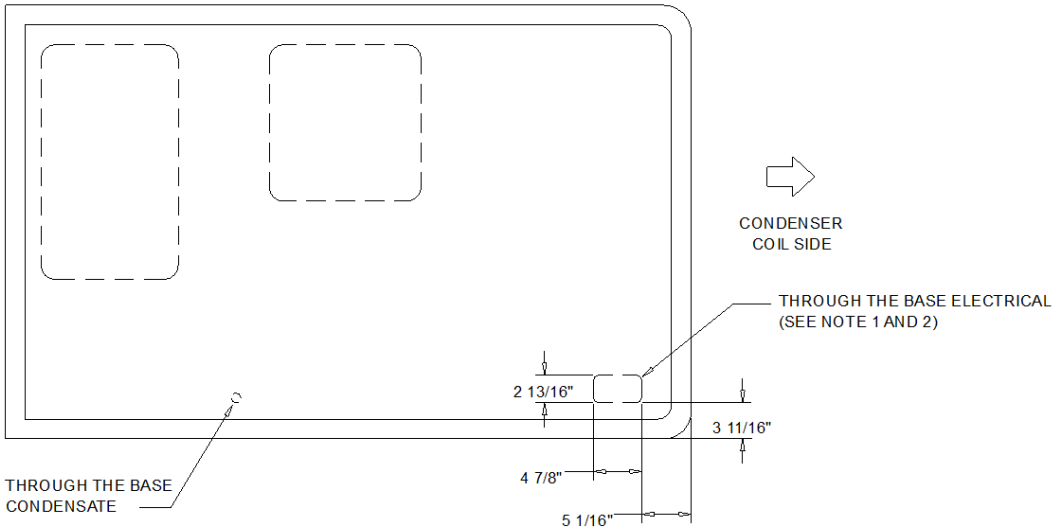
ROOF TOP UNIT
SCREENED-IN ON ROOF TOP ALL BUILDINGS



ISOMETRIC-PACKAGED COOLING

ROOF TOP UNIT
SCREENED-IN ON ROOF TOP ALL BUILDINGS





NOTES:
1. THRU -THE -BASE GAS AND ELECTRICAL IS NOT STANDARD. VERIFY OPTION IN PRODUCT DATA IN THIS DOCUMENT.
2. VERIFY WEIGHT, CONNECTION, OPTION CONFIGURATION AND ALL DIMENSION WITH INSTALLER DOCUMENTS BEFORE INSTALLATION

THRU THE BASE ELECTRICAL

PLAN / ISO VIEW DRAWING

ELECTRICAL / GENERAL DATA

GENERAL (2)(4)(6)

		Oversized Motor	
Model:	YSC036G		
Unit Operating Voltage:	187-253	MCA:	N/A
Unit Primary Voltage:	208	MFS:	N/A
Unit Secondary Voltage	230	MCB:	N/A
Unit Hertz:	60		
Unit Phase:	3		
EER/SEER	12.0/14.0		
Standard Motor		Field Installed Oversized Motor	
MCA:	20.0	MCA:	N/A
MFS:	30.0	MFS:	N/A
MCB:	30.0	MCB:	N/A

HEATING PERFORMANCE

HEATING - GENERAL DATA

Heating Model:	Medium
Heating Input (BTU):	100,000/70,000
Heating Output (BTU):	81,000/56,700
No. Burners:	3
No. Stages	2

Gas Inlet Pressure

Natural Gas (Min/Mix):	4 1/2"/14"
LP (Min/Max)	11"/14"
Gas Pipe Connection Size:	1/2"

INDOOR MOTOR

Standard Motor		Oversized Motor		Field Installed Oversized Motor	
Number:	1	Number:	N/A	Number:	
Horsepower:	0.75	Horsepower:	N/A	Horsepower:	
Motor Speed (RPM):	--	Motor Speed (RPM):	N/A	Motor Speed (RPM):	
Phase	1	Phase	N/A	Phase	
Full Load Amps:	5.7	Full Load Amps:	N/A	Full Load Amps:	
	--		N/A		

COMPRESSOR Circuit 1/2

Number:	1
Horsepower:	2.8
Phase:	3
Rated Load Amps:	10.4
	73.0

OUTDOOR MOTOR

Number:	1
Horsepower:	0.25
Motor Speed (RPM):	1100
Phase:	3
Full Load Amps:	1.1
	3.6

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"x35"x2"

REFRIGERANT (2)

Type

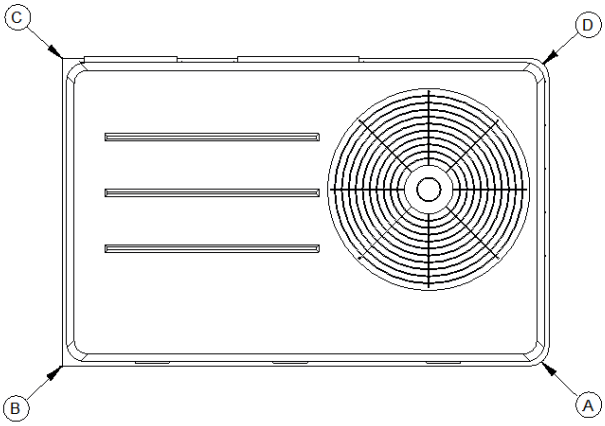
Factory Charge

Circuit #1	3.2 lb
Circuit #2	N/A

NOTES:

1. Maximum (HACR) Circuit Breaker sizing is for installations in the United States only.
2. Refrigerant charge is an approximate value. For a more precise value, see unit nameplate and service instructions.
3. Value does not include Power Exhaust Accessory.
4. Value includes oversized motor.
5. Value does not include Power Exhaust Accessory.
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.

ROOF TOP UNIT
SCREENED-IN ON ROOF TOP ALL BUILDINGS



PACKAGED GAS / ELECTRICAL

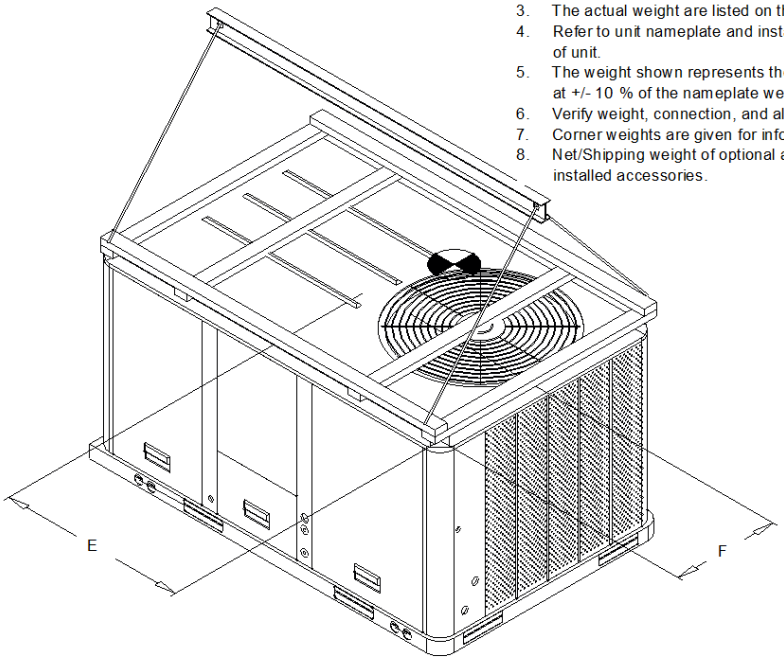
CORNER WEIGHT

INSTALLED ACCESSORIES NET WEIGHT DATA

ACCESSORY	WEIGHTS
ECONOMIZER	70.0 lb
MOTORIZED OUTSIDE AIR DAMPER	
MANUAL OUTSIDE AIR DAMPER	
BAROMETRIC RELIEF	
OVERSIZED MOTOR	
BELT DRIVE MOTOR	
POWER EXHAUST	
THROUGHT THE BASE ELECTRICAL/GAS (FIOPS)	8.0 lb
UNIT MOUNTED CIRCUIT BREAKER (FIOPS)	
UNIT MOUNTED DISCONNECT (FIOPS)	5.0 lb
POWERED CONVENIENCE OUTLET (FIOPS)	38.0 lb
HINGED DOORS (FIOPS)	
HAIL GUARD	
SMOKE DETECTOR, SUPPLY / RETURN	7.0 lb
NOVAR CONTROL	
STAINLESS STEEL HEAT EXCHANGER	
REHEAT	
ROOF CURB	

BASIC UNIT WEIGHTS		CORNER WEIGHTS				CENTER OF GRAVITIY	
SHIPPING	NET	(A)	193.0 lb	(C)	45.0 lb	(E) LENGHT	(F) WIDTH
577.0 lb	472.0 lb	(B)	178.0 lb	(D)	55.0 lb	33"	9"

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



PACKAGED GAS / ELECTRICAL

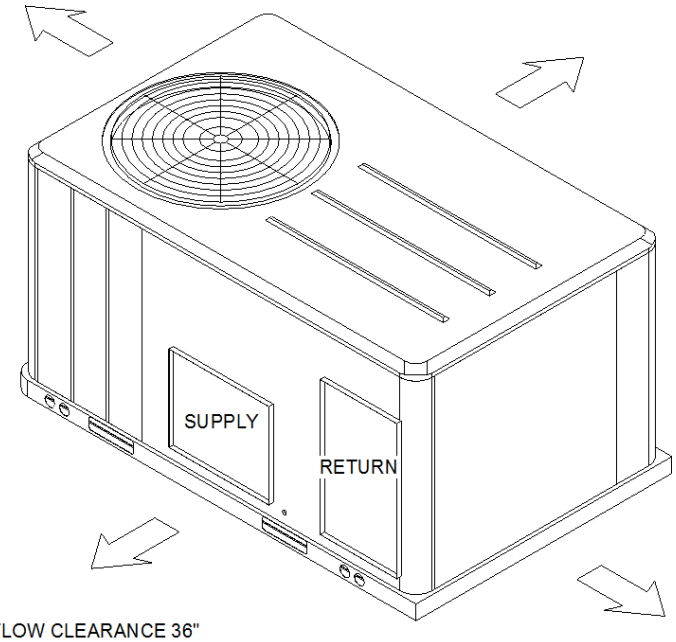
RIGGING AND CENTER OF GRAVITY

ROOF TOP UNIT
SCREENED-IN ON ROOF TOP ALL BUILDINGS

CLEARANCE FROM TOP OF UNIT 72"

CLEARANCE 36"

CLEARANCE 48"



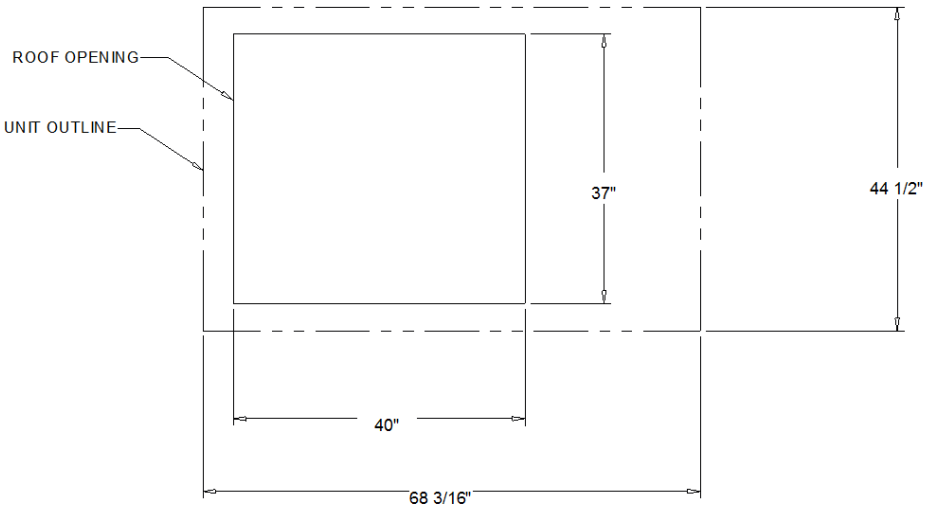
DOWNFLOW CLEARANCE 36"

HORIZONTAL CLEARANCE 18"

CLEARANCE 36"

PACKAGED GAS / ELECTRIC

CLEARANCE

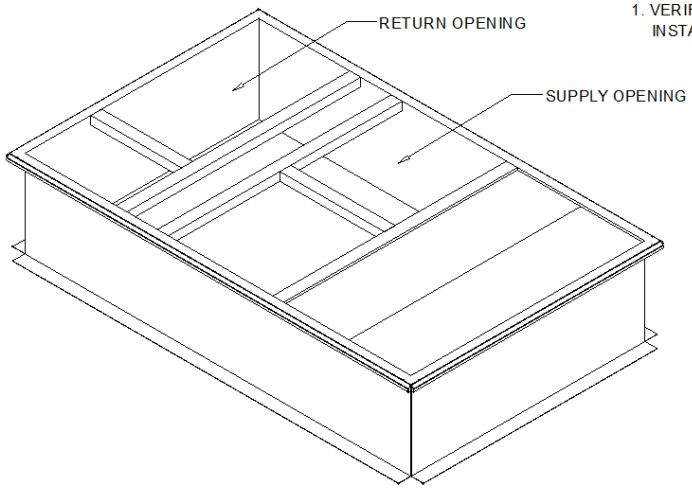


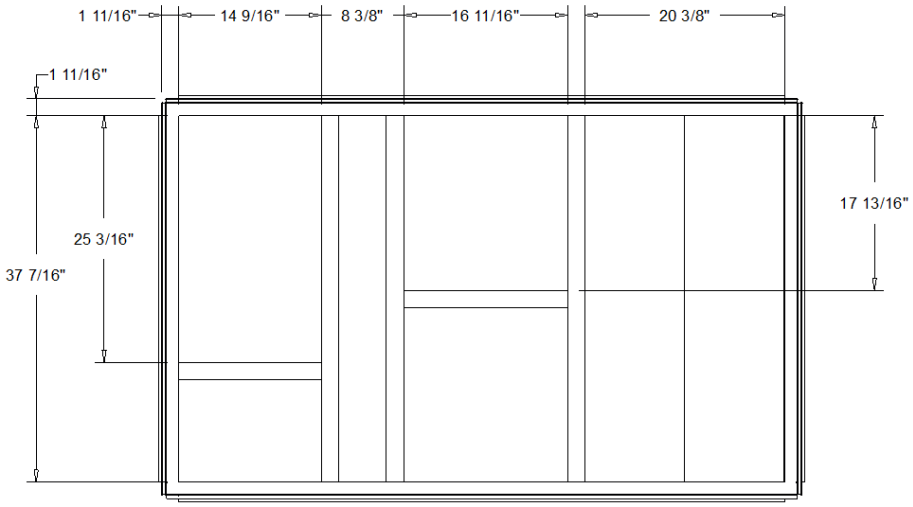
PACKAGED GAS / ELECTRIC

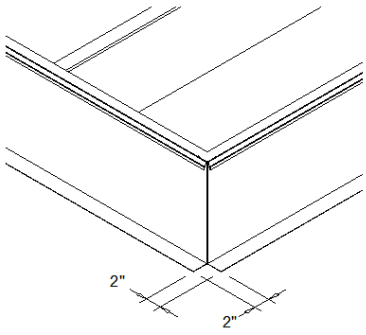
DOWNFLOW TYPICAL ROOF OPENING

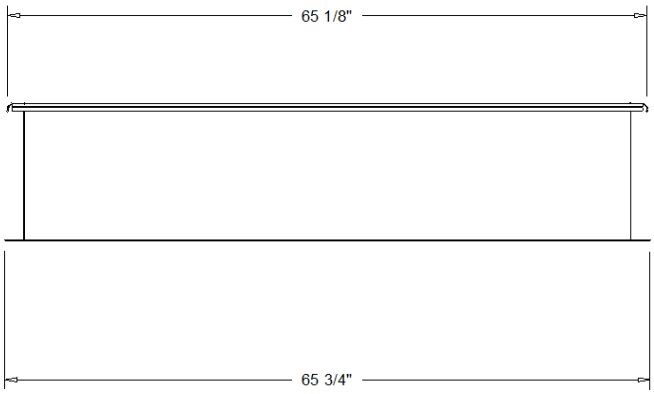
ROOF TOP UNIT
SCREENED-IN ON ROOF TOP ALL BUILDINGS

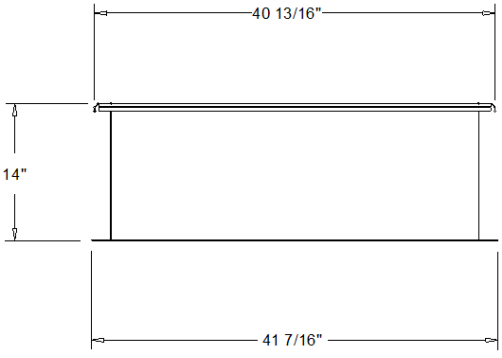
NOTES:
1. VERIFY WEIGHT, CONNECTION, AND ALL DIMENSION WITH INSTALLER DOCUMENTS BEFORE INSTALLATION









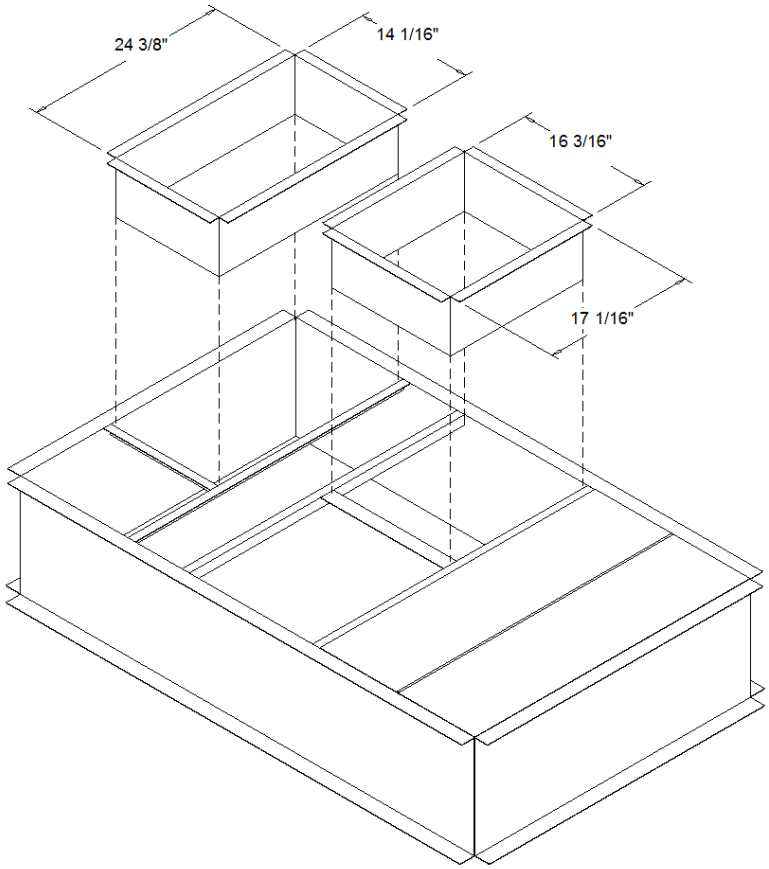


ROOF TOP CURB (BAYCURB042)

ACCESSORY

ROOF TOP UNIT
SCREENED-IN ON ROOF TOP ALL BUILDINGS

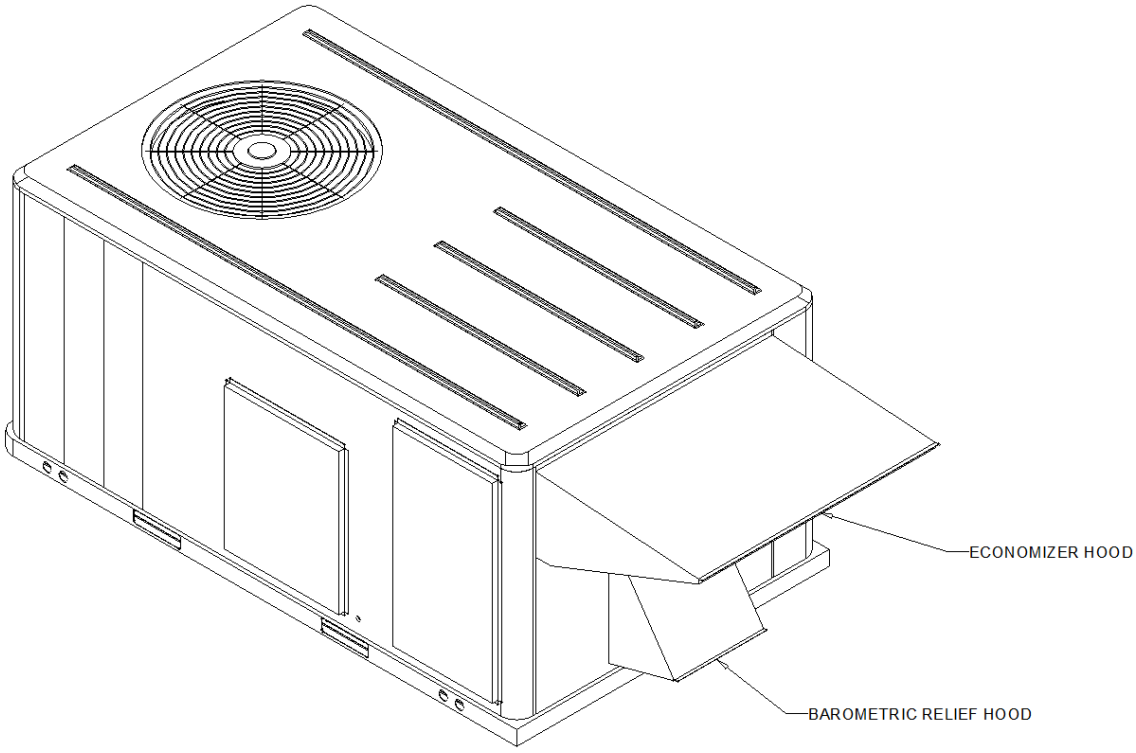
Downflow Duct Connections - Field Fabricated
All Flanges - 1 1/4"



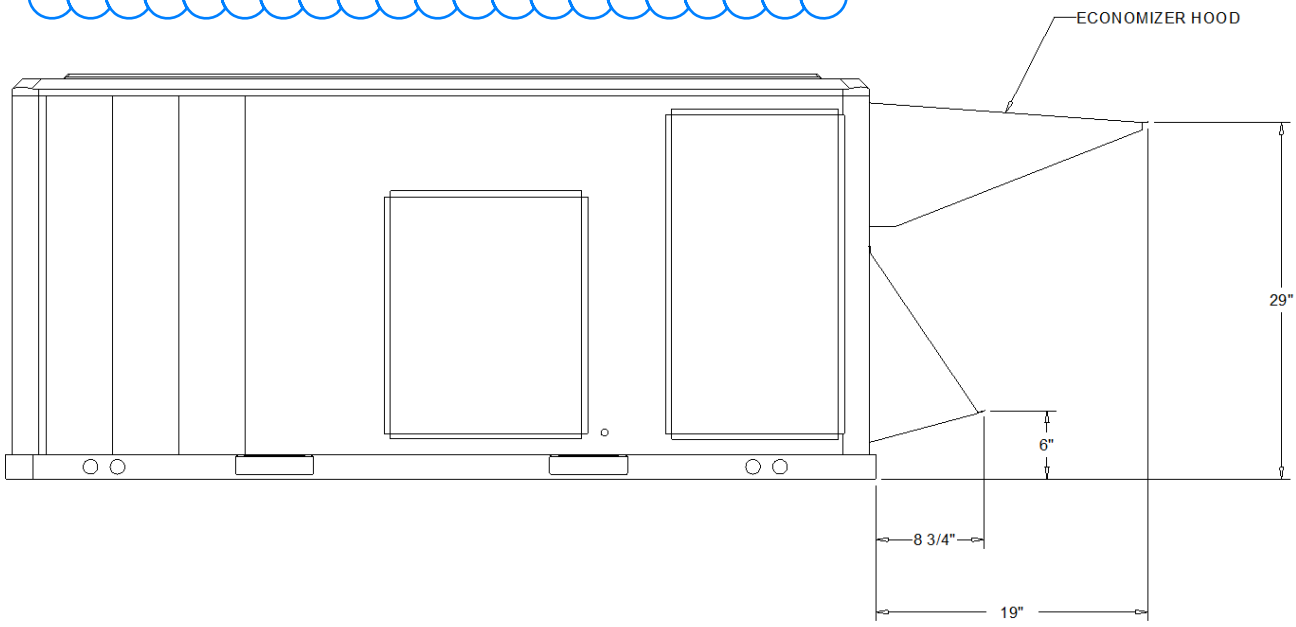
ROOF TOP UNIT
SCREENED-IN ON ROOF TOP ALL BUILDINGS

DUCT CONNECTIONS

ACCESSORY



ROOF TOP UNIT
SCREENED-IN ON ROOF TOP ALL BUILDINGS



LOW LEAK ECONOMIZER HOOD
ACCESSORY

Trane Precedent Gas/Electric Packaged Rooftop

Unit Overview - YSC120H3*H***P7B0A1B000A0000000000000000

Application	Unit Size	Supply Fan		External Dimensions (in.)			Weight		EER	IEER/SEER	Elevation
		Airflow	External Static Pressure	Height	Width	Length	Minimum	Maximum			
DX cooling, gas heat	10 Ton	3850 cfm	1.080 in H2O	3.91 ft	4.44 ft	7.39 ft	1058.0 lb	1384.0 lb	11.2 EER	12.70	

Unit Features

Fresh Air Selection	Low Leak Econ-comp enthalpy 0-100%/BR 3p
SupplyFan/Drive/ MotorType	Multi speed fan

Unit Electrical

Voltage/phase/hertz	208-230/60/3
MCA	49.00 A
MOP	60.00 A

ROOF TOP UNIT
SCREENED-IN ON ROOF TOP ALL BUILDINGS

Cooling Section

Entering Dry Bulb	77.40 F	**Capacity**	
Entering Wet Bulb	67.70 F	**Gross Total**	116.81 MBh
Ambient Temp	95.00 F	**Gross Sensible**	80.26 MBh
Leaving Coil Dry Bulb	58.10 F	**Net Total**	109.28 MBh
Leaving Coil Wet Bulb	58.09 F	**Net Sensible**	72.72 MBh
Leaving Unit Dry Bulb	60.20 F	**Fan Motor Heat**	7.53 MBh
Leaving Unit Wet Bulb	58.88 F	**Refrig Charge-circuit 1**	5.6 lb
Refrigeration System Options		**Refrig Charge-circuit 2**	4.4 lb
Leaving Dew Point	58.08 F		

Heating Section

Heat Type	Gas Heat
Heating Stages	2
Output Heating Capacity	200.00 MBh
Output Heating Capacity with Fan	207.53 MBh
Heating EAT	61.90 F
Heating LAT	110.20 F
Heating Temp Rise	48.30 F

Fan Section

Indoor Fan Data		**Outdoor Fan Data**	
Type	BC Plenum	**Type**	Propeller
Drive Type	Variable Direct	**Fan Quantity**	1
Evap Fan FLA	7.30 A	**Drive Type**	Direct
Indoor Fan Performance		**Outdoor Fan Performance**	
Airflow	3850 cfm	**Outdoor Motor Power**	0.65 kW
Design ESP	1.080 in H2O	**Condenser Fan FLA**	3.30 A
Component SP	0.731 in H2O		
Total SP	1.842 in H2O		
Supply Motor Horsepower	2.750 hp		
Indoor Motor Operating Power	2.65 bhp		
Indoor Motor Power	1.97 kW		
Indoor RPM	1594 rpm		
Indoor Fan FLA	3.30 A		

Compressor Section

Power	8.55 kW
Circuit 1 RLA	19.60 A
Circuit 2 RLA	13.10 A

Accessories

Roof curb	yes

Acoustics

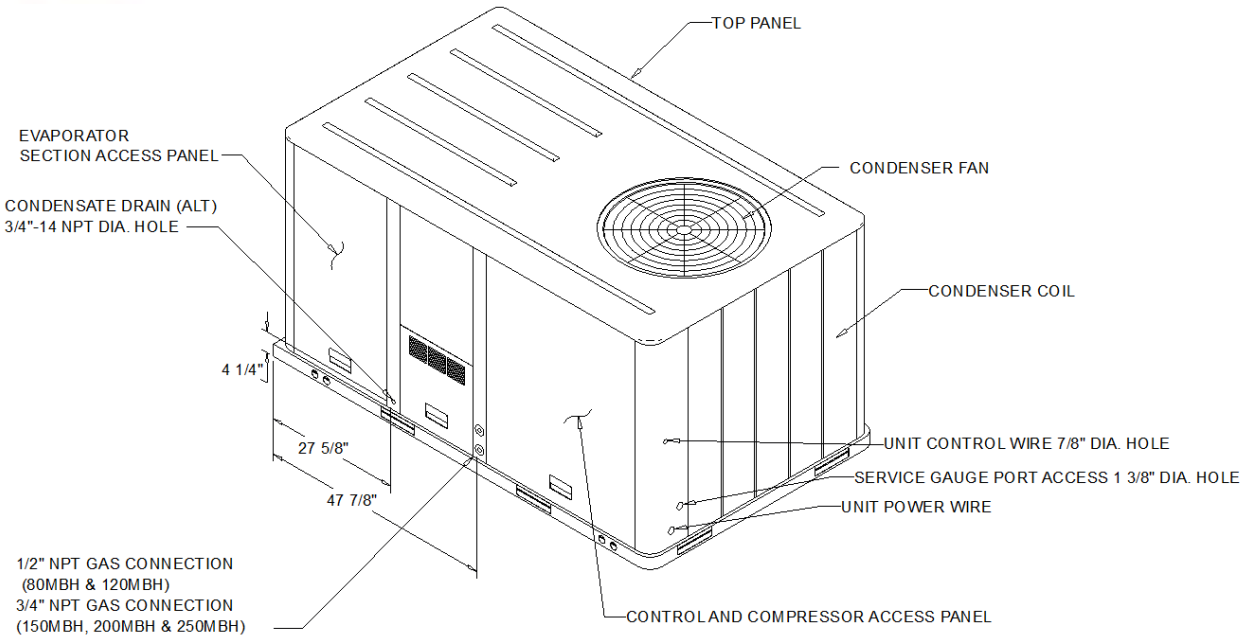
Sound Path	63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz
Ducted Discharge	85 dB	87 dB	85 dB	79 dB	75 dB	71 dB	71 dB	65 dB
Ducted Inlet	83 dB	79 dB	83 dB	68 dB	60 dB	63 dB	64 dB	54 dB
Outdoor Noise	91 dB	86 dB	90 dB	86 dB	82 dB	78 dB	73 dB	67 dB

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.

Warranty

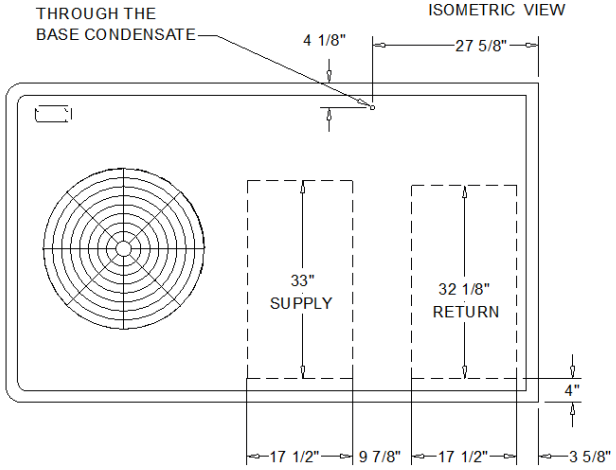
Labor (first year)	1st Year Labor warranty

ROOF TOP UNIT
SCREENED-IN ON ROOF TOP ALL BUILDINGS



PACKAGED GAS / ELECTRICAL

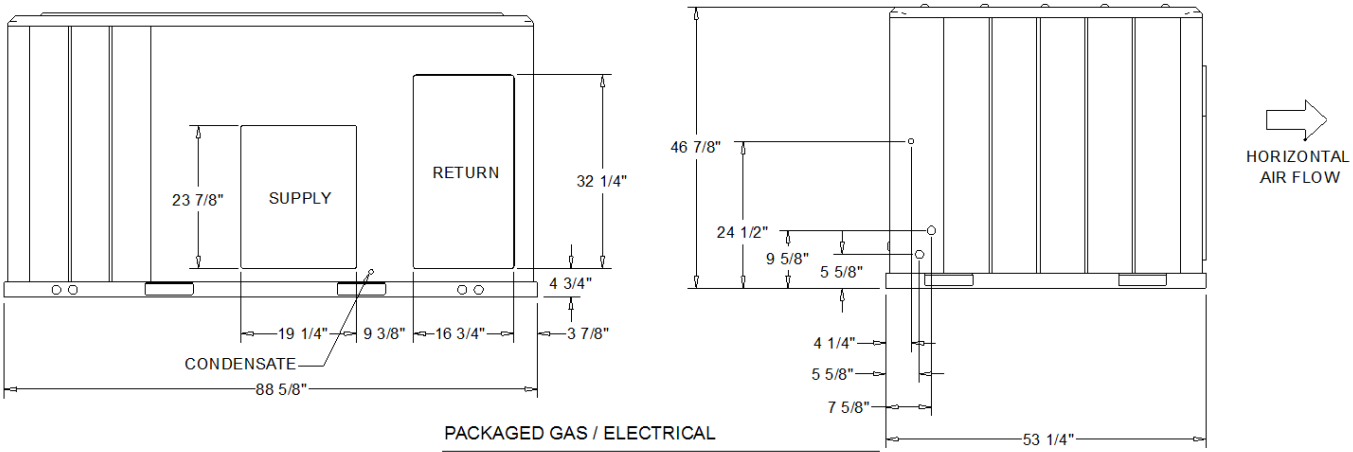
ISOMETRIC VIEW



NOTES:
1. THRU -THE -BASE ELECTRICAL IS NOT STANDARD ON ALL UNITS.
2. VERIFY ALL DIMENSIONS WITH INSTALLER DOCUMENTS BEFORE INSTALLATION.

PLAN VIEW UNIT

DIMENSION DRAWING



PACKAGED GAS / ELECTRICAL

DIMENSION DRAWING

ROOF TOP UNIT
SCREENED-IN ON ROOF TOP ALL BUILDINGS

ELECTRICAL / GENERAL DATA

GENERAL (2)(4)(6)

		Oversized Motor	
Model:	YSC120H	MCA:	N/A
Unit Operating Voltage:	187-253	MFS:	N/A
Unit Primary Voltage:	208	MCB:	N/A
Unit Secondary Voltage	230		
Unit Hertz:	60		
Unit Phase:	3		
EER	11.3		
Standard Motor		Field Installed Oversized Motor	
MCA:	49.0	MCA:	N/A
MFS:	60.0	MFS:	N/A
MCB:	60.0	MCB:	N/A

HEATING PERFORMANCE

HEATING - GENERAL DATA

Heating Model:	High
Heating Input (BTU):	235000 / 164500
Heating Output (BTU):	188000 / 131000
No. Burners:	5
No. Stages	2

Gas Inlet Pressure

Natural Gas (Min/Mix):	4 1/2"/14"
LP (Min/Max)	11"/14"
Gas Pipe Connection Size:	3/4"

INDOOR MOTOR

Standard Motor		Oversized Motor		Field Installed Oversized Motor	
Number:		Number:	N/A	Number:	
Horsepower:		Horsepower:	N/A	Horsepower:	
Motor Speed (RPM):		Motor Speed (RPM):	N/A	Motor Speed (RPM):	
Phase		Phase	N/A	Phase	
Full Load Amps:		Full Load Amps:	N/A	Full Load Amps:	
			N/A		
			N/A		

COMPRESSOR Circuit 1/2

Number:	2
Horsepower:	4.8/3.7
Phase:	3
Rated Load Amps:	19.6 / 13.1
	136.0/83.1

OUTDOOR MOTOR

Number:	1
Horsepower:	0.75
Motor Speed (RPM):	1100
Phase:	1
Full Load Amps:	3.3
	12.3

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	4
Recommended	20"x25"x2"

REFRIGERANT (2)

Type

Factory Charge

Circuit #1	5.6 lb
Circuit #2	4.4 lb

NOTES:

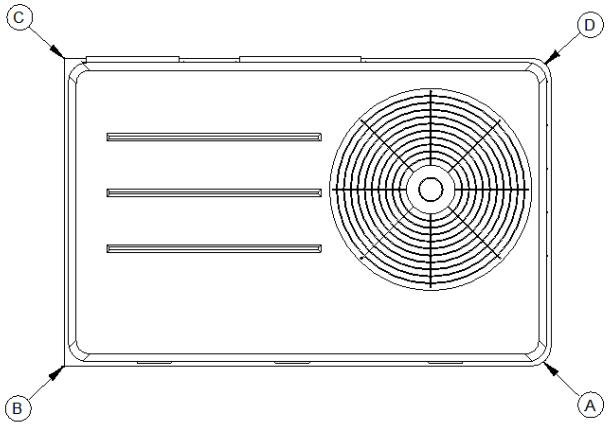
1. Maximum (HACR) Circuit Breaker sizing is for installations in the United States only.
2. Refrigerant charge is an approximate value. For a more precise value, see unit nameplate and service instructions.
3. Value does not include Power Exhaust Accessory.
4. Value includes oversized motor.
5. Value does not include Power Exhaust Accessory.
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.

ROOF TOP UNIT
SCREENED-IN ON ROOF TOP ALL BUILDINGS

INSTALLED ACCESSORIES NET WEIGHT DATA

ACCESSORY	WEIGHTS
ECONOMIZER	91.0 lb
MOTORIZED OUTSIDE AIR DAMPER	
MANUAL OUTSIDE AIR DAMPER	
BAROMETRIC RELIEF	
OVERSIZED MOTOR	
BELT DRIVE MOTOR	
POWER EXHAUST	
THROUGHT THE BASE ELECTRICAL/GAS (FIOPS)	13.0 lb
UNIT MOUNTED CIRCUIT BREAKER (FIOPS)	
UNIT MOUNTED DISCONNECT (FIOPS)	5.0 lb
POWERED CONVENIENCE OUTLET (FIOPS)	
HINGED DOORS (FIOPS)	
HAIL GUARD	
SMOKE DETECTOR, SUPPLY / RETURN	7.0 lb
NOVAR CONTROL	
STAINLESS STEEL HEAT EXCHANGER	
REHEAT	
ROOF CURB	78.0 lb

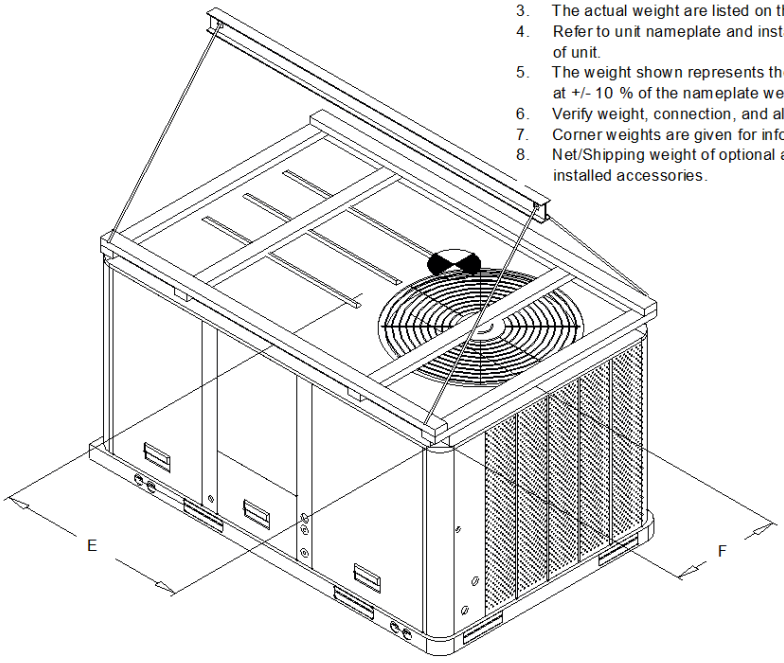
BASIC UNIT WEIGHTS		CORNER WEIGHTS				CENTER OF GRAVITIY	
SHIPPING	NET	(A)	345.0 lb	(C)	258.0 lb	(E) LENGHT	(F) WIDTH
1156.0 lb	1058.0 lb	(B)	242.0 lb	(D)	213.0 lb	41"	23"



PACKAGED GAS / ELECTRICAL

CORNER WEIGHT

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

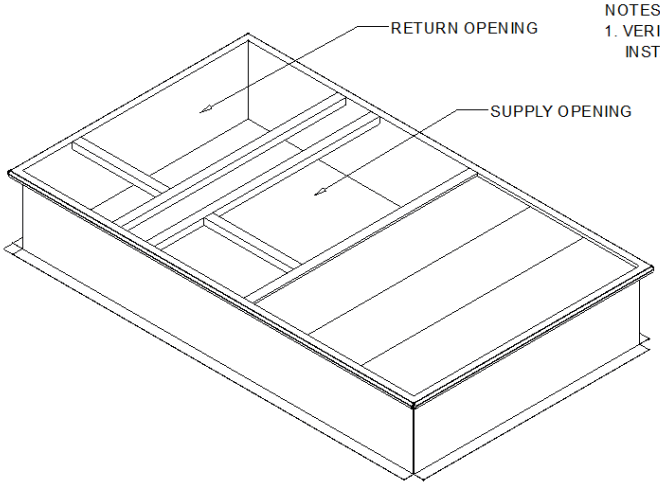


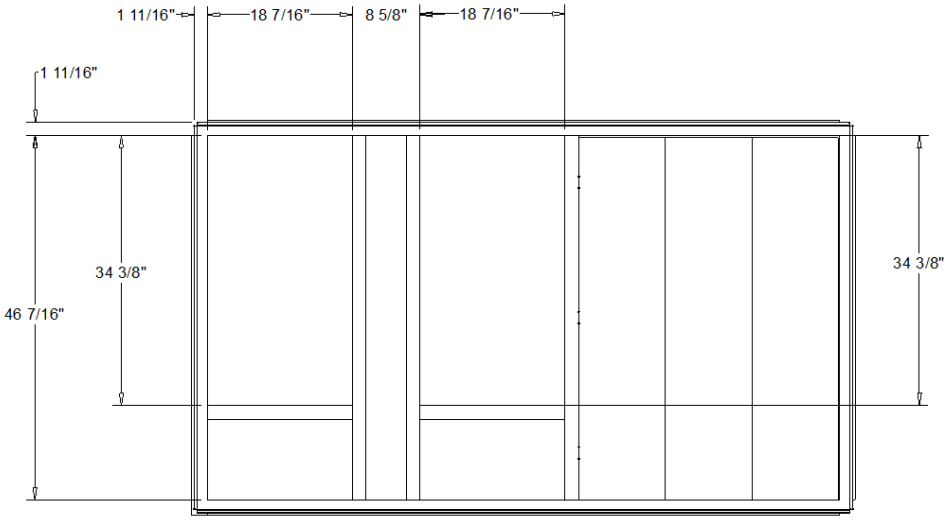
PACKAGED GAS / ELECTRICAL

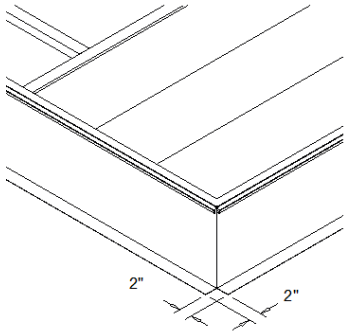
RIGGING AND CENTER OF GRAVITY

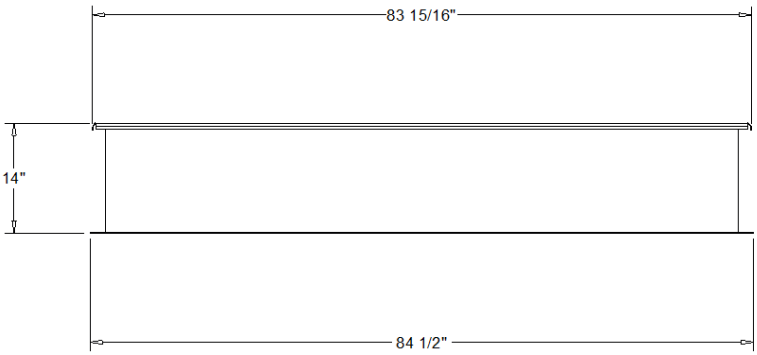
ROOF TOP UNIT
SCREENED-IN ON ROOF TOP ALL BUILDINGS

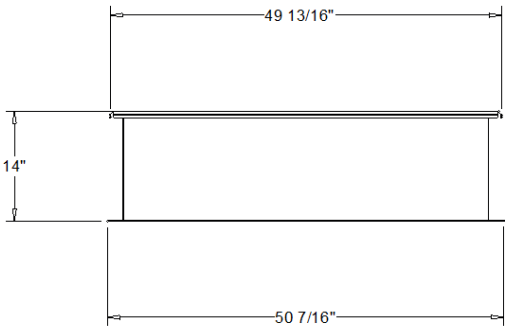
NOTES:
1. VERIFY WEIGHT, CONNECTION, AND ALL DIMENSION WITH INSTALLER DOCUMENTS BEFORE INSTALLATION









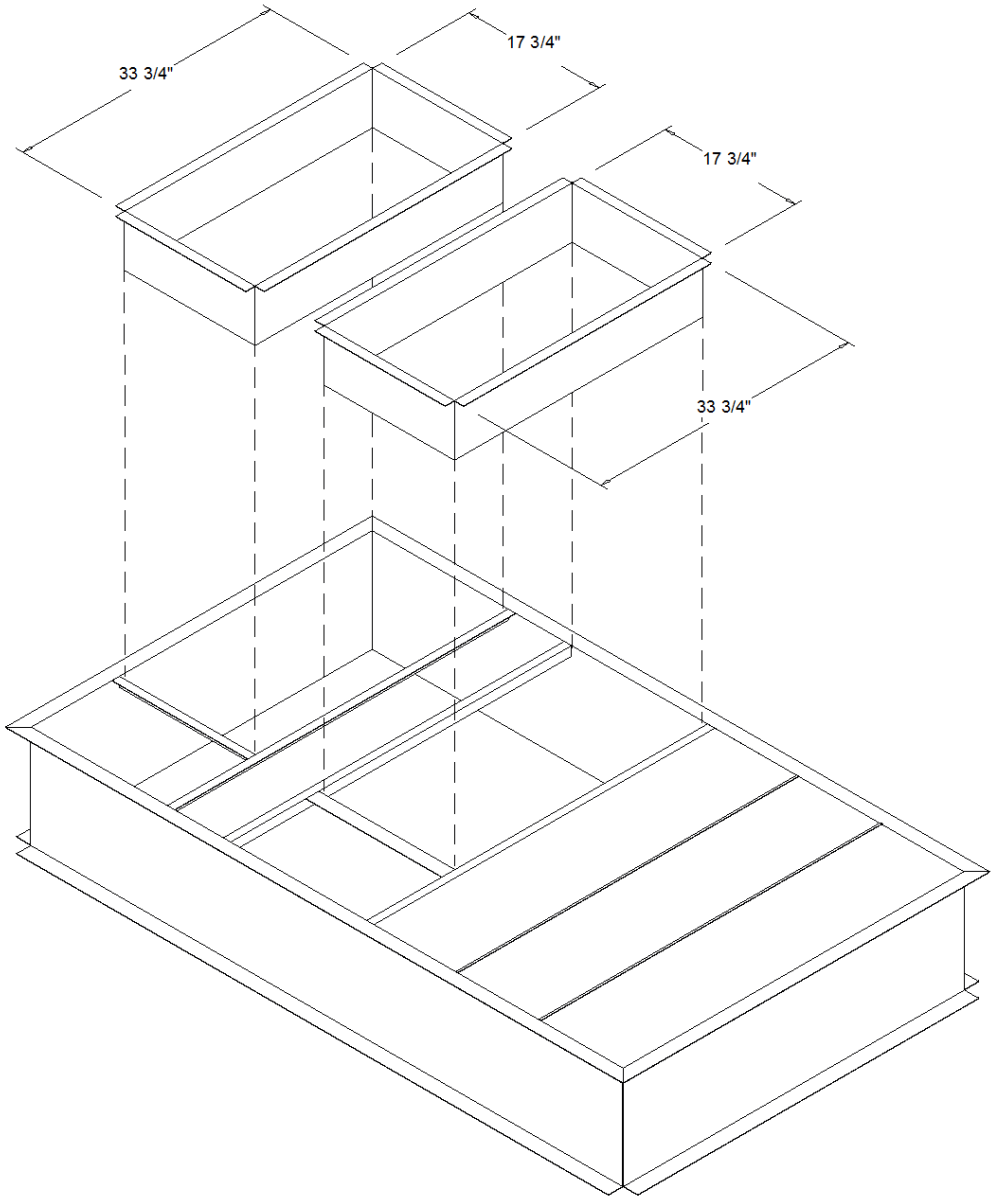


ROOF TOP CURB (BAYCURB043)

ACCESSORY

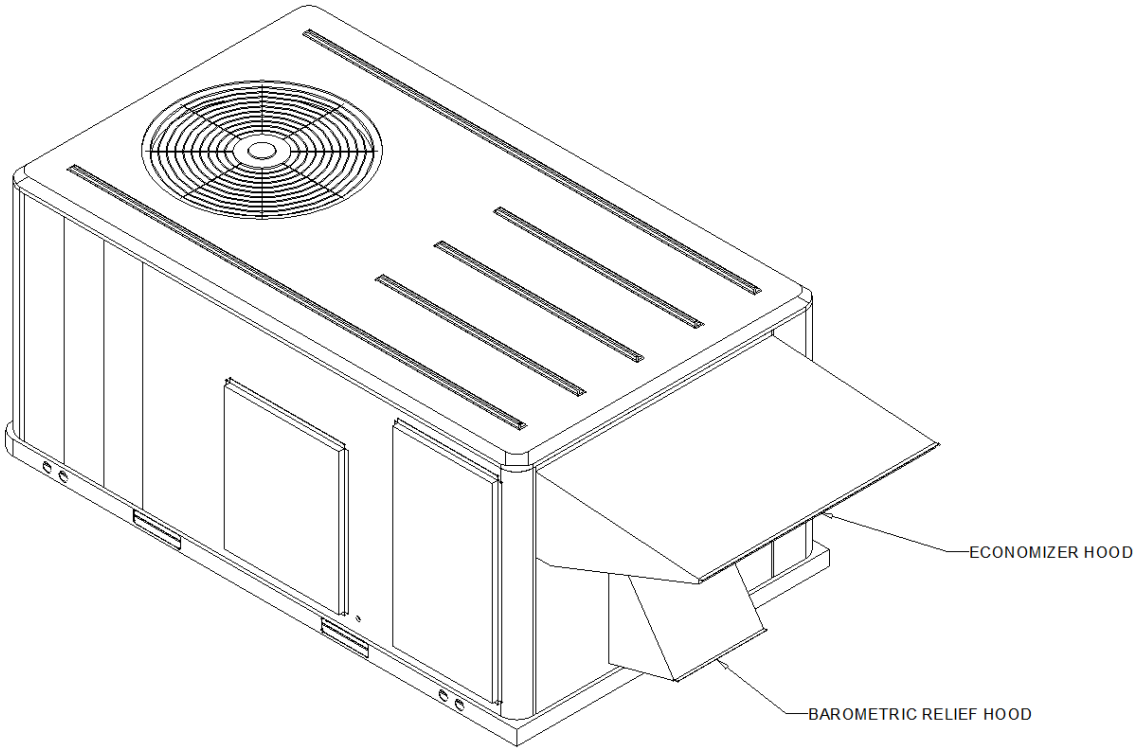
ROOF TOP UNIT
SCREENED-IN ON ROOF TOP ALL BUILDINGS

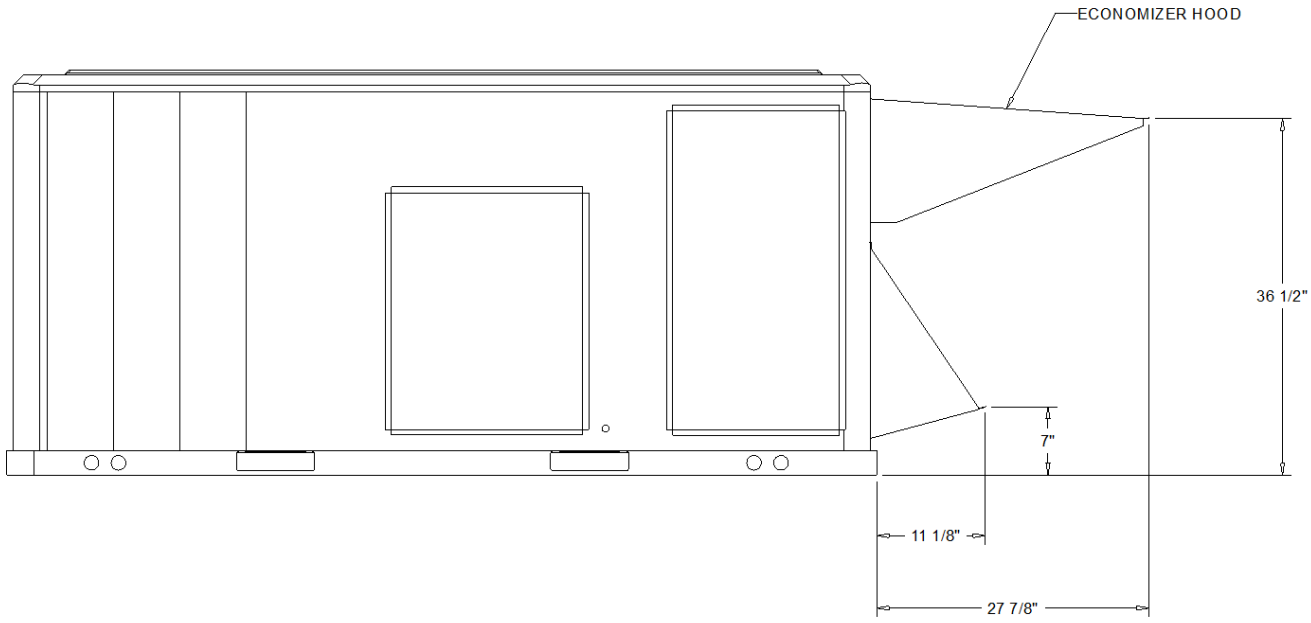
Downflow Duct Connections - Field Fabricated
All Flanges - 1 1/4"



ROOF TOP UNIT
SCREENED-IN ON ROOF TOP ALL BUILDINGS

ACCESSORY - DUCT CONNECTIONS





LOW LEAK ECONOMIZER HOOD
ACCESSORY

ROOF TOP UNIT
SCREENED-IN ON ROOF TOP ALL BUILDINGS

GREENHECK
Building Value in Air.

Document 471321
Model FGI/FGR Fabra Hood
Form B - Single Section with Birdscreen
Throat length less than or equal to 72 inches

Assembly Instructions

Please read and save these instructions for future reference. Read carefully before attempting to assemble, install, operate or maintain the product described. Protect yourself and others by observing all safety information. Failure to comply with these instructions will result in voiding of the product warranty and may result in personal injury and/or property damage.

Standard Assembly

IMPORTANT: For high wind rated hoods, follow assembly instructions starting on page 5.

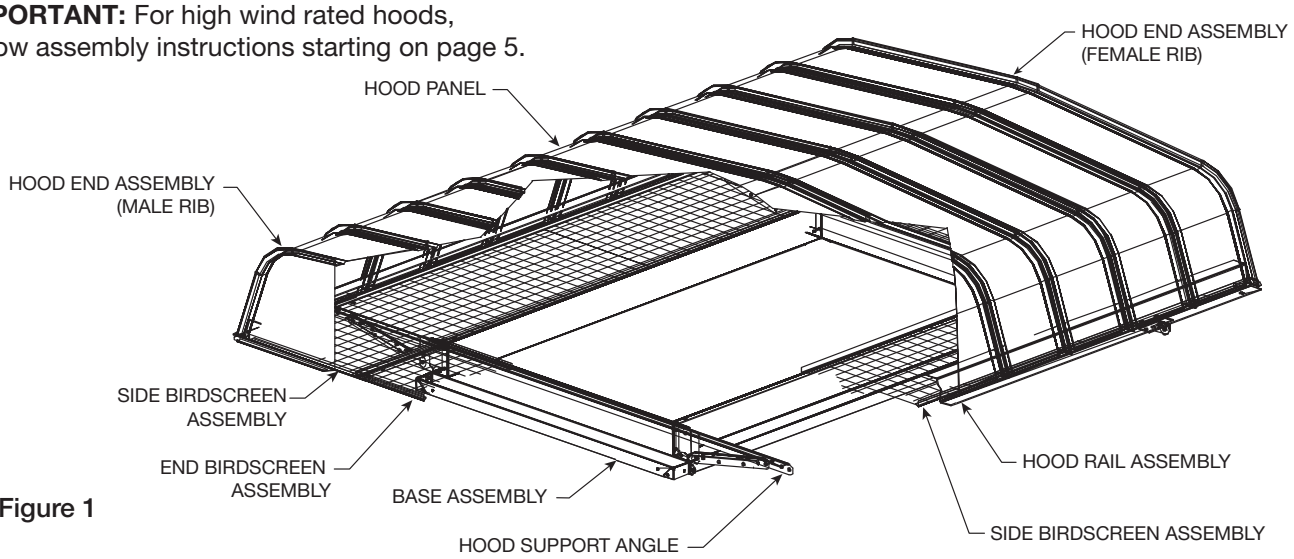


Figure 1

Step 1 – Open crates and separate parts

Open the shipping crates and separate the parts according to the size of the unit, refer to Figure 1.

Step 2 – Place BASE ENDS and BASE SIDES

Place the two base ends and the two base sides in their approximate relationship to each other, see Figure 2. Fasten together using three 1/4-20 fasteners per corner for 5 inch high base and four 1/4-20 fasteners per corner for 12 inch high base.

NOTE: Fasteners should be hand tightened only until Step 4.

On some units where the difference between the hood width and throat width is greater than 32 inches, a reinforcing plate is required in the corners of the base, refer to Figure 2, Detail A.

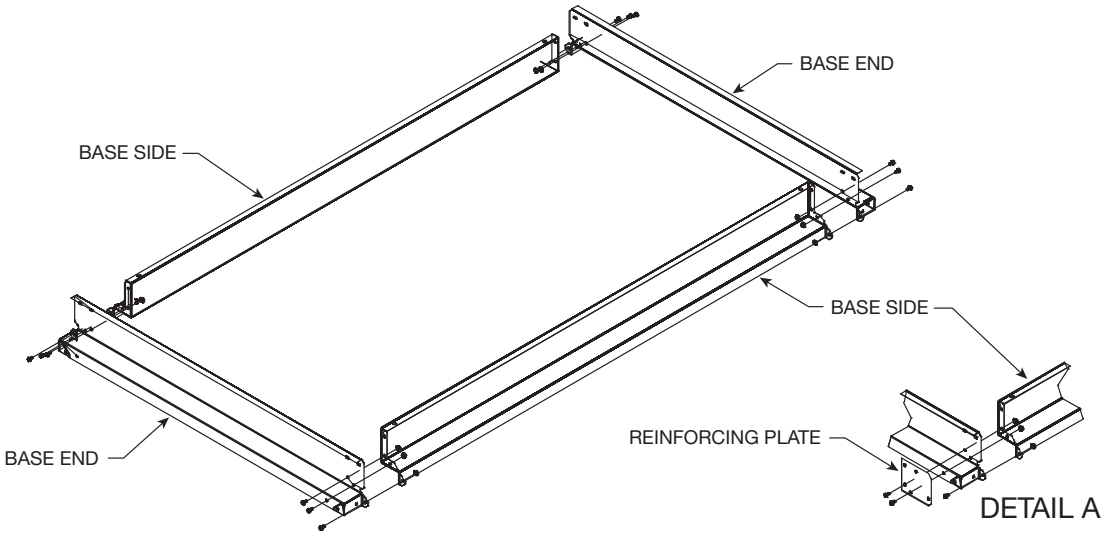


Figure 2

Step 3 – Attach HOOD BASE ENDS to HOOD BASE SIDES

Attach the hood support angle to the base assembly, using four 1/4-20 fasteners per angle, see Figure 3, Detail B.

On some units, two diagonal braces come pre-attached to the hood support angle. Fasten the loose end of the diagonal braces to the base assembly, using one 1/4-20 fastener per diagonal brace. See Figure 3, Detail C.

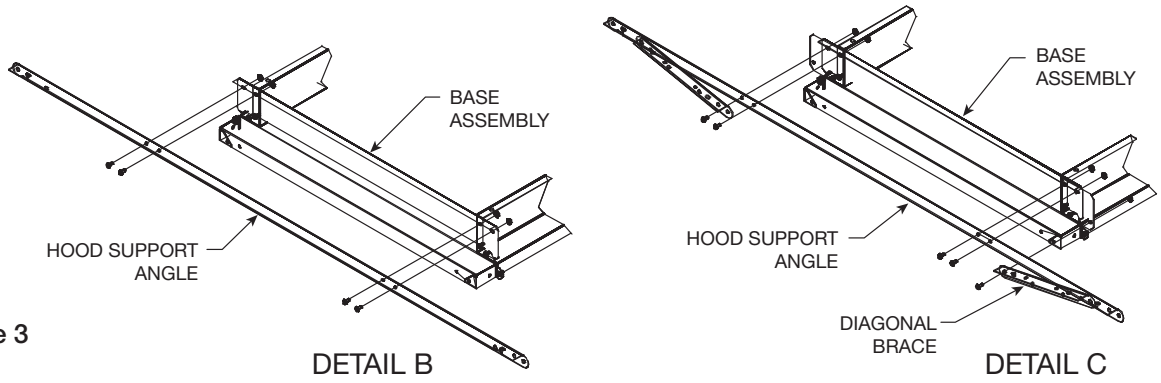


Figure 3

Step 4 – Tighten fasteners and caulk all inside corners

Tighten all fasteners. Caulk all inside corners where the base sections come together. At this point, the base may be lifted onto the roof curb before proceeding with further assembly.

Step 5 – Attach SIDE BIRDSCREEN ASSEMBLY to HOOD SUPPORT ANGLE

Attach the side bird screen assembly to the hood support angle and base assembly using four 1/4-20 x 1 inch fasteners per screen assembly, see Figure 4.

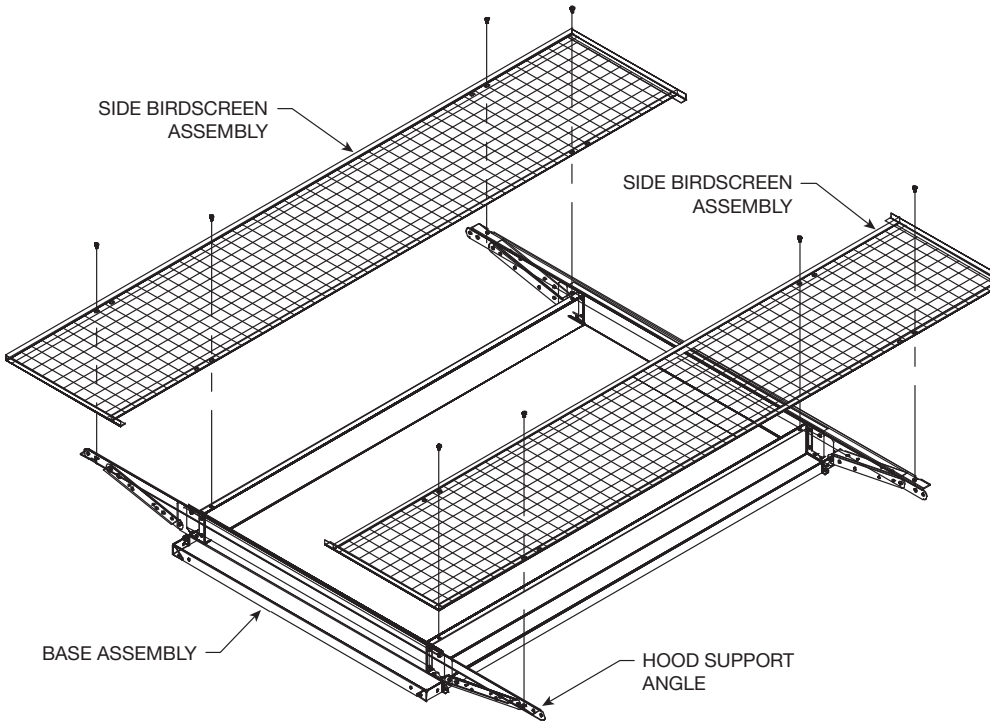


Figure 4

Step 6 – Install END BIRDSCREEN ASSEMBLY

Install the end birdscreen assembly, refer to Figure 5. Turn the birdscreen clips (which are pre-assembled to the end birdscreen assembly) so that two are under the side birdscreen frame extension and the other two are under the hood support angle. See Figure 5, Detail D.

NOTE: Loosen and tighten the birdscreen clip as necessary.

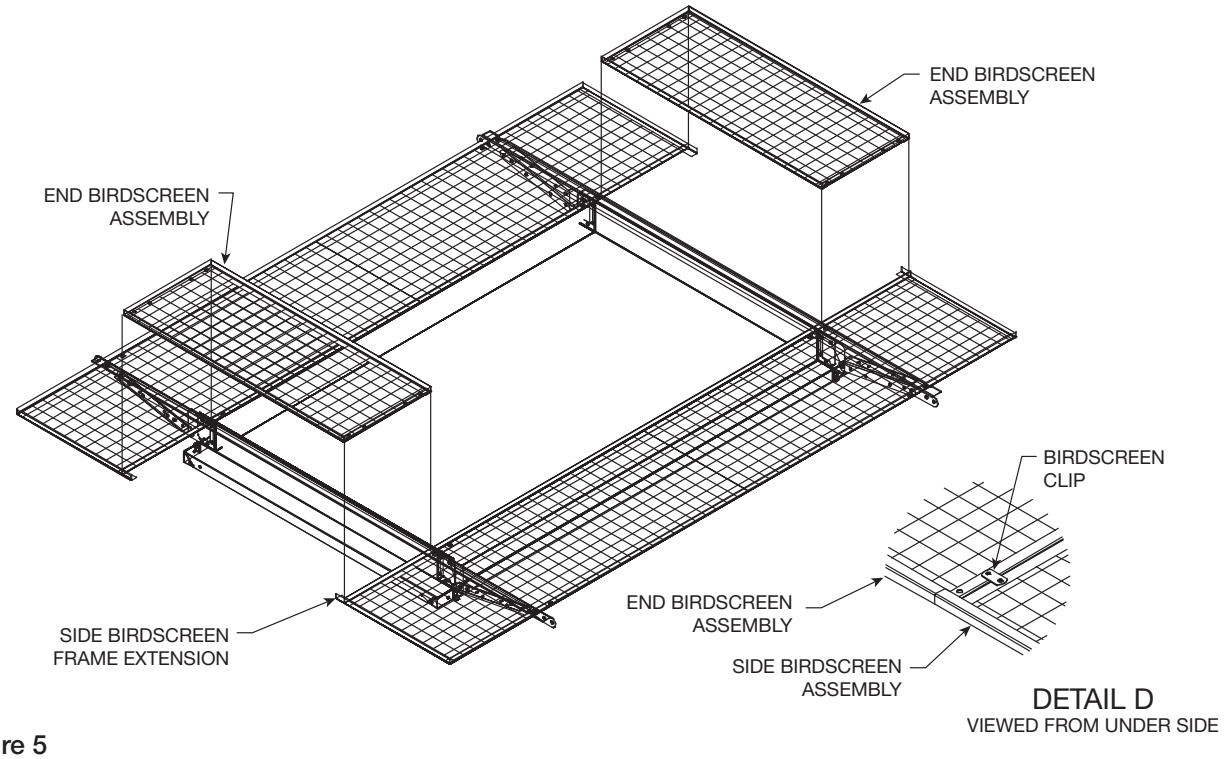


Figure 5

Step 7 – Attach HOOD RAIL ASSEMBLY to HOOD SUPPORT ANGLES

Attach the hood rail assembly to the hood support angles, using 3/8 x 3/4 inch bolt with 3/8 inch Nyloc nut at each attachment point, see Figure 6.

NOTE: Fasteners should be hand tightened only until Step 9.

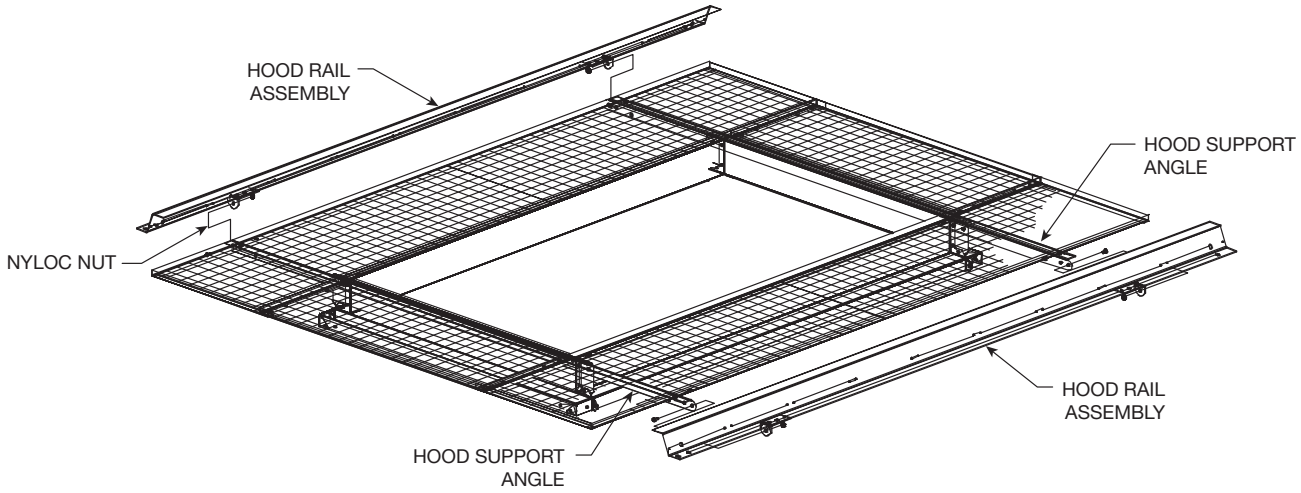


Figure 6

Step 8 – Assemble HOOD PANELS to HOOD RAIL ASSEMBLY

Assemble hood panels to hood rail assembly. The hood end assembly with the “male rib” is to be installed first, see Figure 7, Detail E. Place the remaining hood panels in place, interlocking panels as you go, see Detail E. Secure each hood panel to the hood rail assembly as it is put in place, using four 12 x 3/8 inch sheet metal screws with sealing washers per hood panel. The hood end assembly with the “female rib” is to be installed last.

NOTE: Hoods over 9 feet wide are supplied with special hood clips. See Detail F. hood panels have predrilled holes for hood clip installation. Install clips as hood panels are being put in place, using one 12 x 5/8 inch sheet metal screw with sealing washer per hood clip. To install clips in the last panel, leave the end birdscreen assembly out to provide access to the underside of the hood. The end birdscreen assembly can be easily replaced after the hood is completely assembled.

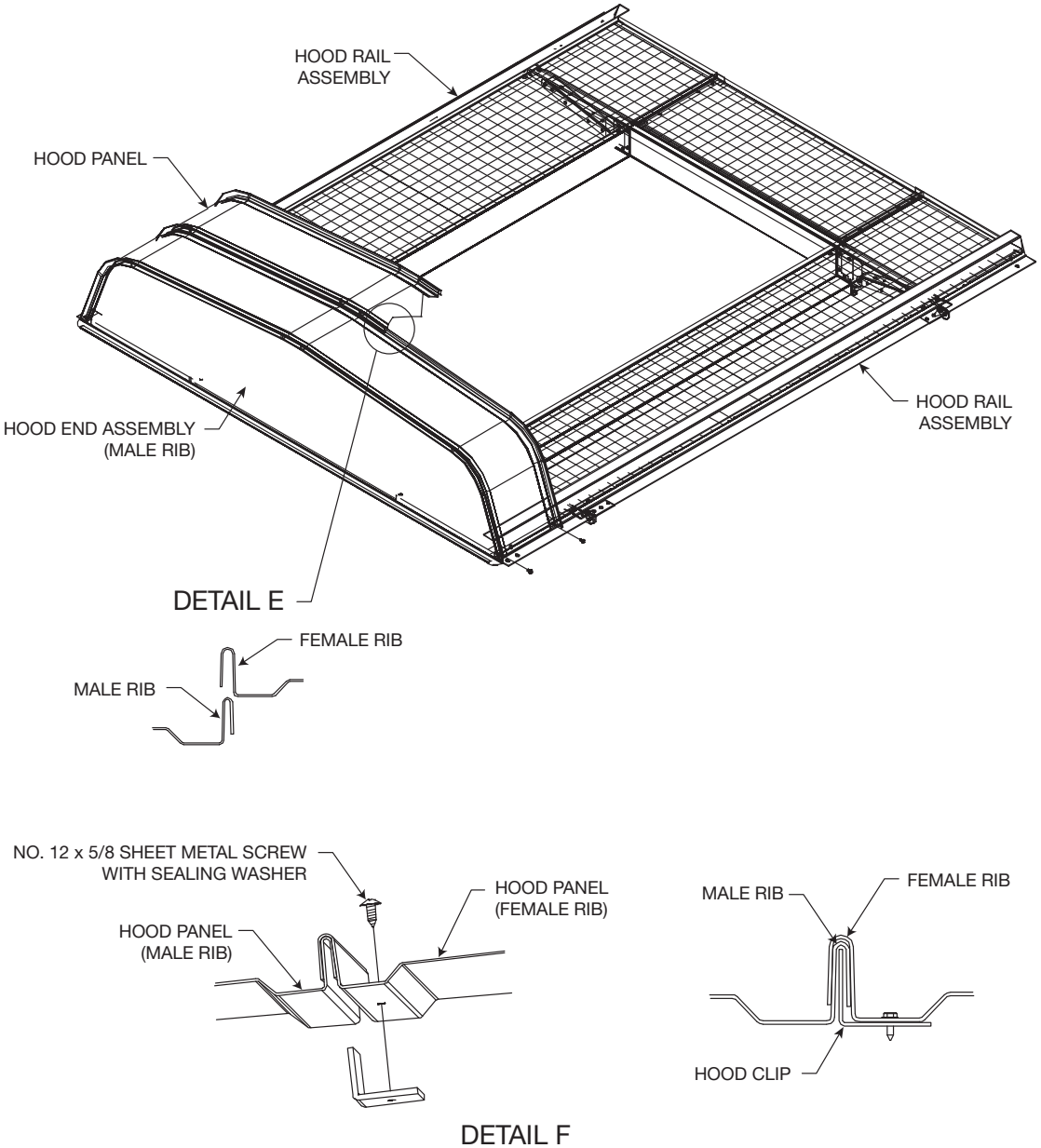


Figure 7

Step 9 – Tighten fasteners

Tighten all pivot bracket fasteners. **NOTE:** There may be extra fasteners.

High Wind Assembly

NOTE: Depending on the size of the hood it may be easier to assemble unit on the ground and lift to the roof assembled. This is due to the self tapping screws that need to be fastened down the center of the hood.

IMPORTANT: Do not climb on top of hood to fasten screws in the center of the hood.

Step 1 – Open crates and separate parts

Open the shipping crates and separate the parts according to the size of the unit, refer back to Figure 1, page 1.

Step 2 – Place BASE ENDS and BASE SIDES

Place the two base ends and the two base sides in their approximate relationship to each other, see Figure 2. Fasten together using three 1/4-20 fasteners per corner for 5 inch high base and four 1/4-20 fasteners per corner for 12 inch high base.

NOTE: Fasteners should be hand tightened only until Step 4.

On some units where the difference between the hood width and throat width is greater than 32 inches, a reinforcing plate is required in the corners of the base. Refer to Figure 2, Detail A.

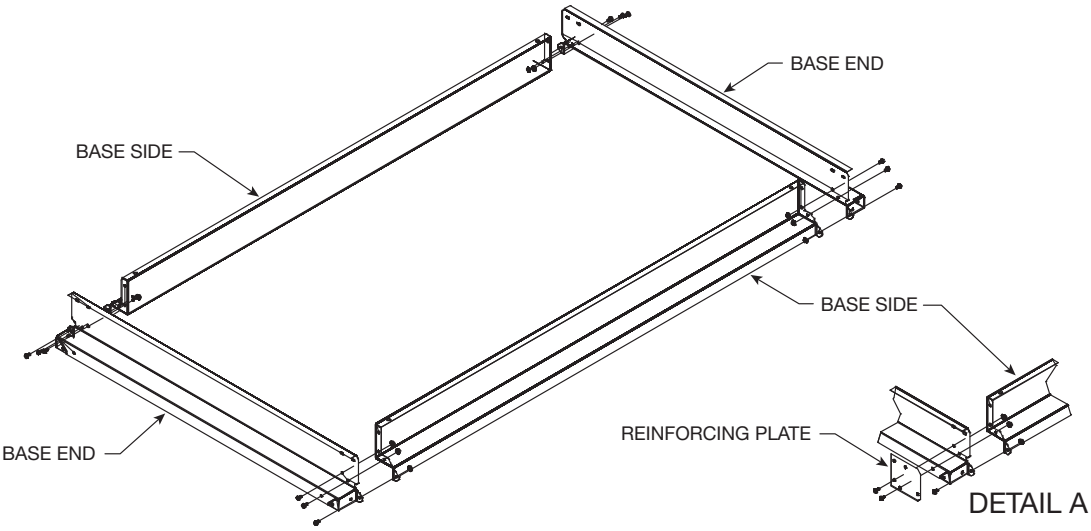


Figure 2

Step 3 – Attach HOOD BASE ENDS to HOOD BASE SIDES

Attach the hood support angle to the base assembly, using four 1/4-20 fasteners per angle, see Figure 3, Detail B.

On some units, two diagonal braces come pre-attached to the hood support angle. Fasten the loose end of the diagonal braces to the base assembly, using one 1/4-20 fastener per diagonal brace. See Figure 3, Detail C.

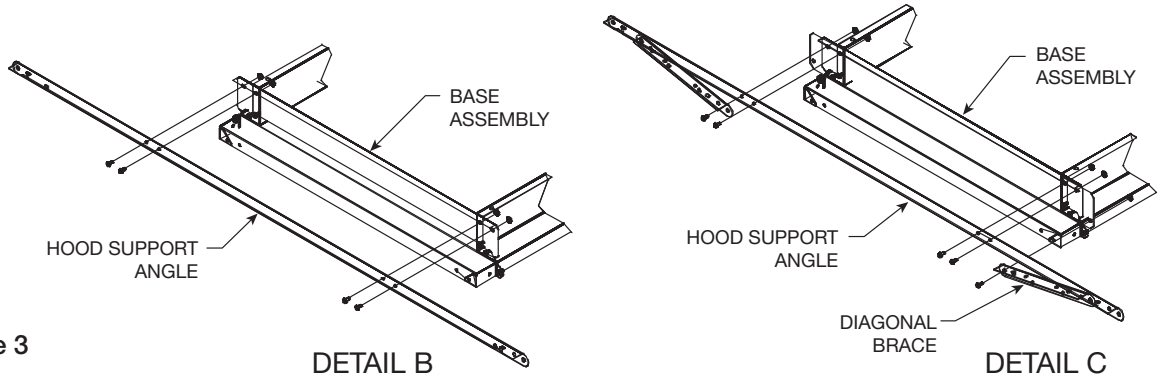


Figure 3

Step 4 – Tighten fasteners and caulk all inside corners

Tighten all fasteners. Caulk all inside corners where the base sections come together.

Step 5 – Attach SIDE BIRDSCREEN ASSEMBLY TO HOOD SUPPORT ANGLE

Attach the side bird screen assembly to the hood support angle and base assembly using four 1/4-20 x 1 inch fasteners per screen assembly, see Figure 4.

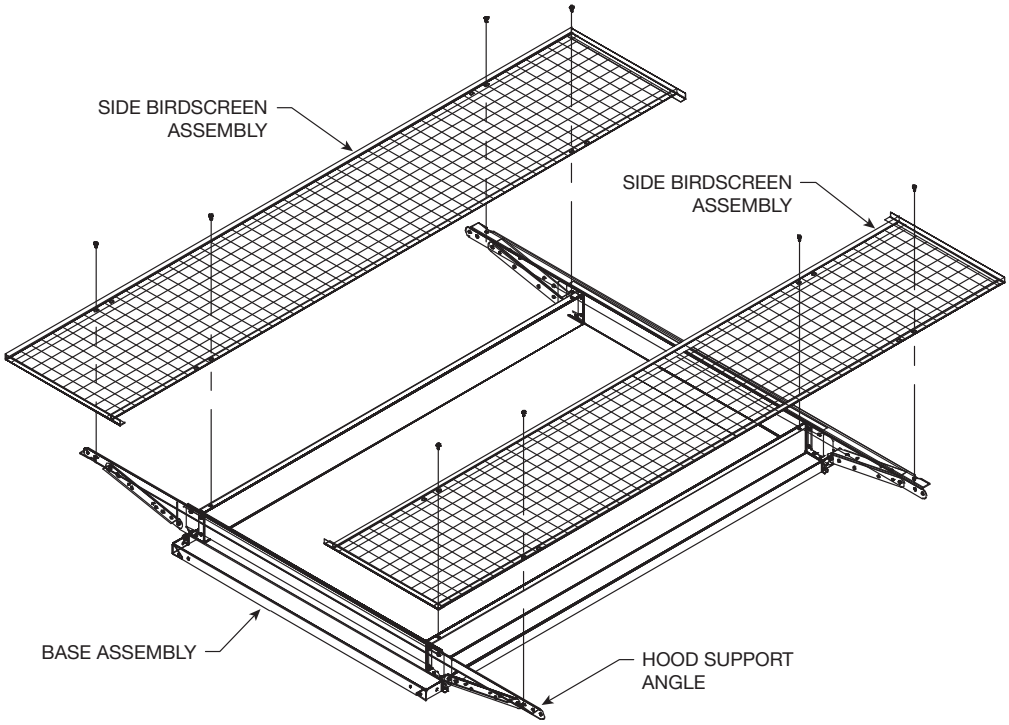


Figure 4

Step – 6 Install END BIRDSCREEN ASSEMBLY

Install the end birdscreen assembly, refer to Figure 5. Turn the birdscreen clips (which are pre-assembled to the end birdscreen assembly) so that two are under the side birdscreen frame extension and the other two are under the hood support angle. See Figure 5, Detail D.

NOTE: Loosen and tighten the birdscreen clip as necessary.

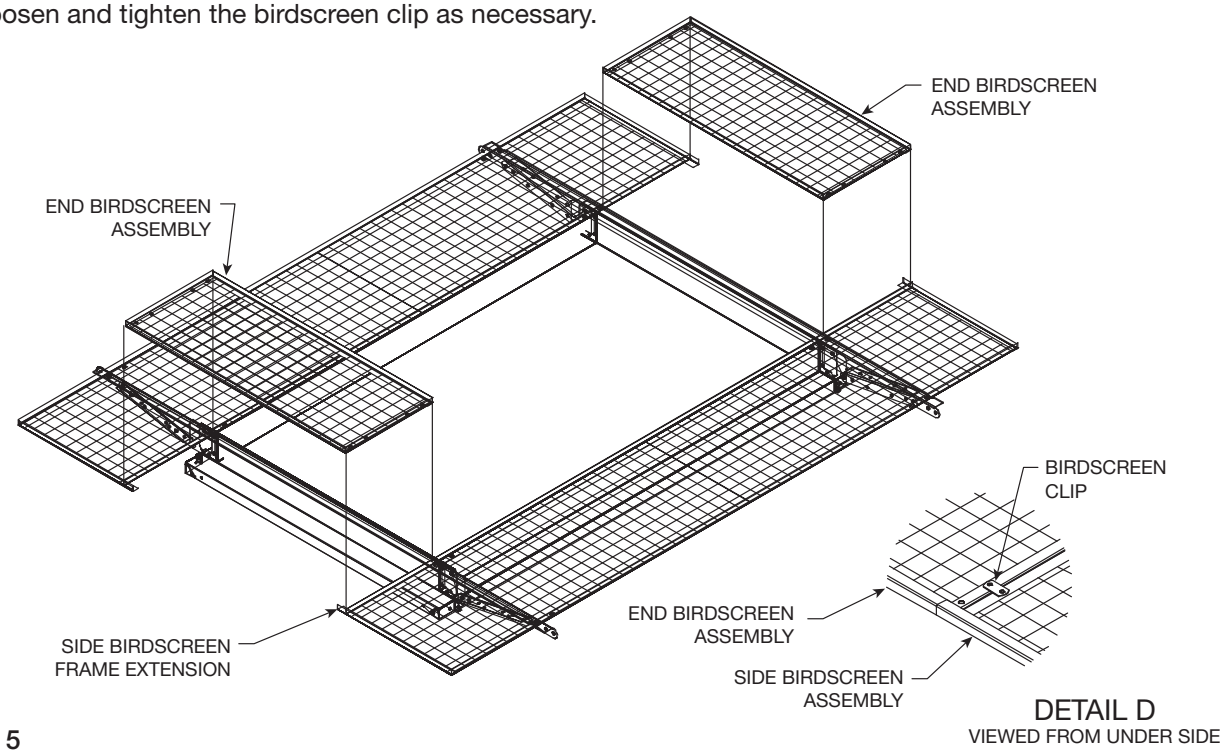


Figure 5

Step – 7 HOOD RAIL ASSEMBLY

NOTE: For easier assembly and lifting elevate hood rail assembly on blocks.

Lay out hood rail assembly and hood end angles, see Figure 6. Install thread cutters (hardware kit # 415041 - 5/16-18 x 1 in.) from underneath, first through hood end angles and second hood rail assembly.

NOTE: Use a builders square to ensure the corners of the frame are as close to 90º as possible.

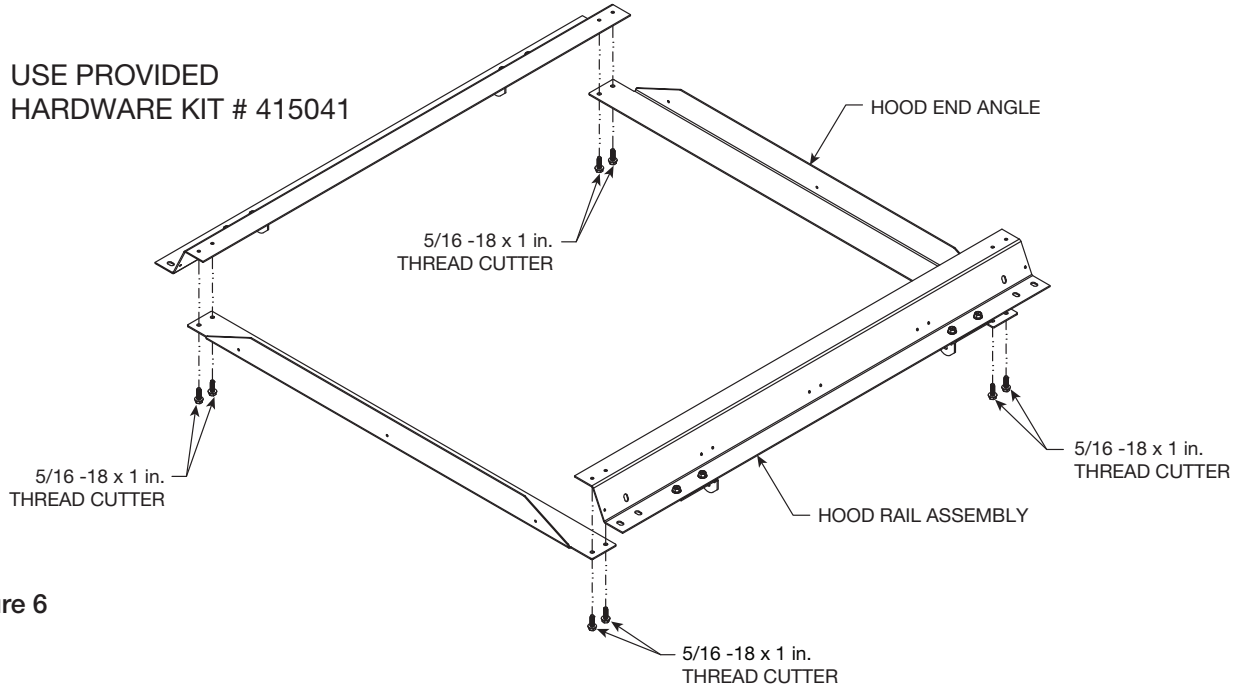


Figure 6

Step 8 – Install HAT CHANNEL

Place diagonal end panel supports with the formed angle running the length of the part facing out and slots next to hat channel. Fasten diagonals with whiz nut (hardware kit # 415456). Leave wiz nuts snug and DO NOT tighten. Lift hat channel into place. The diagonals will support the hat channel as it is being installed. Use thread cutters (hardware kit # 415456) to attach the hat channel to the diagonal end panel supports. Tighten wiz nuts.

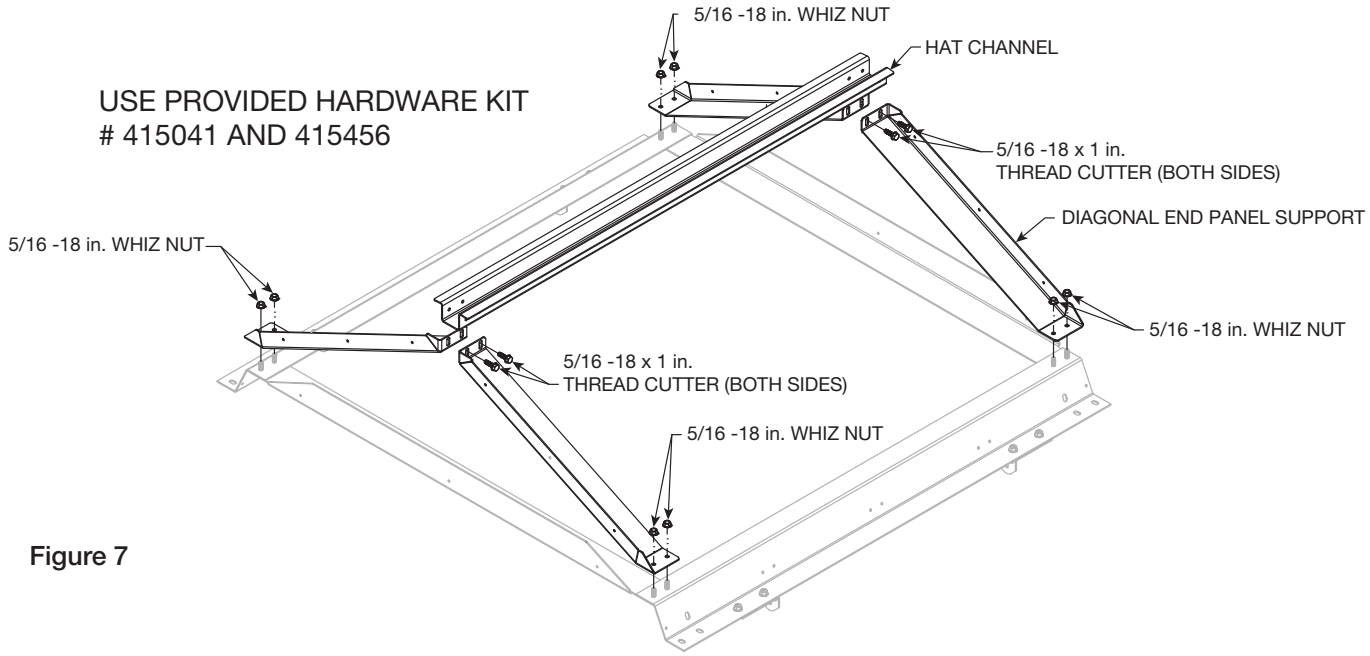


Figure 7

NOTE: Adjustment of the hat channel may be needed. Ensure there is no more than an 1/8 inch gap between the hat channel and hood panel.

Step 9 – Install HOOD END PANEL (MALE RIB)

Lift the hood end panel (male rib) into place. Use the 1/4-20 x 1 thread rolling screws with washer (hardware kit # 417119) to attach hood end panel to the diagonal end panel supports at the holes in the hood end panel that line will line up holes in the diagonal end panel supports.

Use four #12-14 x 1 inch self-tapping screws (hardware kit # 415450) to attach the hood panel to the hat channel. Use four #12-11 x 5/8 sheet metal screws (hardware kit # 417467) to attach the hood panel to the hood rail assembly.

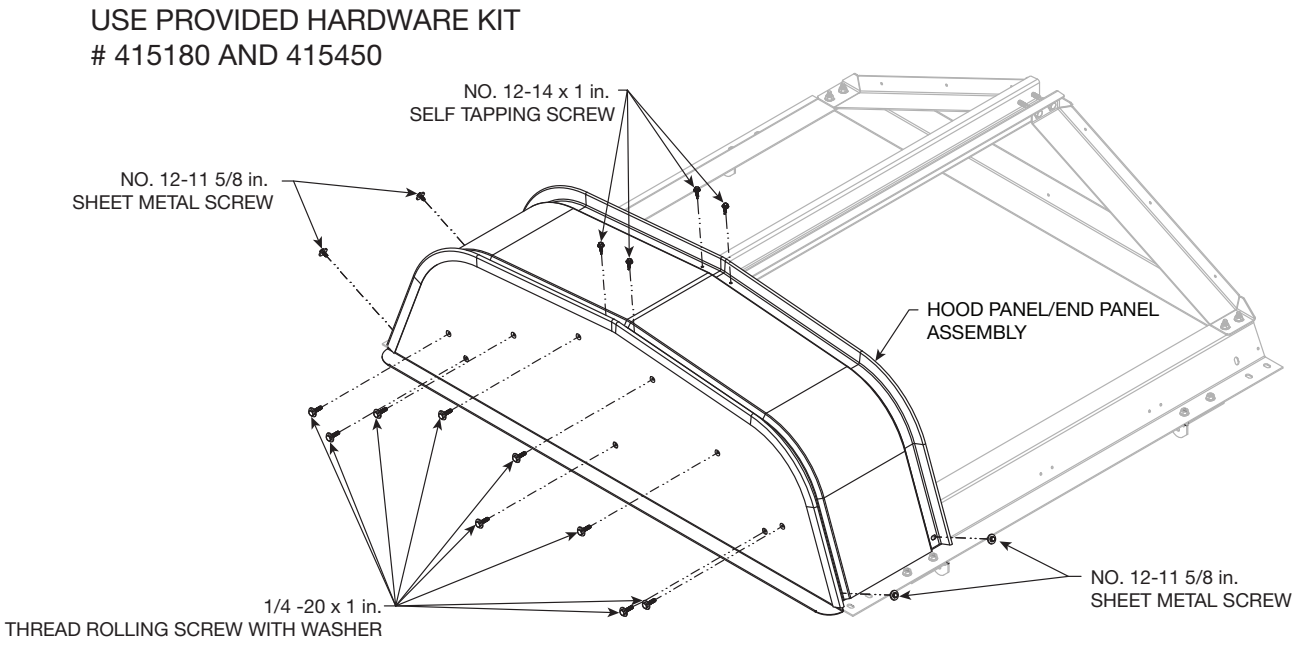


Figure 8

Step 10 – Install HOOD PANELS to HOOD RAIL ASSEMBLY

Place the next hood panel by interlocking each panel as shown in Figure 7, Detail E. Secure each hood panel to the hood rail assembly as it is put in place, using four #12-14 x 1 inch self-tapping screws (hardware kit # 415450) to attach the hood panel to the hat channel. Use four #12-11 x 5/8 sheet metal screws (hardware kit # 417467) to attach the hood panel to the hood rail assembly. Using quantity 10 sheet metal screws (hardware kit # 416900) with sealing washers per hood panel. Place the remaining hood panels in place with the hood end assembly with the female rib is to be installed last as shown in step 9.

IMPORTANT: Do not drive sheet metal screws all the way through both sides of the ribs as this could allow water to leak through the hood. Screws are to fasten only the first 2 layers of the rib joint.

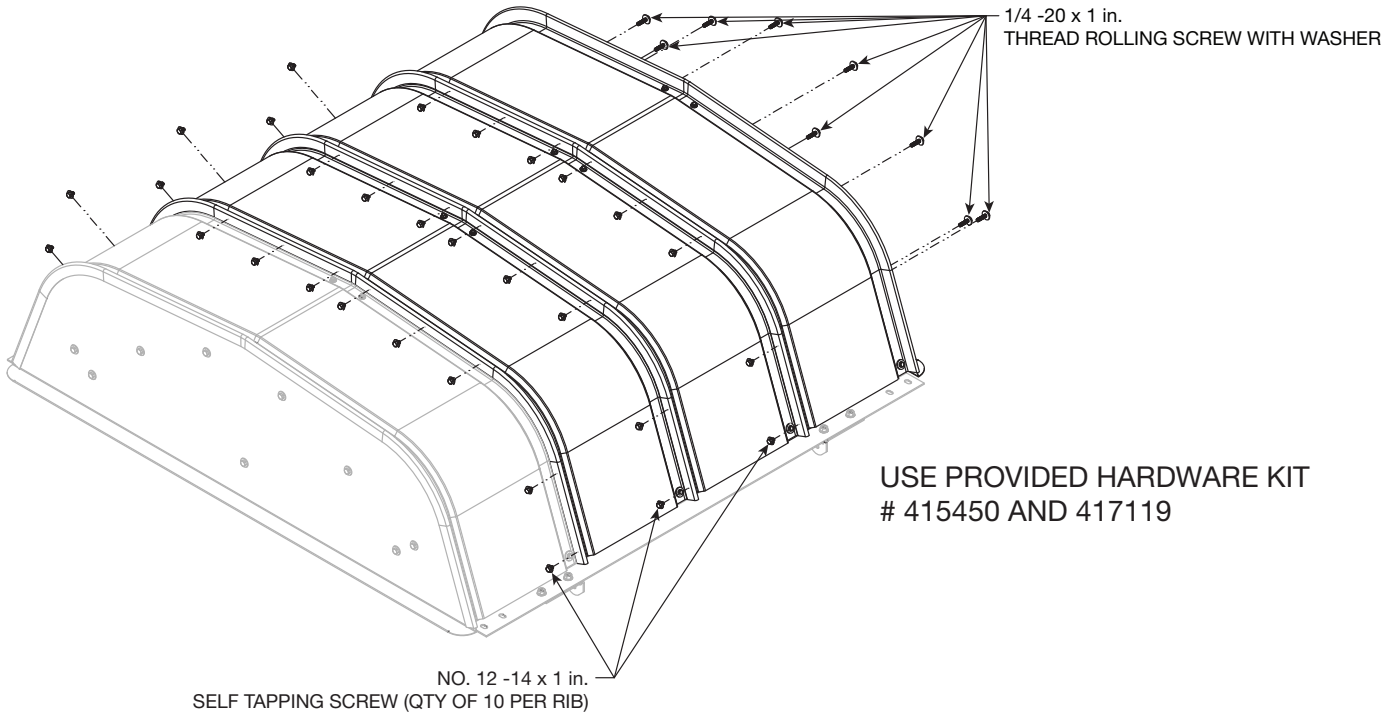


Figure 9

Step 11 – Lift HOOD ASSEMBLY onto HOOD BASE

Lift completed hood assembly onto the hood base and attach the hood assembly to the hood support angles, using 3/8 x 3/4 inch bolt with 3/8 inch Nyloc nut at each attachment point.

Step 12 – Tighten fasteners

Tighten all pivot bracket fasteners.

NOTE: There may be extra fasteners.

GREENHECK
Building Value in Air.

Phone: 715.359.6171 • Fax: 715.355.2399 • Parts: 800.355.5354 • E-mail: gfcinfo@greenheck.com • Website: www.greenheck.com

