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Installed Cost of Solar Photovoltaic Systems in the U.S. Declined Significantly in 2010 and 2011

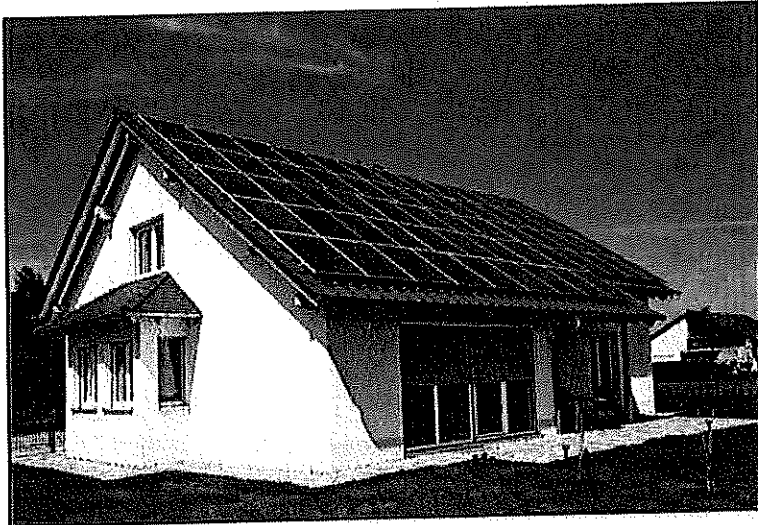
Posted By [Juliechao](#) On September 15, 2011 @ 12:12 pm In [News Releases](#) | [Comments](#)
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Technical Contacts:

Galen Barbose (510) 495-2593, GLBarbose@lbl.gov ^[1]
Ryan Wiser (510) 486-5474, RHWiser@lbl.gov ^[2]

Berkeley, CA — The installed cost of solar photovoltaic (PV) power systems in the United States fell substantially in 2010 and into the first half of 2011, according to the latest edition of an annual PV cost tracking report released by the Department of Energy's Lawrence Berkeley National Laboratory (Berkeley Lab).

The average installed cost of residential and commercial PV systems completed in 2010 fell by roughly 17 percent from the year before, and by an additional 11 percent within the first six months of 2011. These recent installed cost reductions are attributable, in part, to dramatic reductions in the price of PV modules. Galen Barbose of Berkeley Lab's Environmental Energy Technologies Division and co-author of the report explains: "Wholesale PV module prices have fallen precipitously since about 2008, and those upstream cost reductions have made their way through to consumers."



^[3]The report indicates that non-module costs—such as installation labor, marketing, overhead, inverters, and the balance of systems—also fell for residential and commercial PV systems in 2010. "The drop in non-module costs is especially important," notes report co-author and Berkeley Lab scientist Ryan Wiser, "as those are the costs that can be most readily influenced by solar policies aimed at accelerating deployment and removing market barriers, as opposed to research and development

programs that are also aimed at reducing module costs." According to the report, average non-module costs for residential and commercial systems declined by roughly 18 percent from 2009 to 2010.

Turning to utility-sector PV, costs varied over a wide range for systems installed in 2010, with the cost of systems greater than 5,000 kilowatts (kW) ranging from \$2.90 per Watt (W) to \$6.20/W, reflecting differences in project size and system configuration, as well as the unique characteristics of certain individual projects. Consistent with continued cost reductions, current benchmarks for the installed cost of prototypical, large utility-scale PV projects generally range from \$3.80/W to \$4.40/W.

The market for solar PV systems in the United States has grown rapidly over the past decade, as national, state and local governments offered various incentives to expand the solar market and accelerate cost reductions. The study—the fourth in Berkeley Lab's "Tracking the

Sun" report series—describes trends in the installed cost of PV in the United States, and examined more than 115,000 residential, commercial and utility-sector PV systems installed between 1998 and 2010 across 42 states, representing roughly 78 percent of all grid-connected PV capacity installed in the United States. Naïm Darghouth, also with Berkeley Lab, explains that "the study is intended to provide policy makers and industry observers with a reliable and detailed set of historical benchmarks for tracking and understanding past trends in the installed cost of PV."

Costs Differ by Region and by Size and Type of System

The study also highlights differences in installed costs by region and by system size and installation type. Comparing across U.S. states, for example, the average cost of PV systems installed in 2010 and less than 10 kilowatts (kW) in size ranged from \$6.30/W to \$8.40/W depending on the state. The report also found that residential PV systems installed on new homes had significantly lower average installed costs than those installed as retrofits to existing homes.

Based on these data and on installed cost data from the sizable German and Japanese PV markets, the authors suggest that PV costs may be driven lower through large-scale deployment programs, but that other factors are also important in achieving cost reductions.

The report also shows that PV installed costs exhibit significant economies of scale. Among systems installed in 2010, those smaller than 2 kW averaged \$9.80/W, while large commercial systems >1,000 kW averaged \$5.20/W; partial-year data for 2011 suggests that average costs declined even further in 2011. Large utility-sector systems installed in 2010 registered even lower costs, with a number of systems in the \$3.00/W to \$4.00/W range.

Cost Declines for PV System Owners in 2010 Were Partially Offset by Falling Incentives

The average size of direct cash incentives provided through state and utility PV incentive programs has declined steadily since their peak in 2002. The dollar-per-Watt benefit of the federal investment tax credit (ITC) and Treasury grant in lieu of the ITC, which are based on a percentage of installed cost, also fell in 2010 as a result of the drop in average installed costs.

The reduced value of federal, state, and utility incentives in 2010 partially offset the decline in installed costs. Therefore, while pre-incentive installed costs fell by \$1.00/W and \$1.50/W for residential and commercial PV in 2010, respectively, the decline in "net" (or post-incentive) installed costs fell by \$0.40/W for residential PV and by \$0.80/W for commercial PV.

The report "Tracking the Sun IV: An Historical Summary of the Installed Cost of Photovoltaics in the United States from 1998 to 2010," by Galen Barbose, Naïm Darghouth, and Ryan Wiser, may be downloaded from <http://eetd.lbl.gov/ea/emp/reports/lbnl-5047e.pdf>^[4].

The research was supported by funding from the U.S. Department of Energy's Office of Energy Efficiency and Renewable Energy and by the Clean Energy States Alliance, a national nonprofit coalition of leading state clean energy programs that work together to advance renewable energy project deployment in their states and across the country.

Lawrence Berkeley National Laboratory addresses the world's most urgent scientific challenges by advancing sustainable energy, protecting human health, creating new materials, and revealing the origin and fate of the universe. Founded in 1931, Berkeley Lab's scientific expertise has been recognized with 12 Nobel prizes. The University of California manages Berkeley Lab for the U.S. Department of Energy's Office of Science. For more, visit www.lbl.gov^[5].

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URLs in this post:

[1] GLBarbose@lbl.gov: **mailto:GLBarbose@lbl.gov**

[2] RHWiser@lbl.gov: **mailto:RHWiser@lbl.gov**

[3] Image: **<http://newscenter.lbl.gov/wp-content/uploads/solar-panels.jpg>**

[4] **<http://eetd.lbl.gov/ea/emp/reports/lbni-5047e.pdf>**:

<http://eetd.lbl.gov/ea/emp/reports/lbni-5047e.pdf>

[5] www.lbl.gov: **<http://www.lbl.gov>**

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Bill Date 05/20/2013 Customer ID 0228-6001-74-4

Due C 06/12/2013 Amount Due \$ 807.02

Please Pay By Jun 12, 2013

B00007800

L I Natl Cemetery
Wellwood Ave
Farmingdale NY 11735

Copy 1 of 3

- ✓ Please make your check payable to LIPA and mail this part of the bill with your payment.
- ✓ Be sure that the address on the other side appears in the return envelope window.
- ✓ Write your Customer ID on your check.

Tear here →

www.lipower.org
24 Hours/Day - 7 Days/Week

"My Account" PIN
BD05E3

Billing/General Inquiries
Monday - Friday, 8 AM - 8 PM
1-800-966-4818*

outside toll free area
1-631-755-3417*
*Automated Services available
24 Hours/Day - 7 Days/Week

Electric Service Problems
24 Hours/Day - 7 Days/Week
1-800-490-0075

Para Espanol
1-800-490-0085

Hearing or Speech Impaired
1-631-755-6660

Report Theft of Service
1-631-755-6871

SERVICE TO:
L I Natl Cemetery
N Wellwood Av Adm Bldg
Farmingdale NY 11735



A Non-Profit Municipal Electric Utility

Customer ID	Next Meter Reading	Due Date	Amount Due
0228-6001-74-4	On or about 06/17/13	06/12/2013	\$ 807.02

BILLING SUMMARY

Balance From Previous Bill \$ 1,119.89
Payment(s) Received Through 05/15/2013 - Thank You! -1,119.89
LIPA Current Charges 807.02
Please Pay By 06-12-13 **\$ 807.02**

A 1.5% late payment charge may be applied to outstanding charges if payment is not received by JUN 12

Vendor ID#

112 879 306

IMPORTANT MESSAGES

Visit LIPA at www.lipower.org/commercial/small and learn about online options and other programs designed for businesses that can save time, save money and save energy, so you can concentrate on your success.

We're working harder than ever to provide energy for a growing Long Island and customers like you are helping us improve our performance. Thank you. Your credit rating is tops with us!

Invoice Date 5/20/13
Date Invoice Received 5/24/13
Accept/Del Date 5/17/13
PO/Obligation # 815-J37001
Amount \$ 807.02
Station# 815

PAID
5/30/13

SERIALIZED ONLINE
MAY 30 2013

L I Natl Cemetery
Wellwood Ave
Farmingdale NY 11735

02286001744
\$ 807.02

Please be sure the address
to the right appears in the
return envelope window

LIPA
PO Box 9039
Hicksville NY 11802-9039

0228600174410031409807024807024

H

← Tear here →

← Tear here →

Account # 714-20-6310-1

LIPA - Rate 281 - Secondary, Commercial, Large, General Use

ELECTRIC - ENERGY

Meter # 99800127

05/17/2013 ACTUAL reading 14773
04/22/2013 ACTUAL reading -14667
Difference 106
Meter Multiplier x 40
KWH Used in 25 day(s) 4240

DELIVERY & SYSTEM CHARGES

Basic Service : 25 day(s) @ \$ 1.4000 \$ 35.00
4240 KWH @ \$.0387 164.09
Demand 22.0 KW 176.55
Subtotal 375.64

ELECTRIC - DEMAND (Rounded to nearest .5 kw)

ACTUAL reading 34.30
ACTUAL reading -33.97
Difference .33
Meter Multiplier x 40
Recorded Demand (KW) 13.0

POWER SUPPLY CHARGES

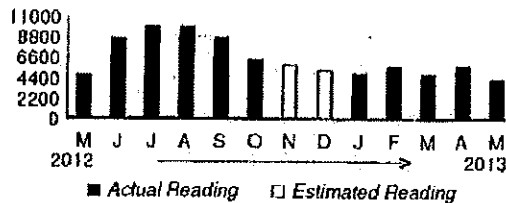
4240 KWH @ \$.088885 376.87
Efficiency & Renewables Charge
4240 KWH @ \$.005187 21.99

OTHER CHARGES

NY State Assessment 9.44
Revenue-Based PILOTS 7.09
Suffolk Property Tax Adjustment 15.99
Subtotal 32.52

Total Charges \$ 807.02

ELECTRIC USAGE HISTORY (kWh)



	Days	Average Daily		
		kWh	Cost	Temp.
Current Month	26	170	\$ 32.28	68
Last Year	27	173	\$ 31.22	68

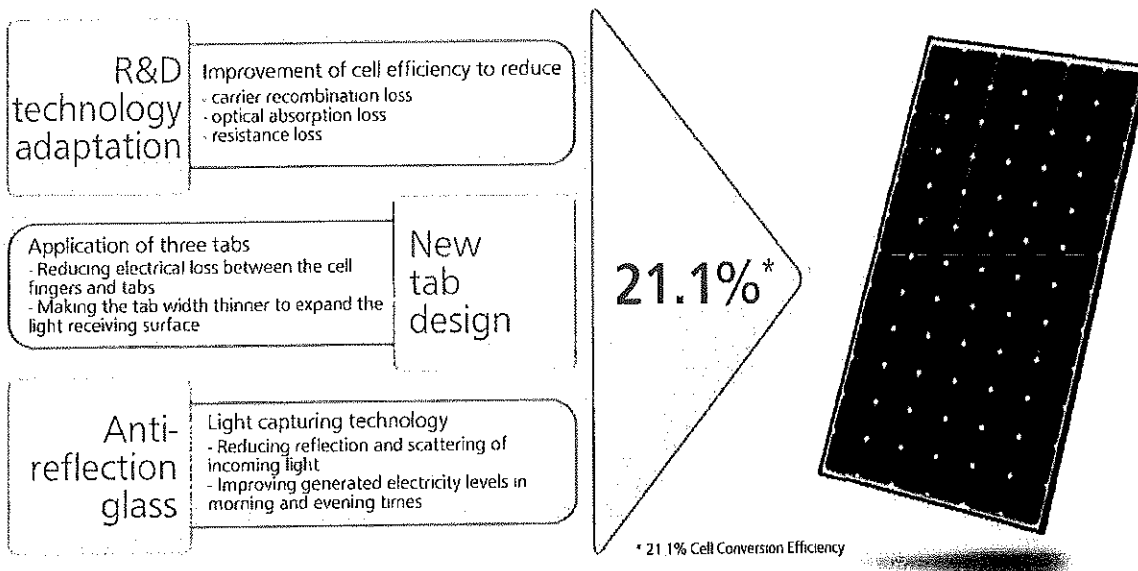
Panasonic

ideas for life

HIT Photovoltaic Module

HIT Power 235S

VBHN235SA06



HIT[®] Power

Photovoltaic Module

Ultra High Efficiency & Superior Real World Performance
 HIT Power Solar panels are leaders in sunlight conversion efficiency. Our hybrid cells produce the highest output on cloudy days.
 21.1% Cell Conversion Efficiency
 Most PTC Power 218.7W
 Highest PTC/STC Ratio 93% +

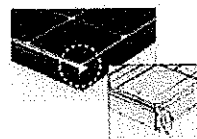
Superior Temperature Performance
 As temperatures rise, HIT Power solar panels produce 10% or more electricity (kWh) than conventional crystalline silicon solar panels at the same temperature.

Quality and Reliability
 Panasonic is truly committed to quality since it began developing and manufacturing solar PV in 1975. Since pioneering, developing and launching HIT Solar cells in the 1990s, we have been the technology leader, and for decades many satisfied customers have placed their trust in the competence in our unique HIT Technology.

Power Guarantee
 The power ratings for HIT Power panels guarantee customers receive 100% of the nameplate rated power (or more) at the time of purchase, enabling owners to generate more kWh per rated Watt, quicken investments returns, and help realize complete customer satisfaction.

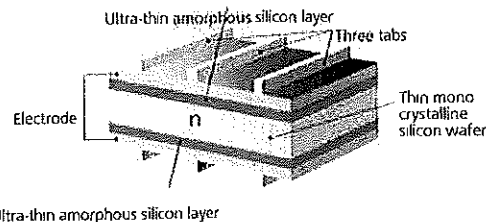
American Made Quality
 Our silicon wafers located inside HIT solar panels are made in Oregon, and the panels are assembled in an ISO 9001 (quality), 14001 (environment), and 18001 (safety) certified factory. Unique eco-packing minimizes cardboard waste at the job site. The panels have a Limited 20-Year Power Output and 10-Year Product Workmanship Warranty.

"Drainage corner frame" to prevent the accumulation of dirt on the panel



Rainwater flush the dirt of the panel

HIT[®] solar cell structure



HIT solar cells are hybrids of mono crystalline silicon surrounded by ultra thin amorphous silicon layers, and are available solely from Panasonic.

HIT Power 235S

Electrical Specifications

Model	HIT Power 235S or VBHN235SA06
Rated Power (P _{max}) ¹	235 W
Maximum Power Voltage (V _{pm})	43.0 V
Maximum Power Current (I _{pm})	5.48 A
Open Circuit Voltage (V _{oc})	51.8 V
Short Circuit Current (I _{sc})	5.84 A
Temperature Coefficient (P _{max})	-0.30%/°C
Temperature Coefficient (V _{oc})	-0.124 V/°C
Temperature Coefficient (I _{sc})	1.75 mA/°C
NOCT	118.9°F (48.3°C)
CEC PTC Rating	218.7 W
Cell Efficiency	21.1%
Module Efficiency	18.6%
Watts per Ft. ²	17.33 W
Maximum System Voltage	600 V
Series Fuse Rating	15 A
Warranted Tolerance (-/+)	-0% / +10%

Mechanical Specifications

Internal Bypass Diodes	3 Bypass Diodes
Module Area	13.56 Ft. ² (1.26m ²)
Weight	33.1 Lbs. (15kg)
Dimensions LxWxH	62.2x31.4x1.4 in. (1580x798x35 mm)
Cable Length +Male/-Female	40.55/34.64 in. (1030/880 mm)
Cable Size / Type	No. 12 AWG / PV Cable
Connector Type ³	Multi-Contact [®] Type IV (MC4 [™])
Static Wind / Snow Load	50 PSF (2,400 Pa)
Pallet Dimensions LxWxH	63.2x32x.65 in. (1607x815x1650 mm)
Quantity per Pallet / Pallet Weight	40 pcs./1388.9 Lbs (630 kg)
Quantity per 40' Container	560 pcs.
Quantity per 20' Container	280 pcs.

Operating Conditions & Safety Ratings

Ambient Operating Temperature ²	-4°F to 115°F (-20°C to 46°C)
Hail Safety Impact Velocity	1" hailstone (25mm) at 52 mph (23m/s)
Fire Safety Classification	Class C
Safety & Rating Certifications	UL 1703, cUL, CEC
Limited Warranty	10 Years Workmanship, 20 Years Power Output

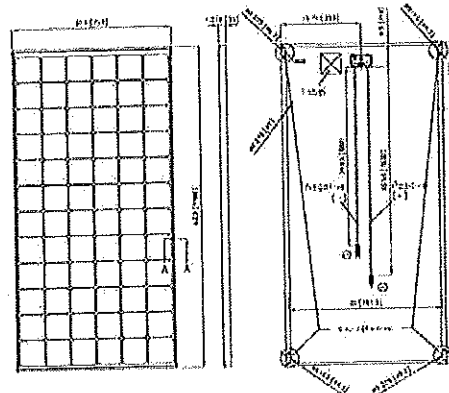
¹ STC: Cell temp. 25°C, AM1.5, 1000W/m²

² Monthly average low and high of the installation site.

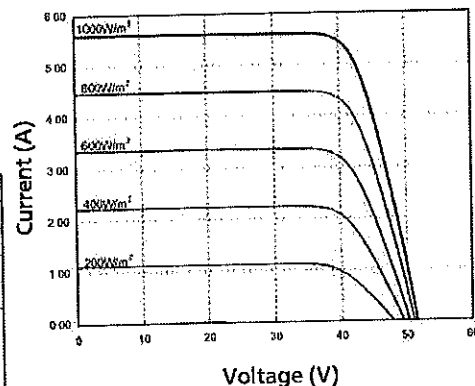
Note: Specifications and information above may change without notice.

³ Safety locking clip (PV-SSH4) is not supplied with the module.

Dimensions and Weight



Dependence on Irradiance



HIT is a registered trademark of Panasonic Group. The name "HIT" comes from "Heterojunction with intrinsic Thin-layer" which is an original technology of Panasonic Group.

⚠ CAUTION! Please read the installation manual carefully before using the products.

Panasonic Eco Solutions
Energy Management North America
Unit of Sanyo North America Corporation

10900 N. Tantau Ave., Suite 200
Cupertino, CA 95014
Phone 408-861-8424
Fax 408-861-3990
<http://us.sanyo.com/solar>

Panasonic ^(P)

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07/2012

CUT SHEETS

Submittal Data Sheet

Project Name: _____
 Location: _____
 Engineer: _____
 Submitted to: _____
 Submitted by: _____
 Reference: _____

Approval: _____
 Date: _____
 Construction: _____
 Unit #: _____
 Drawing #: _____

Performance

Outdoor Unit Model No: RXYQ96PBTJ
 Type: Non-Ducted / Ducted
 Rated Cooling Capacity (Btu/hr): 92000
 Nom Cooling Capacity (Btu/hr): 96000
 Cooling Input Power (kW): 7.36
 SEER: N/A
 IEER: 23.0/18.8
 Rated Heating Capacity (Btu/hr): 103000
 Nom Heating Capacity (Btu/hr): 108000
 Heating Input Power (kW): 8.27
 Heating COP (Btu/hr / Btu/hr): 4.2/3.65
 HSPF: N/A
 Heating COP 17F (Btu/hr / Btu/hr): 2.85/2.5

Condensing Unit Type: 8-Ton VRV-III Heat Pump

Unit Combination: RXYQ96PBTJ

Rated Cooling Conditions
 Indoor: 80°F DB/67°F WB
 Outdoor: 95°F DB/75°F WB

Rated Heating Conditions
 Indoor: 70°F DB/60°F WB
 Outdoor: 47°F DB/43°F WB

Rated Piping Length (ft) 50 / 25
 Rated Height Difference (ft) 0

Condensing Unit Details

Power Supply (V/Hz/Ph): 208-230/60/3ph
 Power Supply Connections: L1, L2, L3 Ground
 Min. Circuit Amps MCA (A): 43
 Max. Overcurrent Protection (MOP)(A): 50
 Max. Starting Current MSC(A): 131
 Rated Load Amps RLA (A): 7.8+16.8
 Dimensions Height (Inch): 66-1/8
 Dimensions Width (Inch): 48-7/8
 Dimensions Depth (Inch): 30-1/8
 Net Weight (lbs): 620

Compressor Type: Inverter
 Capacity Control Range (%): 14 - 100
 Capacity Index Limit: 48 - 124.8 (130%)
 Airflow Rate (CFM): 8230
 Gas Pipe Connection (inch): 7/8
 Liquid Pipe Connection (inch): 3/8
 H/L Pressure Connection (inch): _____
 H/L Equalizing Connection (inch): _____
 Sound Pressure Level (dBA): 60
 Sound Power Level (dBA): _____
 Max. No. of Indoor Units: 16

System Details

Refrigerant Type: R-410A
 Holding Refrigerant Charge (lbs): 21.4
 Additional Charge (lbs/ft): install data
 Pre-charge Piping (Length ft): -
 Max. Pipe Length (Total ft): _____
 Max. Pipe Length (Vertical ft): 164 ft (295 ft) / 295 ft
 Max Height Separation (Ind to Ind ft): _____

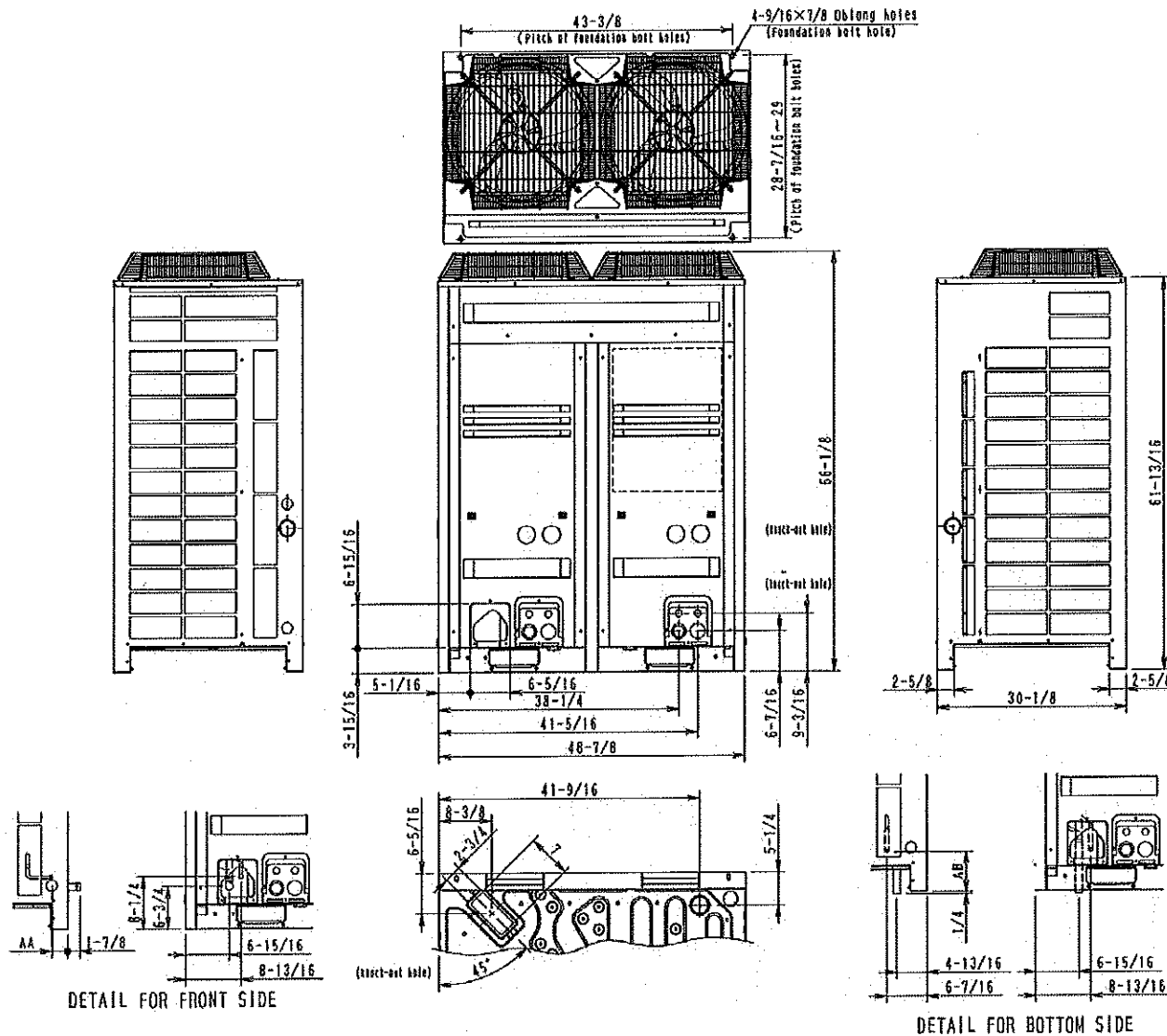
Cooling Operation Range (°F): 23 - 110
 Cooling Range w/Baffle (°F): _____
 Heating Operation Range (°F): 0 - 77 / (-4) - 60
 Heating Range w/Baffle (°F): _____

Project Name: _____
Location: _____
Engineer: _____
Submitted to: _____
Submitted by: _____
Reference: _____

Approval: _____
Date: _____
Construction: _____
Unit #: _____
Drawing #: _____

Dimensional Drawing - Condensing Unit

RXYQ96PBTJ

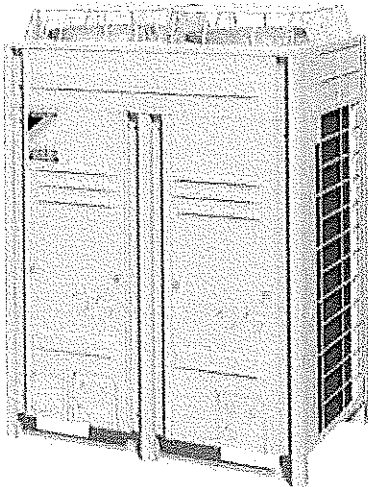


Submittal Data Sheet

Project Name: _____
Location: _____
Engineer: _____
Submitted to: _____
Submitted by: _____
Reference: _____

Approval: _____
Date: _____
Construction: _____
Unit #: _____
Drawing #: _____

RXYQ96PBTJ



RXYQ96PBTJ

Std U.S. Warranty: 7yrs Compressor, 1yrs Parts

Submittal Data Sheet

Project Name: _____
Location: _____
Engineer: _____
Submitted to: _____
Submitted by: _____
Reference: _____

Approval: _____
Date: _____
Construction: _____
Unit #: _____
Drawing #: _____

Performance

Indoor Unit Model No: FXZQ07M7VJU
Rated Cooling Capacity (Btu/hr): 7500
Sensible Capacity (Btu/hr): 5900
Cooling Input Power (kW): 0.075
Rated Heating Capacity (Btu/hr): 8700
Heating Input Power (kW): 0.069

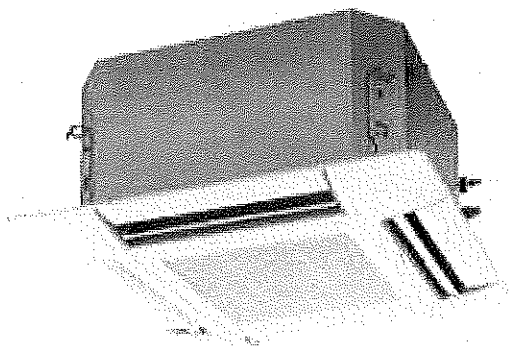
Indoor Unit Type: 2' x 2' 4 Way Cassette
Rated Cooling Conditions Indoor: 80°F DB/67°F WB
Ambient: 95°F DB/75°F WB
Rated Heating Conditions Indoor: 70°F DB/60°F WB
Ambient: 47°F DB/43°F WB
Rated Piping Length (ft) 25
Rated Height Separation (ft) 0

Indoor Unit Details

Power Supply (V/Hz/Ph): 208-230/60/1ph
Power Supply Connections: L1, L2, Ground
Min. Circuit Amps MCA (A): 0.8
Max. Overcurrent Protection (MOP) (A): 15
Dimensions (HxWxD): 11 1/4x22 5/8x22 5/8
Panel (HxWxD): 2 5/32x27 9/16x27 9/16
Net Weight (lbs): 42
Net Weight with Panel (lbs): 48

Airflow Rate (CFM wet coil) 320/247
Moisture Removal (pt/h): 1/2
Gas Pipe Connection (inch): 1/4
Liquid Pipe Connection (inch): 1-1/32
Condensate Connection (inch): 3/16
Sound Pressure Level (dBA): 31
Sound Power Level (dBA): 0 / 0
External Static Pressure/Max (inWg): 0 / 0
Controller Name: _____

FXZQ07M7VJU



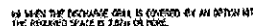
FXZQ07M7VJU

Std U.S. Warranty: 7yrs Compressor, 1yrs Parts



Approval: _____
Date: _____
Construction: _____
Unit #: _____
Drawing #: _____

FXZQ07M7VJU



Submittal Data Sheet

Project Name: _____
Location: _____
Engineer: _____
Submitted to: _____
Submitted by: _____
Reference: _____

Approval: _____
Date: _____
Construction: _____
Unit #: _____
Drawing #: _____

Performance

Indoor Unit Model No: **FXZQ12M7VJU**
Rated Cooling Capacity (Btu/hr): **12000**
Sensible Capacity (Btu/hr): **8000**
Cooling Input Power (kW): **0.08**
Rated Heating Capacity (Btu/hr): **14000**
Heating Input Power (kW): **0.073**

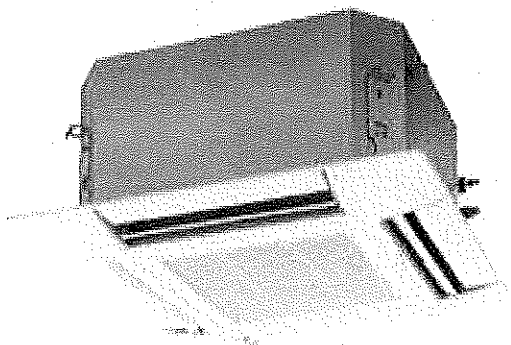
Indoor Unit Type: **2' x 2' 4 Way Cassette**
Rated Cooling Conditions: Indoor: 80°F DB/67°F WB
Ambient: 95°F DB/75°F WB
Rated Heating Conditions: Indoor: 70°F DB/60°F WB
Ambient: 47°F DB/43°F WB
Rated Piping Length (ft): **25**
Rated Height Separation (ft): **0**

Indoor Unit Details

Power Supply (V/Hz/Ph): **208-230/60/1ph**
Power Supply Connections: **L1, L2, Ground**
Min. Circuit Amps MCA (A): **0.8**
Max. Overcurrent Protection (MOP) (A): **15**
Dimensions (HxWxD): **11 1/4x22 5/8x22 5/8**
Panel (HxWxD): **2 5/32x27 9/16x27 9/16**
Net Weight (lbs): **42**
Net Weight with Panel (lbs): **48**

Airflow Rate (CFM wet coil): **335/265**
Moisture Removal (pt/h): _____
Gas Pipe Connection (inch): **1/2**
Liquid Pipe Connection (inch): **1/4**
Condensate Connection (inch): **1-1/32**
Sound Pressure Level (dBA): **41**
Sound Power Level (dBA): _____
External Static Pressure/Max (inWg): **0 / 0**
Controller Name: _____

FXZQ12M7VJU



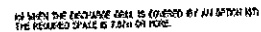
FXZQ12M7VJU

Std U.S. Warranty: 7yrs Compressor, 1yrs Parts



Approval: _____
Date: _____
Construction: _____
Unit #: _____
Drawing #: _____

Dimensional Drawing - Indoor Unit



Submittal Data Sheet

Project Name: _____
Location: _____
Engineer: _____
Submitted to: _____
Submitted by: _____
Reference: _____

Approval: _____
Date: _____
Construction: _____
Unit #: _____
Drawing #: _____

Performance

Indoor Unit Model No: **FXZQ18M7VJU**
Rated Cooling Capacity (Btu/hr): **18000**
Sensible Capacity (Btu/hr): **13000**
Cooling Input Power (kW): **0.128**
Rated Heating Capacity (Btu/hr): **21000**
Heating Input Power (kW): **0.122**

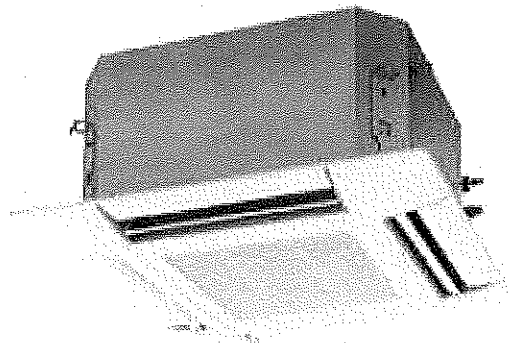
Indoor Unit Type: **2' x 2' 4 Way Cassette**
Rated Cooling Conditions: Indoor: 80°F DB/67°F WB
Ambient: 95°F DB/75°F WB
Rated Heating Conditions: Indoor: 70°F DB/60°F WB
Ambient: 47°F DB/43°F WB
Rated Piping Length (ft): **25**
Rated Height Separation (ft): **0**

Indoor Unit Details

Power Supply (V/Hz/Ph): **208-230/60/1ph**
Power Supply Connections: **L1, L2, Ground**
Min. Circuit Amps MCA (A): **0.9**
Max. Overcurrent Protection (MOP) (A): **15**
Dimensions (HxWxD): **11 1/4x22 5/8x22 5/8**
Panel (HxWxD): **2 5/32x27 9/16x27 9/16**
Net Weight (lbs): **42**
Net Weight with Panel (lbs): **48**

Airflow Rate (CFM wet coil) **495/353**
Moisture Removal (pt/h): _____
Gas Pipe Connection (inch): **1/2**
Liquid Pipe Connection (inch): **1/4**
Condensate Connection (inch): **1-1/32**
Sound Pressure Level (dBA): **41**
Sound Power Level (dBA): _____
External Static Pressure/Max (inWg): **0 / 0**
Controller Name: _____

FXZQ18M7VJU



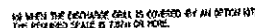
FXZQ18M7VJU

Std U.S. Warranty: 7yrs Compressor, 1yrs Parts



Approval: _____
Date: _____
Construction: _____
Unit #: _____
Drawing #: _____

Dimensional Drawing - Indoor Unit



Submittal Data Sheet

Project Name: _____
Location: _____
Engineer: _____
Submitted to: _____
Submitted by: _____
Reference: _____

Approval: _____
Date: _____
Construction: _____
Unit #: _____
Drawing #: _____

Performance

Indoor Unit Model No:	FXAQ18PVJU
Rated Cooling Capacity (Btu/hr):	18000
Sensible Capacity (Btu/hr):	13700
Cooling Input Power (kW):	0.033
Rated Heating Capacity (Btu/hr):	20000
Heating Input Power (kW):	0.039

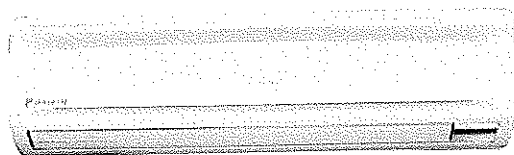
Indoor Unit Type:	Wall Mounted
Rated Cooling Conditions	Indoor: 80°F DB/67°F WB Ambient: 95°F DB/75°F WB
Rated Heating Conditions	Indoor: 70°F DB/60°F WB Ambient: 47°F DB/43°F WB
Rated Piping Length (ft)	25
Rated Height Separation (ft)	0

Indoor Unit Details

Power Supply (V/Hz/Ph):	208-230/60/1ph
Power Supply Connections:	L1, L2, Ground
Min. Circuit Amps MCA (A):	0.5
Max. Overcurrent Protection (MOP) (A):	15
Dimensions (HxWxD):	11-3/8x41-3/8x9-1/4
Panel (HxWxD):	N/A
Net Weight (lbs):	31
Net Weight with Panel (lbs):	

Airflow Rate (CFM wet coil)	500//400
Moisture Removal (pt/h):	
Gas Pipe Connection (inch):	1/2
Liquid Pipe Connection (inch):	1/4
Condensate Connection (inch):	11/16
Sound Pressure Level (dBA):	43
Sound Power Level (dBA):	
External Static Pressure/Max (inWg):	0 / 0
Controller Name:	

FXAQ18PVJU



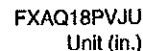
FXAQ18PVJU

Std U.S. Warranty: 7yrs Compressor, 1yrs Parts



Approval: _____
Date: _____
Construction: _____
Unit #: _____
Drawing #: _____

FXAQ18PVJU



Minivent-750

CONSTRUCTION FEATURES AND ACCESSORIES

Unit Overview

Model	Outside Air (CFM)	Exhaust (CFM)	Electrical V/C/P
Minivent-750	450	450	115/60/1

Features

- Exterior housing constructed of galvanized steel
- Energy recovery cassette with a desiccant wheel
- Two direct drive blower and motor assemblies
- Ball bearing motors
- Corrosion resistant fasteners
- Forward curved steel wheels
- Fan shafts in permanently lubricated rubber mounted ball bearings
- Housing lined with .5 in insulation
- Pleated 1 in filters (30% efficient)
- Single point wiring
- Four factory mounted hanging brackets
- Removable panels enable easy access to internal components

Options and Accessories

- Listed to UL-1995
- Solid State Speed Controllers, (2), Shipped Loose



Note: Weight does NOT include skid/crating and may vary by 15% based on selected options.

Minivent-750

PERFORMANCE AND SPECIFICATIONS

Description/Arrangement

Model	Qty	Unit Weight (lb)	Side A Discharge	Side A Intake	Side B Discharge	Side B Intake
Minivent-750	1	250	Side / Top	Side	Side / Bottom	Side

Design Conditions

Elevation (ft)	Summer DB (F)	Summer WB (F)	Winter DB (F)
154	92	74	13

Air Performance

Type	Volume (CFM)	External SP (in. wg)	Total SP (in. wg)	RPM	Motor Size (hp)
Supply	450	0.5	0.5	1011	1/3
Exhaust Normal	450	0.5	0.5	1011	1/3

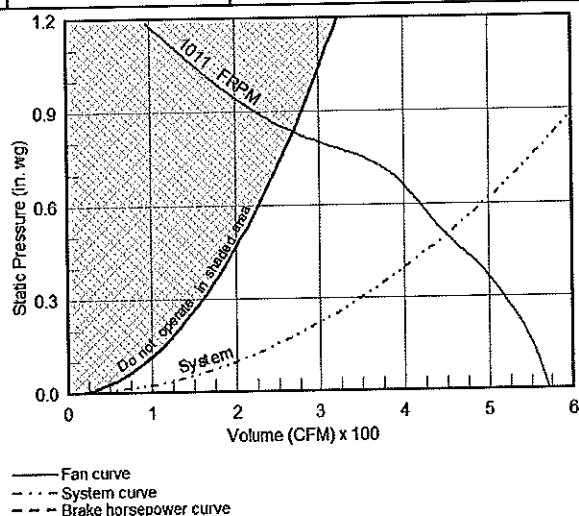
Electrical/Motor Specifications

VIC/P	Unit MCA (amps)	Unit MOP (amps)	Enclosure	Motor RPM	Supply Efficiency
115/60/1	18.3	25	ODP	1625	SE

Minivent-750 FAN CURVES

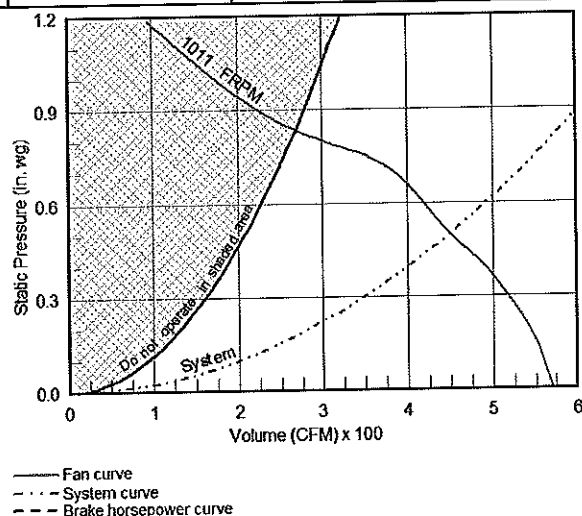
Supply Fan Performance

Volume (CFM)	Supply SP (in wg)	Total SP (in wg)	RPM	Motor Size (hp)	Fan Quantity
450	0.5	0.5	1011	1/3	1



Exhaust Fan Performance - Normal Operation

Volume (CFM)	Exhaust SP (in wg)	Total SP (in wg)	RPM	Motor Size (hp)	Fan Quantity
450	0.5	0.5	1011	1/3	1



Minivent-750

FAN SOUND PERFORMRANCE

EXHAUST FAN SOUND PERFORMANCE

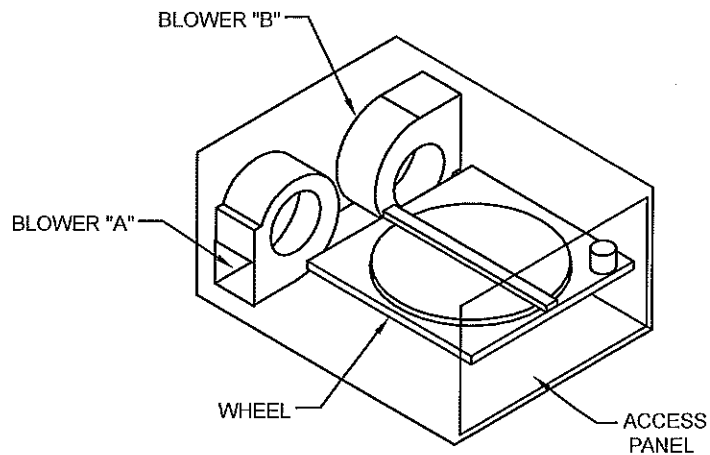
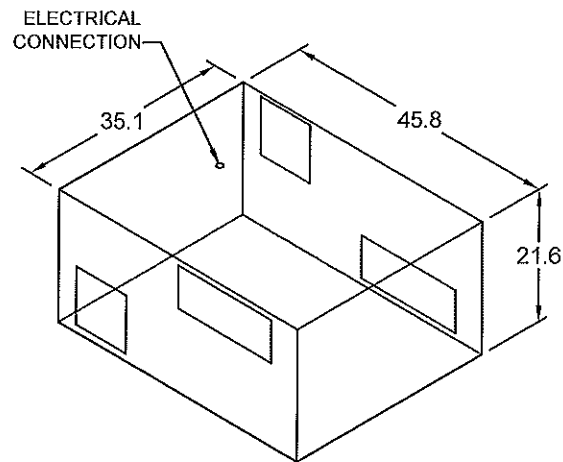
Exhaust Inlet Sound Power by Octave Band								Lwa	dBA
62.5	125	250	500	1000	2000	4000	8000		
74.7	73.8	62	47.5	51.5	49.2	46.5	43	61.2	49.7

SUPPLY FAN SOUND PERFORMANCE

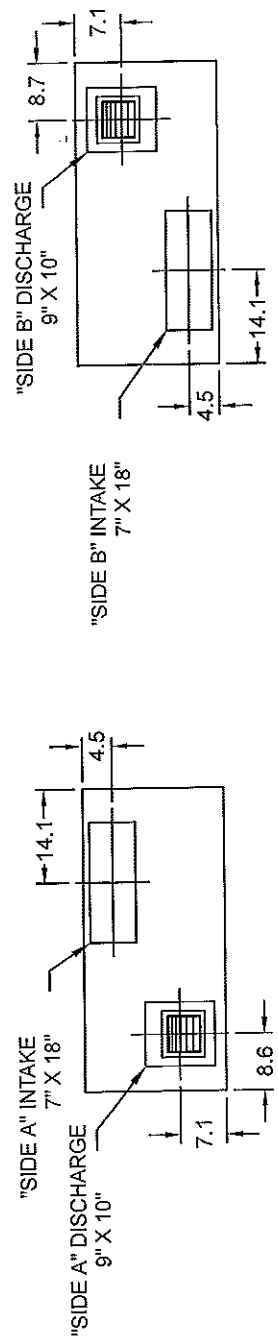
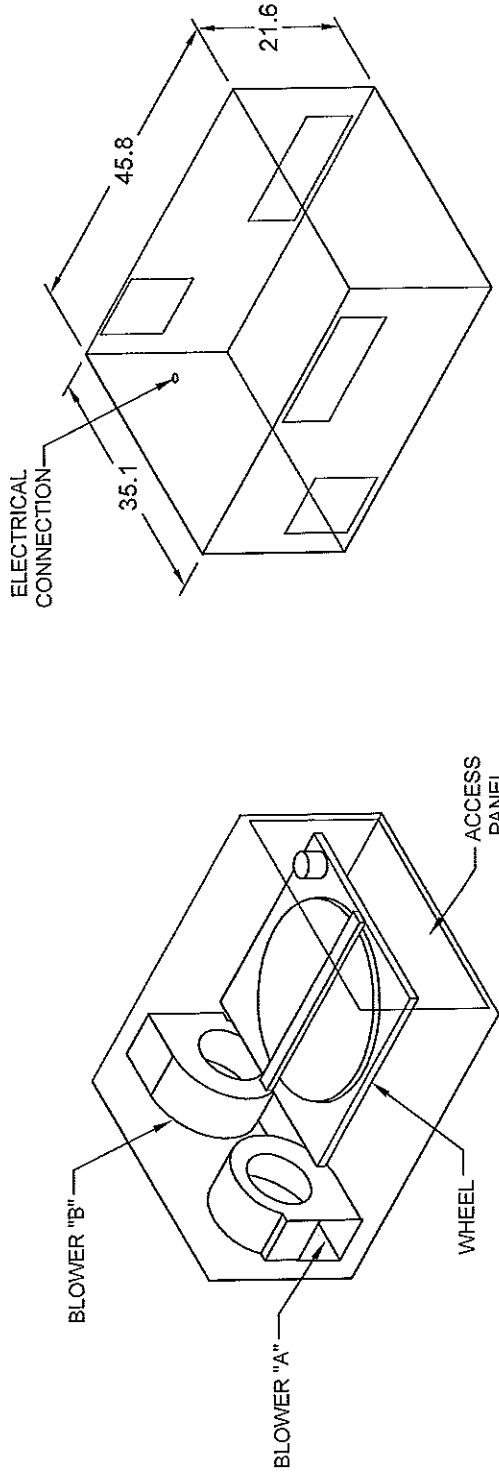
Supply Outlet Sound Power by Octave Band								Lwa	dBA
62.5	125	250	500	1000	2000	4000	8000		
74.7	73.8	62	47.5	51.5	49.2	46.5	43	61.2	49.7

Minivent-750

ISOMETRIC DRAWINGS



Minivent-750
OVERVIEW DRAWINGS



Minivent-750

UNIT WARRANTY

Limited Warranty

Greenheck warrants this equipment to be free from defects in material and workmanship for a period of 1 year(s) from the purchase date. The energy recovery wheel is warranted to be free from defects in material and workmanship for a period of five years from the purchase date. Any component which proves defective during the warranty period will be repaired, or replaced, at Greenheck's sole option when returned to our factory, transportation prepaid.

The warranty does not include labor costs associated with troubleshooting, removal, or installation. Greenheck will not be liable for any consequential, punitive, or incidental damages resulting from use, repair, or operation of any Greenheck product.

This warranty is exclusive, and is in lieu of all other warranties, whether written, oral or implied, including the warranty of merchantability and the warranty of fitness for a particular purpose.

Minivent-450

CONSTRUCTION FEATURES AND ACCESSORIES

Unit Overview

Model	Outside Air (CFM)	Exhaust (CFM)	Electrical V/C/P
Minivent-450	320	225	115/60/1

Features

- Exterior housing constructed of galvanized steel
- Energy recovery cassette with a desiccant wheel
- Two direct drive blower and motor assemblies
- Ball bearing motors
- Corrosion resistant fasteners
- Forward curved steel wheels
- Fan shafts in permanently lubricated rubber mounted ball bearings
- Housing lined with .5 in insulation
- Pleated 1 in filters (30% efficient)
- Single point wiring
- Four factory mounted hanging brackets
- Removable panels enable easy access to internal components

Options and Accessories

- Listed to UL-1995
- Solid State Speed Controllers, (2), Shipped Loose



Note: Weight does NOT include skid/crating and may vary by 15% based on selected options.

Minivent-450

PERFORMANCE AND SPECIFICATIONS

Description/Arrangement

Model	Qty	Unit Weight (lb)	Side A Discharge	Side A Intake	Side B Discharge	Side B Intake
Minivent-450	1	150	Side / Top	Side	Side / Bottom	Side

Design Conditions

Elevation (ft)	Summer DB (F)	Summer WB (F)	Winter DB (F)
154	92	74	13

Air Performance

Type	Volume (CFM)	External SP (in. wg)	Total SP (in. wg)	RPM	Motor Size (hp)
Supply	320	0.5	0.5	1399	NA
Exhaust Normal	225	0.5	0.5	1252	NA

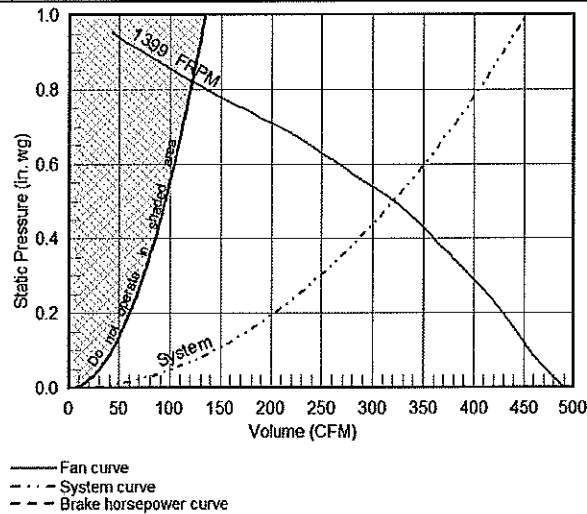
Electrical/Motor Specifications

VIC/P	Unit MCA (amps)	Unit MOP (amps)	Enclosure	Motor RPM	Supply Efficiency
115/60/1	8.1	15	ODP	1600	SE

Minivent-450 FAN CURVES

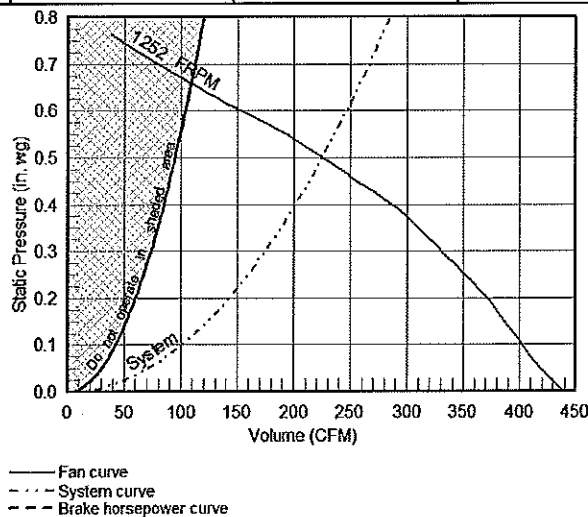
Supply Fan Performance

Volume (CFM)	Supply SP (in wg)	Total SP (in wg)	RPM	Motor Size (hp)	Fan Quantity
320	0.5	0.5	1399	NA	1



Exhaust Fan Performance - Normal Operation

Volume (CFM)	Exhaust SP (in wg)	Total SP (in wg)	RPM	Motor Size (hp)	Fan Quantity
225	0.5	0.5	1252	NA	1



Minivent-450

FAN SOUND PERFORMRANCE

EXHAUST FAN SOUND PERFORMANCE

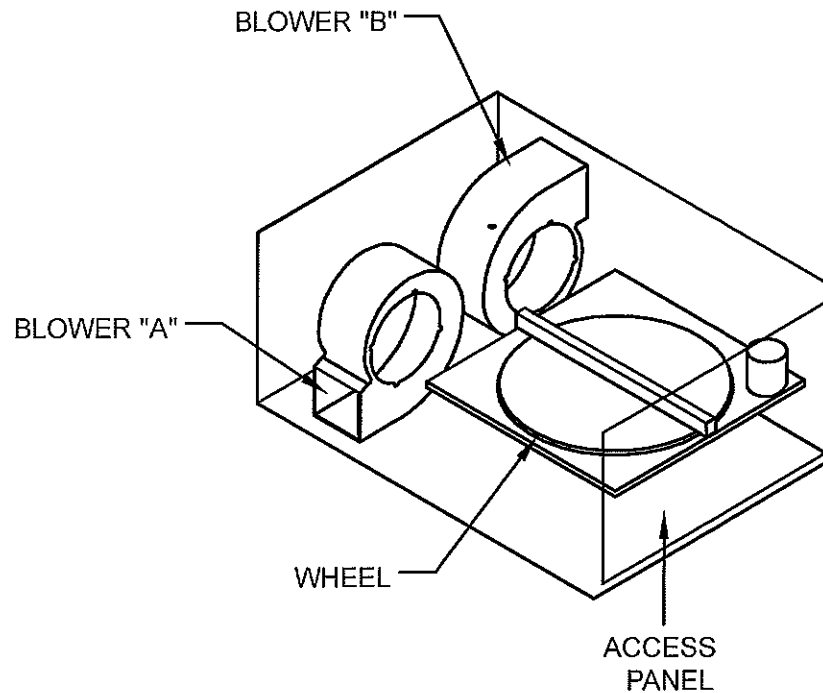
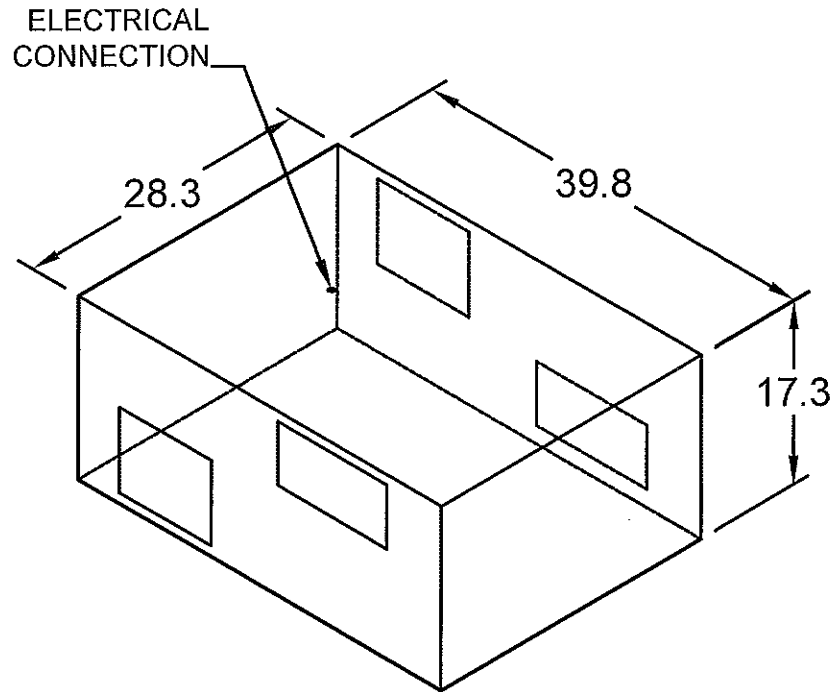
Exhaust Inlet Sound Power by Octave Band								Lwa	dBA
62.5	125	250	500	1000	2000	4000	8000		
64.9	72.1	69.1	57.6	43.3	40.8	40.8	37.6	62.9	51.4

SUPPLY FAN SOUND PERFORMANCE

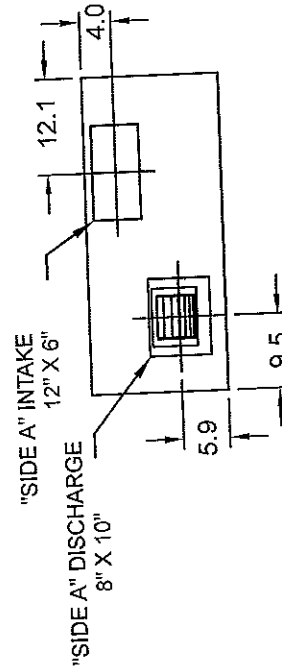
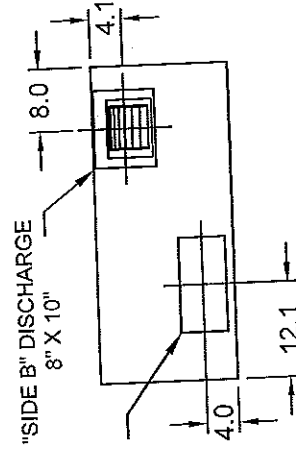
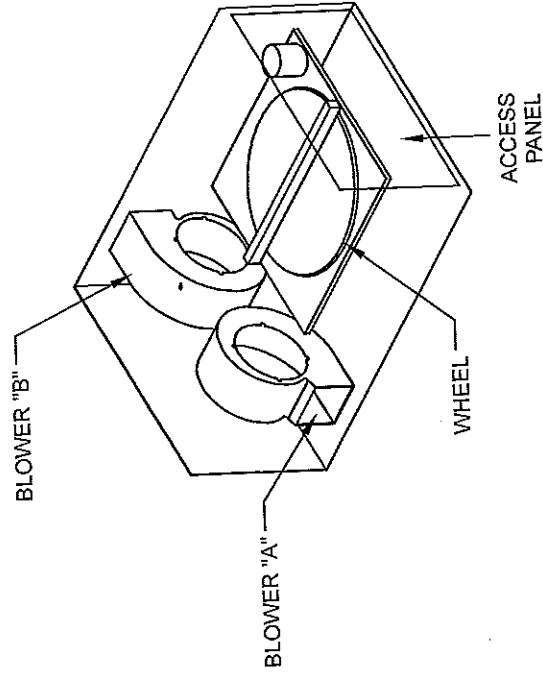
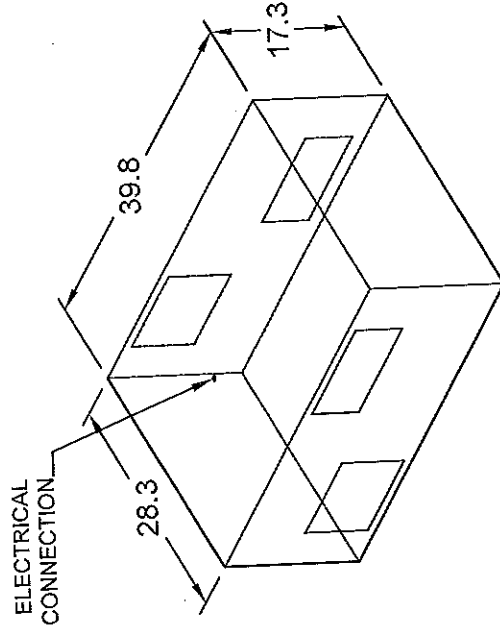
Supply Outlet Sound Power by Octave Band								Lwa	dBA
62.5	125	250	500	1000	2000	4000	8000		
64.1	70.1	67.7	56.1	44	43.4	43.4	39.9	61.5	50

Minivent-450

ISOMETRIC DRAWINGS



Minivent-450 OVERVIEW DRAWINGS



Minivent-450

UNIT WARRANTY

Limited Warranty

Greenheck warrants this equipment to be free from defects in material and workmanship for a period of 1 year(s) from the purchase date. The energy recovery wheel is warranted to be free from defects in material and workmanship for a period of five years from the purchase date. Any component which proves defective during the warranty period will be repaired, or replaced, at Greenheck's sole option when returned to our factory, transportation prepaid.

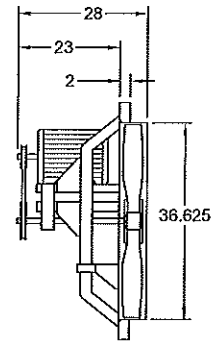
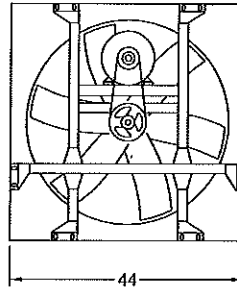
The warranty does not include labor costs associated with troubleshooting, removal, or installation. Greenheck will not be liable for any consequential, punitive, or incidental damages resulting from use, repair, or operation of any Greenheck product.

This warranty is exclusive, and is in lieu of all other warranties, whether written, oral or implied, including the warranty of merchantability and the warranty of fitness for a particular purpose.

Model: SBE-3H36-20

Sidewall Belt Drive Exhaust Fan

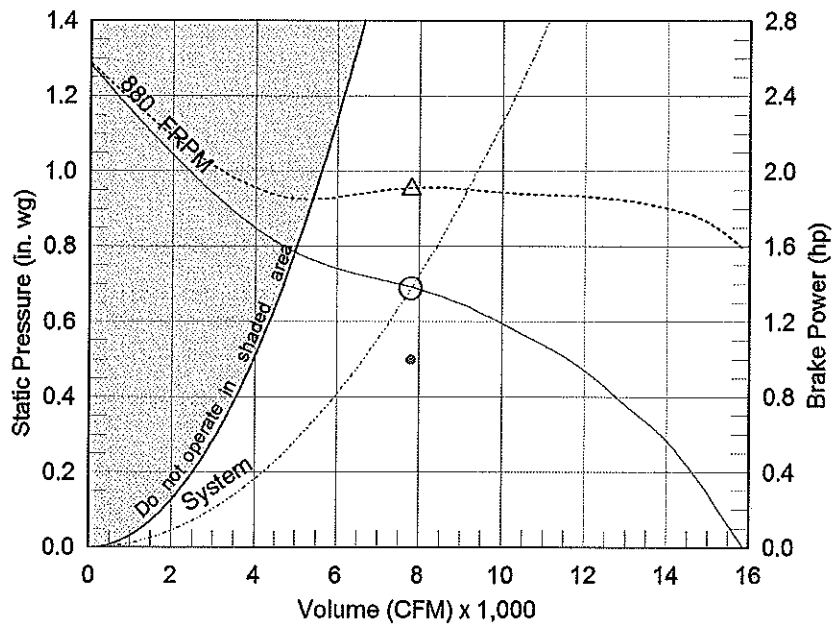
Dimensional	
Quantity	1
Weight w/o Acc's (lb)	150
Weight w/ Acc's (lb)	442
Max T Motor Frame Size	184
Wall Opening (in.)	45.75 x 45.75



AIR FLOW

See the Assembly Drawing For
 Selected Accessories

Performance	
Requested Volume (CFM)	7,800
Actual Volume (CFM)	7,800
External SP (in. wg)	0.5
Total SP (in. wg)	0.689
Fan RPM	880
Operating Power (hp)	1.9
Elevation (ft)	154
Airstream Temp.(F)	70
Air Density (ft3)	0.075
Drive Loss (%)	4.9
Tip Speed (ft/min)	8,296
Static Eff. (%)	47



Motor	
Motor Mounted	Yes
Size (hp)	2
V/C/P	208/60/3
Enclosure	ODP
Motor RPM	1725
Windings	1
NEC FLA* (Amps)	7.5

- △ Operating Bhp point
- Operating point at Total SP
- Operating point at External SP
- Fan curve
- System curve
- Brake horsepower curve

Sound Power by Octave Band

Sound Data	62.5	125	250	500	1000	2000	4000	8000	LwA	dBA	Sones
Inlet	92	92	93	89	84	79	75	70	91	79	31

Notes:

All dimensions shown are in units of in.
 *FLA - based on tables 150 or 148 of National Electrical Code 2002. Actual motor FLA may vary, for sizing thermal overload, consult factory.
 LwA - A weighted sound power level, based on ANSI S1.4
 dBA - A weighed sound pressure level, based on 11.5 dB attenuation per Octave band at 5.0 ft - dBA levels are not licensed by AMCA International
 Sones - calculated using AMCA 301 at 5.0 ft



Model: SBE-3H36-20

Sidewall Belt Drive Exhaust Fan

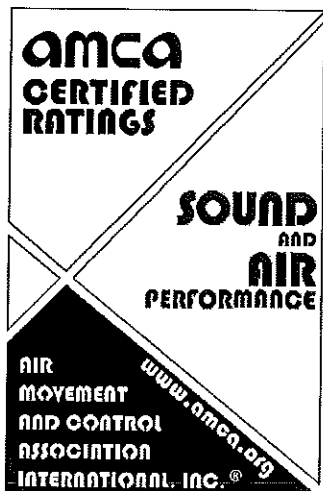
Standard Construction Features:

- Galvanized steel fan panel - Die formed, galvanized steel drive frame assembly
- Fabricated steel propeller for Levels 1 and 2, welded and painted steel for Level 3
- Adjustable motor pulley - Ball bearing motors - Fan shaft mounted in ball bearing pillow blocks - Static resistant belts - Corrosion resistant fasteners

Options & Accessories:

Louver, ESD-403-44.25X44.25, Not Welded, Not Coated
Long Wall Hsg, Extended, w/ OSHA Grd.
Bearings with Grease Fittings

AMCA



AMCA Licensed for Sound and Air Performance Without Appurtenances (Accessories). Power rating (BHP/kW) includes transmission losses.

Greenheck Fan Corporation certifies that the model shown herein is licensed to bear the AMCA Seal. The ratings shown are based on tests and procedures performed in accordance with AMCA Publication 211 and AMCA Publication 311 and comply with the requirements of the AMCA Certified Ratings Program. Performance certified is for installation type A: Free inlet, Free outlet. Power rating (BHP/kW) includes transmission losses. Performance ratings do not include the effects of appurtenances (accessories). The sound ratings shown are loudness values in fan sones at 5 ft. (1.5 m) in a hemispherical free field calculated per AMCA Standard 301. Values shown are for installation type A: free inlet hemispherical sone levels. dBA levels are not licensed by AMCA International. The AMCA Certified Ratings Seal applies to sone ratings only.

The AMCA licensed air and/or sound performance data has been modified for installation, appurtenances or accessories, etc. not included in the certified data. The modified performance is not AMCA licensed but is provided to aid in selection and applications of the product.