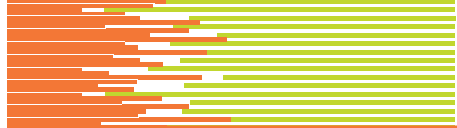


GEORGIA TECH SOLAR DECATHLON 07



PROJECT SPECIFICATIONS

PROJECT ICARUS

08.07.07

ADDENDA TO MAIN SPECS FROM 03.03.07
MECHANICAL, ELECTRICAL, AND PLUMBING

The Solar Decathlon is a project of the U.S. Department of Energy (DOE) in partnership with DOE's National Renewable Energy Laboratory.



SOLAR DECATHLON



Heating Ventilation and Air Conditioning (HVAC)

1.1 Introduction

The Heating Ventilation and Air Conditioning (HVAC) system provides the heating, cooling and dehumidification needs of the Solar Decathlon House. It has its own sequence of operations that are all and in part coordinated with the overall control logic of the house. It shares information with other subsystems in order to achieve optimal energy use.

The criteria of the system design are to achieve the maximum allowable points during the competition.

The point distribution is as follows:

100 points for comfort zone

150 points for engineering

100 points for energy balance

For the comfort zone competition, there is a delicate balance in which our indoor environments comfortably operate. The HVAC system must be effectively designed to consistently achieve the

predetermined target temperature and humidity. The tight temperature range of 72-76 °F and relative humidity of 40-55% are defined as the optimal comfort zones.

For the engineering competition, a model will be used to predict the annual energy performance of the house. The model will be assessed on the building envelope, indoor environmental control, mechanical, electrical, and plumbing systems. The indoor environmental control and the mechanical systems are the focus of the HVAC team.

For the energy balance competition, the HVAC system will need to work succinctly with the other components of the house as to allow for cohesion within the house. Similarly, the HVAC system must consume least amount of energy provided by the photovoltaic system as possible.

The HVAC system for the Georgia Institute of Technology's Solar Decathlon House consists of one outdoor heat pump unit, two indoor fan coil units, one energy recovery ventilation unit, one dehumidifier, and ducts. Please refer to section 3 for the sequence of operations and section 4 for the mechanical drawings.

1.2. System Specifications

The HVAC system for the Georgia Tech Solar Decathlon House currently consists of one outdoor heat pump unit, two indoor fan coil units, one energy recovery ventilation system, one dehumidifier, and ducts. Specific information regarding each piece of equipment is detailed out in the next couple sub-sections.

Please note that the HVAC system is continually being updated. Therefore, some of the information might be not be completely up-to-date.

1.2.1. Heat Pump

Table 1.2.1.1. Heat Pump System Specifications

Unit	Outdoor Condenser
Manufacturer	Mitsubishi
Model	MXZ-3A30NA
Sound Rating (dB)	49
Heating Capacity (BTU)	28,600
Cooling Capacity (BTU)	28,400
SEER	16
HSPF	10
Dimensions (H-W-D) (in)	35-7/16 x 35-7/16 x 12-19/32
Weight (lbs)	158
Supply Voltage (V)	208/230
Power Supply (W)	1000-3250



Figure 1.2.1.1. Mitsubishi MXZ-3A30NA

1.2.2. Fan Coil Unit

Table 1.2.2.1: Fan Coil Unit System Specifications

Unit	Indoor Fan Coil (Bedroom)	Indoor Fan Coil (Living)
Manufacturer	Mitsubishi	Mitsubishi
Model	MSZ-A9NA	MSZA12-NA
Cooling Capacity (Btu/h)	8,500	8,500
Heating Capacity (Btu/h)	8,600	8,600
Dimensions (H-W-D) (in)	12 x 30-1/2 x 8-1/2	12 x 30-1/2 x 8-1/2
Weight (lbs)	23	23
Supply Voltage (V)	(From outdoor unit)	(From outdoor unit)
Power Supply (W)	(From outdoor unit)	(From outdoor unit)
Quantity	1	2



Figure 1.2.2.1 MSZ Fan coil unit

1.2.3. Energy Recovery Ventilation Unit

Table 1.2.3.1: Energy Recovery Ventilation Unit System Specifications

Unit	ERV
Manufacturer	UltimateAir
Model	200DX
Air Flow (CFM)	60-210
Dimensions (H-W-D) (in)	25 x 19 x 25
Weight (lbs)	72
Supply Voltage (V)	120
Power Supply (W)	34-200
Quantity	1



Figure 1.2.3.1. UltimateAir 200DX Energy Recovery Ventilation Unit

INVERTER Technology for Superior Year-round Comfort and Performance

INVERTER Technology

Select straight-cool and all heat pump outdoor units employ Mitsubishi Electric’s INVERTER-driven compressor technology (Variable Frequency Drive) to provide exceptional, high-speed cooling and heating performance. Thanks to high rotation speeds, desired temperatures are reached more quickly than with conventional systems. So you can enjoy your ideal level of comfort without delay.

High-speed Cooling and Heating

High rotation compressor speeds also cool and heat a room quickly, saving both energy and cash. The compressor speed is controlled to maximize efficiency, changing speeds according to the cooling and heating load of a room.

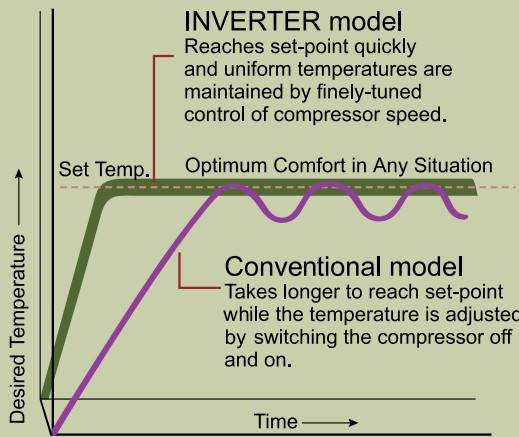
Optimum Comfort Year-round

Conventional units start and stop repetitively, unlike INVERTER units that detect subtle changes in temperature and adjust compressor speed automatically. Low rotation speed efficiently maintains desired temperature to reduce temperature swings and provide a more comfortable climate.

Extra Energy Savings

For optimum performance INVERTER technology delivers only the energy needed to satisfy the cooling and heating load of a room, thereby reducing energy consumption.

Our CITY MULTI® product line also employs INVERTER technology. Find out how the Mr. Slim® and the CITY MULTI INVERTER systems give you even greater performance capabilities and design flexibility, making Mitsubishi Electric products the best choice for any of your cooling and heating applications by visiting www.mehvac.com.



Wireless Remote Controller



Mitsubishi Electric Shizuoka Works acquired ISO 9001 certification under Series 9000 of the International Standard Organization (ISO), based on a review of quality warranties for the production of air-conditioning equipment. The plant also acquired environmental management system standard ISO 14001 certification.

Choose the Mr. Slim® Product Size That’s Right for You

Room Size	Performance
100 - 350 Sq. Ft.	<9,500 BTU/H
350 - 440 Sq. Ft.	9,500 - 12,000 BTU/H
440 - 550 Sq. Ft.	12,000 - 15,000 BTU/H
550 - 600 Sq. Ft.	15,000 - 16,200 BTU/H
600 - 800 Sq. Ft.	16,200 - 22,000 BTU/H
800 - 1,100 Sq. Ft.	22,000 - 30,000 BTU/H

This table is for general guidance only. Additional conditions may factor into your actual cooling or heating needs. Please contact your contractor or Mitsubishi Electric for a more accurate determination of your specific cooling or heating needs.

Efficient. Quiet. Secure. Pick All Three.

That’s right. Reliable Mr. Slim units deliver all of these. First its small design, smart functionality, and lack of ductwork plus INVERTER technology make it energy-efficient. Second, the unit’s fan is designed to deliver air quietly and continuously with only a gentle whoosh for constant circulation and filtration. (That’s why Mr. Slim systems were the first choice for thousands of churches, schools, and libraries across the U.S. *Shhh!*) Third, because each system installs with only a three-inch opening for connecting the indoor and outdoor units, you don’t have to worry about thieves gaining access through an easy-to-remove window unit. With Mr. Slim systems you can sleep in quiet comfort with a sense of security.



Mitsubishi Electric Advanced Products Division
3400 Lawrenceville Suwanee Road
Suwanee, GA 30024

Phone: 888-467-7546 Fax: 800-658-1458



Features	Benefits
EFFICIENT, QUIET OPERATION	Mr. Slim products are designed to be quieter and more efficient than old window units, so you’ll sleep easier with less worry about operating costs.
NO DUCTWORK AND EASY TO INSTALL	Mr. Slim systems install without ductwork, requiring only a three-inch opening in the wall or ceiling. This design allows you to retain the original aesthetics of a room. Because no ductwork is involved, the installation can be quick and simple, which means little or no disruption to your home or business.
VERSATILE	From living rooms to kitchens to cafeterias, there’s a Mr. Slim system to fit any cooling or heating need.
WIRELESS REMOTE CONTROLLER	Mr. Slim M-Series systems come with a convenient wireless remote controller that puts you in control of your own comfort. (Optional wired remote controller available)
ENVIRONMENTALLY FRIENDLY	Mr. Slim systems use an environmentally-friendly refrigerant.
INVERTER TECHNOLOGY	You will enjoy high-speed cooling and heating, and consistent delivery of comfort year-round.

M-SERIES

RESIDENTIAL AND SELECT COMMERCIAL
AIR CONDITIONERS AND HEAT PUMPS

MS | MSY | MSZ | MXZ



Mr. SLIM®
Split-ductless A/C and Heat Pumps



www.mrslim.com



Lifestyle photo courtesy of Mitsubishi Digital Electronics America, Inc. Plasma TV Model PD-5065 shown. Visit mitsubishitv.com for details.

System Control in the Palm of Your Hand

Mr. Slim’s M-Series offers a comprehensive remote controller that controls more than temperature and fan speed. It provides four modes: COOL, HEAT, AUTO, and DRY and has a 12-hour ON/OFF timer, giving you one-button control over your personal comfort. Our MSY(Z)-A24NA model adds the WIDE VANE button to distribute airflow to a wider angle (150 deg.) evenly from right to left to ensure a more comfortable temperature is maintained over a wider area. The M-Series INVERTER models can tie into the P-Series wired controller and CITY MULTI® M-Net with adapter.

Form No. MSBR0M-03-07-20M

For more information visit www.mrslim.com

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Mr. Slim® Systems: Redefining Comfort

Comfort is a concept many of us notice only when we're either uncomfortable or extremely comfy. At Mitsubishi Electric HVAC Advanced Products Division comfort is all we think about, and our industry-leading Mr. Slim split-ductless cooling and heating systems reflect that thinking. At home or at work our Mr. Slim systems are designed to make any space inviting. Maybe your home has a room that's always too hot or too cold. Or perhaps you're looking for a way to control the climate effectively in multiple rooms in your office building, such as the conference room. No matter what your cooling and heating needs may be, Mr. Slim systems are the perfect way to make rooms in your home or workplace as comfortable as possible.

What is Mr. Slim Ductless Technology?

For decades split-ductless air-conditioning systems have been the quiet solution for cooling and heating problems around the world. Our quiet and powerful Mr. Slim systems have three main components: an indoor unit, outdoor unit, and remote controller. These indoor and outdoor units are easily connected by refrigerant lines running through a small three-inch opening in the wall or ceiling. The outdoor unit cycles the refrigerant through the lines to and from the indoor unit, where the air is conditioned and distributed into the indoor space. Installation is as simple as mounting the indoor and outdoor units, connecting the refrigerant lines, and making a few electrical connections. An easy installation for your authorized contractor means you quickly will be enjoying the comfort Mr. Slim systems provide.

Why Mr. Slim Systems?

Mitsubishi Electric is the industry leader in split-ductless air-conditioning technology, period. Our innovations have defined cutting-edge technology for over 25 years. Compare and you'll see no one surpasses the Mr. Slim brand's performance for quiet, easy-to-use, and energy-efficient operation. And since our split-ductless technology

carries the Mitsubishi Electric name, you know every system is built to last. The bottom line is that the Mr. Slim product delivers ultimate comfort control for your home or office. It's true today and will be comfortably evident for years to come.

Small Size, Big Performance

While all of our Mr. Slim units are compact and lightweight, the M-Series is designed specifically for tight spaces. But don't be fooled. The powerful M-Series delivers plenty of cool or warm air to almost any size room. And unlike window units, the Mr. Slim indoor unit's small size, neutral color, and mounting position mean it blends in well.

No Ductwork Required

Mr. Slim systems need no ductwork. There's only a small, three-inch opening connecting the indoor and outdoor units. This means quicker installation, less mess, and a better looking and more comfortable home.



MXZ Multi INVERTER Heat Pump Specifications

INVERTER

Model Name	Outdoor Unit		MXZ-2A20NA *4	MXZ-3A30NA *5	
Indoor Unit	Cooling *1	Rated Capacity	Btu/h	20,000	28,400
		Capacity Range	Btu/h	7,800-20,000	12,600-28,400
		Total Input	W	2,150 (630-2,150)	3,250 (1,000-3,250)
	Heating 47° *2	Rated Capacity	Btu/h	22,000	28,600
		Capacity Range	Btu/h	8,500-22,000	11,400-36,000
		Total Input	W	1,780 (620-1,780)	2,180 (740-2,880)
Heating at 17° *3	Capacity	Btu/h	14,500	18,800	
	Total Input	W	1,500	2,120	
Power supply	1 Phase, 60Hz, 208/230V				
Voltage	Indoor - Outdoor S1-S2		AC 208/230V		
	Indoor - Outdoor S2-S3		DC12-24V		
Outdoor Unit	MCA		A	15	15
	Max. Fuse Size		(Time Delay) A	20	20
	Fan Motor		F.L.A.	0.96	0.93
	Compressor	Model (Type)		SNB130FPDH1	TNB220FMCH
		R.L.A.		10.1	11
		L.R.A.		15	15
	Airflow (Cooling/Heating) *1/*2		CFM	1,485/1,640	1,365/1,605
	Refrigerant Control		Linear Expansion Valve		
	Defrost Method		Reverse Cycle		
	Sound Level (Cooling/Heating) *1/*2		dB(A) *1	49/51	49/49
External Finish Color		Munsell 5Y 8/1			
Remote Controller	Type		Wireless Remote		
	Type		R410A		
	Charge		lbs., oz.	5, 15	7, 11
	Oil		Type (fl. oz.)	NE022 (20.3)	NE022 (29.4)
	Gas Side O.D.		inch	A: B: 3/8	A: 1/2; B: C: 3/8
Refrigerant Pipe	Liquid Side O.D.		inch	1/4	1/4
	Height Difference (Max.)		feet	33	33
	Length (Max.) (a + b or a + b + c)		feet	164	230
	Length (Each Outdoor Unit)		feet	82	82
Connection Method	Indoor/Outdoor			Flared/Flared	

MXZ-3A30NA Combinations

Indoor Unit Combinations (Unit A + Unit B + Unit C)		Cooling Capacity (Btu/h)				Power Usage (W)	Energy Efficiency		Current (A)		Port Adapter Requirements	
		Heating Capacity (Btu/h)									Size	Qty. and Joint Pipe Part No.
		Unit A	Unit B	Unit C	Total				SEER	HSPF		
MSZ-A09NA + MSZ-A09NA	9,000	9,000	—	18,000	1,800	13.0	7.7	8.92	8.07	N.A.		
	10,900	10,900	—	21,800	1,700			8.43	7.62			
MSZ-A09NA + MSZ-A12NA	9,000	12,000	—	21,000	2,000	13.0	7.7	9.91	8.96	N.A.		
	10,900	13,600	—	24,500	1,980			9.81	8.87			
MSZ-A09NA + MSZ-A15NA	9,000	15,000	—	24,000	2,500	13.0	7.7	12.39	11.21	N.A.		
	10,100	16,900	—	27,000	2,200			12.90	9.86			
MSZ-A09NA + MSZ-A17NA	9,000	16,200	—	25,200	2,700	13.0	7.7	13.38	12.10	N.A.		
	9,300	17,700	—	27,000	2,200			12.90	9.86			
MSZ-A09NA + MSZ-A24NA	7,600	20,400	—	28,000	3,200	13.0	7.7	15.86	14.34	3/8 X 5/8" or 1/2 X 5/8"	(1) PAC-SG76RJ-E or (1) MAC-A456JP-E	
	7,300	19,700	—	27,000	1,980			9.81	8.87			
MSZ-A12NA + MSZ-A12NA	12,000	12,000	—	24,000	2,500	13.0	7.7	12.39	11.21	N.A.		
	13,500	13,500	—	27,000	2,200			12.90	9.86			
MSZ-A12NA + MSZ-A15NA	11,500	14,500	—	26,000	2,800	13.0	7.7	13.88	12.55	N.A.		
	12,000	15,000	—	27,000	2,160			10.71	9.68			
MSZ-A12NA + MSZ-A17NA	10,800	15,200	—	26,000	2,800	13.0	7.7	13.88	12.55	N.A.		
	11,200	15,800	—	27,000	2,140			10.61	9.59			
MSZ-A15NA + MSZ-A15NA	13,000	13,000	—	26,000	2,800	13.0	7.7	13.88	12.55	3/8 X 1/2"	(1) MAC-A454JP-E	
	13,500	13,500	—	27,000	2,120			10.51	9.50			
MSZ-A15NA + MSZ-A17NA	12,200	13,800	—	26,000	2,800	13.0	7.7	13.88	12.55	3/8 X 1/2"	(1) MAC-A454JP-E	
	12,700	14,300	—	27,000	2,110			10.46	9.46			
MSZ-A17NA + MSZ-A17NA	13,000	13,000	—	26,000	2,800	13.0	7.7	13.88	12.55	3/8 X 1/2"	(1) MAC-A454JP-E	
	13,500	13,500	—	27,000	2,100			10.41	9.41			
MSZ-A09NA + MSZ-A09NA + MSZ-A09NA	9,000	9,000	9,000	27,000	2,860	13.0	7.7	14.18	12.82	1/2 X 3/8"	(1) MAC-A455JP-E	
	9,500	9,500	9,500	28,500	2,180			10.80	9.77			
MSZ-A09NA + MSZ-A09NA + MSZ-A12NA	8,500	8,500	11,400	28,400	3,250	16.0	10.0	16.11	14.57	1/2 X 3/8"	(1) MAC-A455JP-E	
	8,600	8,600	11,400	28,600	2,180			10.80	9.77			
MSZ-A09NA + MSZ-A09NA + MSZ-A15NA	7,750	7,750	12,900	28,400	3,250	13.0	7.7	16.11	14.57	N.A.		
	7,800	7,800	13,000	28,600	2,180			10.80	9.77			
MSZ-A09NA + MSZ-A09NA + MSZ-A17NA	7,300	7,300	13,800	28,400	3,250	13.0	7.7	16.11	14.57	N.A.		
	7,350	7,350	13,900	28,600	2,180			10.80	9.77			



Note: Test conditions are based on ARI 210/240

- *1 Rating conditions (cooling) - Indoor: 80° FDB, 67° FWB, Outdoor: 95° FDB, 75° FWB.
- *2 Rating conditions (heating) - Indoor: 70° FDB, 60° FWB, Outdoor: 47° FDB, 43° FWB.
- *3 Rating conditions (heating) - Indoor: 70° FDB, 60° FWB, Outdoor: 17° FDB, 15° FWB
- *4 Data from combination of Indoor Units MSZ-A09NA and MSZ-A12NA.
- *5 Data from combination of Indoor Units MSZ-A09NA, MSZ-A09NA, and MSZ-A12NA.

Power factor equals 97%.

Specifications are subject to change without notice.

LIMITED WARRANTY | Six-year warranty on compressor. One-year warranty on parts.

MXZ-2A20NA Combinations

Indoor Unit A + Unit B Combinations	Cooling Capacity (Btu/h)			Power Usage (W)	Energy Efficiency		Current (A)	
	Heating Capacity (Btu/h)				SEER	HSPF	208V	230V
	Unit A	Unit B	Total					
MSZ-A09NA + MSZ-A09NA	9,000	9,000	18,000	1,740	13.0	7.7	8.62	7.88
	10,900	10,900	21,800	1,820			9.02	8.16
MSZ-A09NA + MSZ-A12NA	8,500	11,500	20,000	2,150	16.0	9.0	10.66	9.64
	9,500	12,500	22,000	1,780			8.82	7.98
MSZ-A09NA + MSZ-A15NA*	7,500	12,500	20,000	2,150	13.0	7.7	10.66	9.64
	8,250	13,750	22,000	1,780			8.82	7.98
MSZ-A12NA + MSZ-A12NA	10,000	10,000	20,000	2,150	13.0	7.7	10.66	9.64
	11,000	11,000	22,000	1,780			8.82	7.98

Port Adapter size = 3/8" x 1/2", Qty = 1, Part No. = MAC-A454JP-E



MS/MSY/MSZ Systems

Model Name	Indoor Unit		MS-A09WA	MS-A12WA	MSY-A15NA	MSY-A17NA	MSY-A24NA	MSZ-A09NA	MSZ-A12NA	MSZ-A15NA	MSZ-A17NA	MSZ-A24NA	
	Outdoor Unit		MU-A09WA	MU-A12WA	MUY-A15NA	MUY-A17NA	MUY-A24NA	MUZ-A09NA	MUZ-A12NA	MUZ-A15NA	MUZ-A17NA	MUZ-A24NA	
Cooling *1	Rated Capacity	Btu/h	9,500	12,000	15,000	16,200	22,000	9,000	12,000	15,000	16,200	22,000	
	Capacity Range	Btu/h	N.A.	N.A.	3,000-15,000	3,100-15,000	4,400-22,000	5,500-9,000	5,700-12,000	3,100-15,000	3,100-16,200	4,400-22,000	
	Energy Efficiency	SEER	13		16			17			16		
	Moisture Removal	Pints/h	2.7	3.2	4.7	5.1	7.3	2.3	3.2	4.7	5.1	7.3	
	Sensible Heat Factor		0.68	0.70	0.65	0.65	0.63	0.71	0.70	0.65		0.63	
Heating at 47° *2	Rated Capacity	Btu/h	N.A.		N.A.			10,900	13,600	18,000	20,100	23,200	
	Capacity Range	Btu/h	N.A.		N.A.			5,200-12,600	5,200-13,600	3,400-20,900		3,600-24,400	
	HSPF (Region IV)	Btu/h/W	N.A.		N.A.			8.2					
Heating at 17° *3	Capacity	Btu/h	N.A.		N.A.			7,700	8,300	13,000		15,200	
	Total Input	W	N.A.		N.A.			880	930	1,740		1,960	
	Power Supply	Phase, Cycle, Voltage	1 Phase, 60Hz, 115V				1 Phase, 60Hz, 208/230V						
Voltage	Indoor - Outdoor S1-S2	AC 115V				AC 208/230V							
	Indoor - Outdoor S2-S3	DC12-24V				DC12-24V							
	Indoor - Remote Controller	Wireless Type				Wireless Type (Optional Wired Controller: DC12V)							
Indoor Unit	MCA	A	1.2		1.0			1.2		1.0			
	Max. Fuse Size	(Time Delay) A	15					15					
	Airflow (Cool) (Lo-Med-Hi)	DRY (CFM)	183-261-335	222-286-406	268-328-381		296-431-568	152-229-307	152-240-353	268-328-381		296-431-568	
		WET (CFM)	162-233-300	198-254-363	240-293-342		265-385-508	134-205-275	134-215-318	240-293-342		265-385-508	
	Airflow (Heat) (Lo-Med-Hi)	DRY (CFM)	N.A.	N.A.	N.A.	N.A.	N.A.	159-222-307	159-240-353	254-314-381		296-486-568	
	Sound Level (Cooling) (Lo-Med-Hi) *1	dB(A)	26-32-42	33-38-46	34-40-45	34-40-46	34-40-49	22-33-38	22-34-48	34-40-45	34-40-46	34-40-49	
	Sound Level (Heating) (Lo-Med-Hi) *2	dB(A)	N.A.		N.A.			22-33-38	22-34-42	34-38-44	34-38-44	34-40-49	
	External Finish Color		Munsell 1.0Y 9.2/0.2				Munsell 1.0Y 9.2/0.2						
	Dimension Unit	W: inch	30-11/16		30-11/16			43-5/16		30-11/16			43-5/16
		D: inch	8-1/4		8-1/4			10-1/4		8-1/4			10-1/4
H: inch		11-3/4		11-3/4			12-13/16		11-3/4			12-13/16	
Weight Unit		lbs.	23		23			37		23			37
Outdoor Unit	MCA	A	14	16	14		17	12		14		17	
	Max. Fuse Size	(Time Delay) A	15	20	15		20	15				20	
	Sound Level	dB(A) *1	47	52	50	52	55	48		51	53	55	
	External Finish Color		Munsell 3Y 7.8/1.1				Munsell 3Y 7.8/1.1						
	Dimensions	W: inch	31-1/2	33-7/16	31-1/2		33-1/16	31-1/2			33-1/16		
		D: inch	11-1/4		11-1/4			13		11-1/4			13
		H: inch	21-5/8	23-13/16	21-5/8		33-7/16	21-5/8			33-7/16		
	Weight	lbs.	78	96	88			82		88		128	
Remote Controller	Type	Wireless Remote		Wireless Remote (Optional Wired Controller)									
Refrigerant	Type	R410A		R410A									
	Charge	lbs., oz.	2.5	3.1	2.7		4	2.5		2.7		4	
	Oil	Type (fl. oz.)	NE022 (10.8)		NE022 (15.2)			NE022 (10.8)		NE022 (15.2)			
Refrigerant Pipe	Gas Side O.D.	inch	3/8	1/2	1/2		5/8	1/4		1/2		5/8	
	Liquid Side O.D.		1/4		1/4								
	Height (Max.)		35		40			50		40			50
	Length (Max.)	feet	65		65			100		65			100

NOTES: Test conditions are based on ARI 210/240

- *1 Rating conditions (cooling) - Indoor 80° FDB, 67° FWB, Outdoor: 95° FDB, (75° FWB)
- *2 Rating conditions (heating) - Indoor 70° FDB, 60° FWB, Outdoor: 47° FDB, (43° FWB)
- *3 Rating conditions (heating) - Indoor 70° FDB, 60° FWB, Outdoor: 17° FDB, (15° FWB)

Specifications are subject to change without notice.

SUBMITTAL DATA: MXZ-3A30NA
MULTI-INDOOR UNIT INVERTER HEAT-PUMP SYSTEM

Job Name:

Location:

Date:

Purchaser:

Engineer:

Submitted to:

For ☐ Reference ☐ Approval ☐ Construction

Unit Designation:

Schedule No.:

GENERAL FEATURES

- Limited warranty: one year on parts and defects and six years on compressor
- Compact side discharge outdoor unit
- Zone control
- Wireless remote controller
- Automatic fan speed control
- Quiet operation – both indoor and outdoor units
- Auto restart following a power outage
- Self check function – onboard diagnostics
- Advanced microprocessor control

Cooling

Rated capacity 28,400/(12,600 ~ 28,400) Btu/h
SEER 16.0 Btu/h/W
Power consumption 3,250/(1,000 ~ 3,250) W
Power supply 208 / 230V, 1 Phase, 60 Hz

Heating

Rated capacity 28,600/(11,400 ~ 36,000) Btu/h
Power consumption 2,180/(740 ~ 2,880) W
HSPF (I/V) 10.0
COP 13.1
Weight (lbs/Kg) 158 / 72
Field drain pipe size I.D. (inches/mm) 1/2 / 12.7
Compressor DC inverter/twin rotary
MCA 15
Fan motor 0.93 F.L.A.
Sound level 49 dB(A)

DIMENSIONS		INCHES	MM
inches	W	35-7/16	900
	D	12-19/32	320
	H	35-7/16	900

Weight (lbs/Kg) 128 / 58
Refrigerant type R410A
Refrigerant pipe size O.D. (inches/mm)
gas side A: 1/2 / 12.7 B: 3/8 / 9.5
liquid side 1/4 / 6.35
Max. refrigerant pipe length (ft/m) 230 / 70
Max. refrigerant pipe height difference (ft/m) 33 / 10
Connection method flared


Remote
Controller


Outdoor Unit: MXZ-3A30NA

INDOOR MODELS
MSZ-A09NA

9,000 Btu/h Cooling
10,900 Btu/h Heating

MSZ-A12NA

12,000 Btu/h Cooling
13,600 Btu/h Heating

MSZ-A15NA

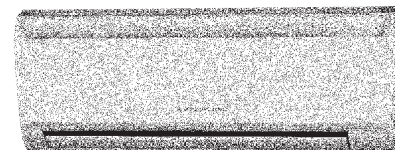
15,000 Btu/h Cooling
18,000 Btu/h Heating

MSZ-A17NA

16,200 Btu/h Cooling
20,100 Btu/h Heating

MSZ-A24NA

22,200 Btu/h Cooling
23,200 Btu/h Heating


NOTES :

*1. Rating conditions (cooling)-indoor : D.B. 80°F, W.B. 67°F
outdoor : D.B. 95°F, W.B. 75°F.

*2. Rating conditions (heating)-indoor : D.B. 70°F, W.B. 60°F outdoor : D.B. 17°F, W.B. 15°F.

Operating range

		Indoor intake air temp.		Outdoor intake air temp.
Cooling	Maximum	D.B. 95°F, W.B. 71°F		D.B. 115°F
	Minimum	D.B. 67°F, W.B. 57°F		D.B. 14°F *
Heating	Maximum	D.B. 80°F, W.B. 67°F		D.B. 70°F, W.B. 59°F
	Minimum	D.B. 70°F, W.B. 60°F		D.B. 12°F, W.B. 10°F

*



Notes:

COOLING: MXZ-3A30NA

Indoor units combination	Cooling capacity (BTU/h)				Power consumption (W)	Current (A)		Power factor (%)
	Unit A	Unit B	Unit C	Total		208V	230V	
09	9,000	—	—	9,000 (7,200 ~ 9,000)	800 (650 ~ 800)	4.05	3.66	95
12	12,000	—	—	12,000 (7,200 ~ 12,000)	1,000 (650 ~ 1,000)	5.06	4.58	95
15	15,000	—	—	15,000 (7,200 ~ 15,000)	1,320 (650 ~ 1,320)	6.68	6.04	95
17	16,200	—	—	16,200 (7,200 ~ 16,200)	1,480 (650 ~ 1,480)	7.49	6.77	95
24	22,000	—	—	22,000 (7,200 ~ 22,000)	2,220 (650 ~ 2,200)	11.13	10.07	95
09+09	9,000	9,000	—	18,000 (12,000 ~ 18,000)	1,800 (920 ~ 1,800)	8.92	8.07	97
09+12	9,000	12,000	—	21,000 (12,000 ~ 21,000)	2,000 (920 ~ 2,000)	9.91	8.96	97
09+15	9,000	15,000	—	24,000 (12,000 ~ 24,000)	2,500 (920 ~ 2,500)	12.39	11.21	97
09+17	9,000	16,200	—	25,200 (12,000 ~ 25,200)	2,700 (920 ~ 2,700)	13.38	12.10	97
09+24	7,600	20,400	—	28,000 (12,000 ~ 28,000)	3,200 (920 ~ 3,200)	15.86	14.34	97
12+12	12,000	12,000	—	24,000 (12,000 ~ 24,000)	2,500 (920 ~ 2,500)	12.39	11.21	97
12+15	11,500	14,500	—	26,000 (12,000 ~ 26,000)	2,800 (920 ~ 2,800)	13.88	12.55	97
12+17	10,800	15,200	—	26,000 (12,000 ~ 26,000)	2,800 (920 ~ 2,800)	13.88	12.55	97
15+15	13,000	13,000	—	26,000 (12,000 ~ 26,000)	2,800 (920 ~ 2,800)	13.88	12.55	97
15+17	12,200	13,800	—	26,000 (12,000 ~ 26,000)	2,800 (920 ~ 2,800)	13.88	12.55	97
17+17	13,000	13,000	—	26,000 (12,000 ~ 26,000)	2,800 (920 ~ 2,800)	13.88	12.55	97
09+09+09	9,000	9,000	9,000	27,000 (12,600 ~ 27,000)	2,860 (1,000 ~ 2,850)	14.18	12.82	97
09+09+12	8,500	8,500	11,400	28,400 (12,600 ~ 28,400)	3,250 (1,000 ~ 3,250)	16.11	14.57	97
09+09+15	7,750	7,750	12,900	28,400 (12,600 ~ 28,400)	3,250 (1,000 ~ 3,250)	16.11	14.57	97
09+09+17	7,300	7,300	13,800	28,400 (12,600 ~ 28,400)	3,250 (1,000 ~ 3,250)	16.11	14.57	97

HEATING: MXZ-3A30NA

Indoor units combination	Heating capacity (BTU/h)				Power consumption (W)	Current (A)		Power factor (%)
	Unit A	Unit B	Unit C	Total		208V	230V	
09	10,900	—	—	10,900 (8,600 ~ 15,400)	1,100 (780 ~ 1,520)	5.57	5.03	95
12	13,600	—	—	13,600 (8,600 ~ 16,400)	1,380 (780 ~ 1,600)	6.98	6.32	95
15	18,000	—	—	18,000 (8,600 ~ 21,100)	1,940 (780 ~ 2,280)	9.82	8.88	95
17	20,100	—	—	20,100 (8,600 ~ 21,500)	2,240 (780 ~ 2,300)	11.34	10.25	95
24	23,200	—	—	23,200 (8,600 ~ 27,800)	2,520 (780 ~ 3,000)	12.75	11.53	95
09+09	10,900	10,900	—	21,800 (11,000 ~ 31,000)	1,700 (740 ~ 2,560)	8.43	7.62	97
09+12	10,900	13,600	—	24,500 (11,000 ~ 33,000)	1,980 (740 ~ 2,800)	9.81	8.87	97
09+15	10,100	16,900	—	27,000 (11,000 ~ 35,000)	2,200 (740 ~ 2,920)	10.90	9.86	97
09+17	9,300	17,700	—	27,000 (11,000 ~ 35,000)	2,200 (740 ~ 2,920)	10.90	9.86	97
09+24	7,300	19,700	—	27,000 (11,000 ~ 35,000)	1,980 (740 ~ 2,740)	9.81	8.87	97
12+12	13,500	13,500	—	27,000 (11,000 ~ 35,000)	2,200 (740 ~ 2,920)	10.90	9.86	97
12+15	12,000	15,000	—	27,000 (11,000 ~ 35,000)	2,160 (740 ~ 2,860)	10.71	9.68	97
12+17	11,200	15,800	—	27,000 (11,000 ~ 35,000)	2,140 (740 ~ 2,860)	10.61	9.59	97
15+15	13,500	13,500	—	27,000 (11,000 ~ 35,000)	2,120 (740 ~ 2,800)	10.51	9.50	97
15+17	12,700	14,300	—	27,000 (11,000 ~ 35,000)	2,110 (740 ~ 2,800)	10.46	9.46	97
17+17	13,500	13,500	—	27,000 (11,000 ~ 35,000)	2,100 (740 ~ 2,800)	10.41	9.41	97
09+09+09	9,500	9,500	9,500	28,500 (11,400 ~ 36,000)	2,180 (740 ~ 2,880)	10.80	9.77	97
09+09+12	8,600	8,600	11,400	28,600 (11,400 ~ 36,000)	2,180 (740 ~ 2,880)	10.80	9.77	97
09+09+15	7,800	7,800	13,000	28,600 (11,400 ~ 36,000)	2,180 (740 ~ 2,880)	10.80	9.77	97
09+09+17	7,350	7,350	13,900	28,600 (11,400 ~ 36,000)	2,180 (740 ~ 2,880)	10.80	9.77	97

UltimateAir® RecoupAerator®

Whole-house
ventilation
and filtration

Standard Features

95% Efficiency

Self-balancing

Reliable, low maintenance

Variable speed control

Multi-function timer

Patented design

GM ECM brushless motors

Merv 12 filtration + aluminum pre-filter

Frost prevention

No drain

Humidity regulation without desiccants

Economic Cooling mode

5-year Warranty

Award-winner for energy efficiency, design and easy install



Filters/ core material: Easily washable/replaceable high filtration polymer material.

Case: 16 and 20 Gauge powder coated steel.

Controls: Standard, remote located, low voltage, variable speed wall controller. Standard 0-10 vds input control. Standard furnace input control.

EconoCool: To perform night time cooling / home air flush

Options:

PressureGuard: To control indoor pressure real-time

Co2 Guard: To automate ventilation with the increase in occupancy

HEPA: Add on HEPA filtration package

Boost Inputs: To boost ventilation using a bathroom switch

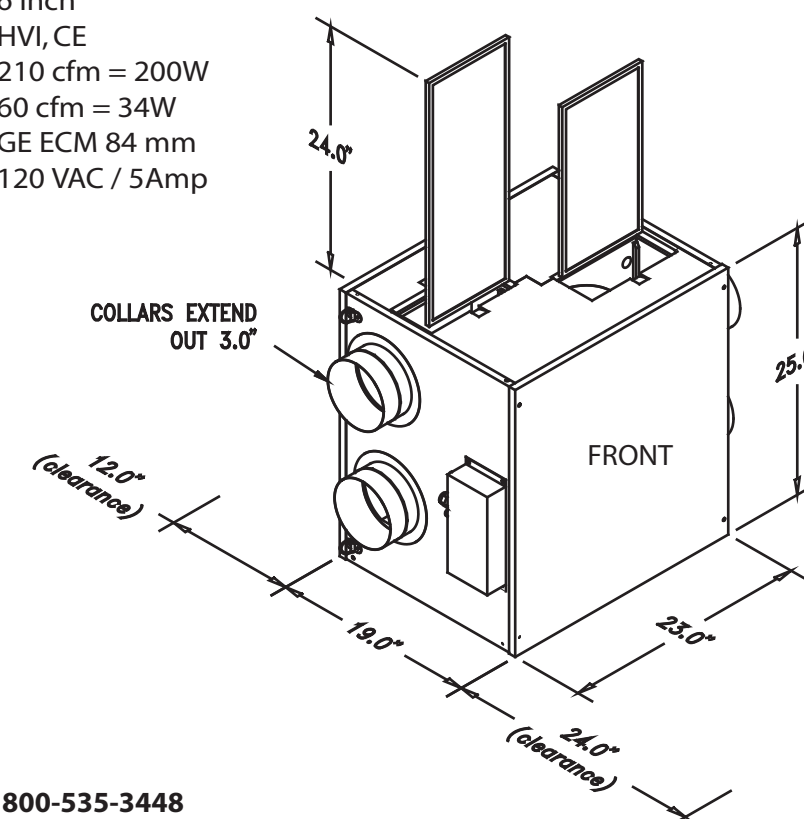
Mounting: Four rubber feet to set on a horizontal surface, or four metal D-rings for hanging from ceiling joists.

Weight: 72 lbs. Shipped weight: 80 lbs.

Certification:

All units are ETL certified to UL 1812. Third party performance testing done by Bodycote Materials Testing, Mississauga Ontario, Canada and by the Maryland Aviation Administration.

Variable air exchange rate:	60 - 210 cfm
Temperature effectiveness at full flow:	up to 95%
Latent efficiency (max):	88%
Dimensions:	25"H X 19"W X 25"D
Filter class of core material:	MERV 12
Pre-filter:	Washable aluminum mesh
Heat exchange material:	Washable polyester fiber
Duct connections:	6 inch
Certifications:	HVI, CE
Avg.electrical consumption	210 cfm = 200W 60 cfm = 34W GE ECM 84 mm 120 VAC / 5Amp
Motor option	
Electrical	



178 Mil Street, Athens, OH 45701

www.ultimateair.com / info@ultimateair.com / 800-535-3448



Fantech

IR SERIES

IRIS DAMPERS

The 'Leave in Place' Solution to Airflow Measurement and Balancing

Features:

- Flow measurement accuracy +/- 5%
- Linear response flow control
- Nine sizes available from 4" to 25"
- Quiet, low self-generated noise characteristic
- Compact design allows for simple installation
- Each damper comes with permanent pressure taps
- Airtight construction with integral gaskets for duct connection
- Internal aperture opens fully to allow duct cleaning without dismantling
- Five year warranty



Description and Function

The Fantech Iris Damper is the ideal device for measuring and adjusting airflow through a duct. The design of the adjustable aperture ensures low turbulence resulting in minimal self-generated noise.

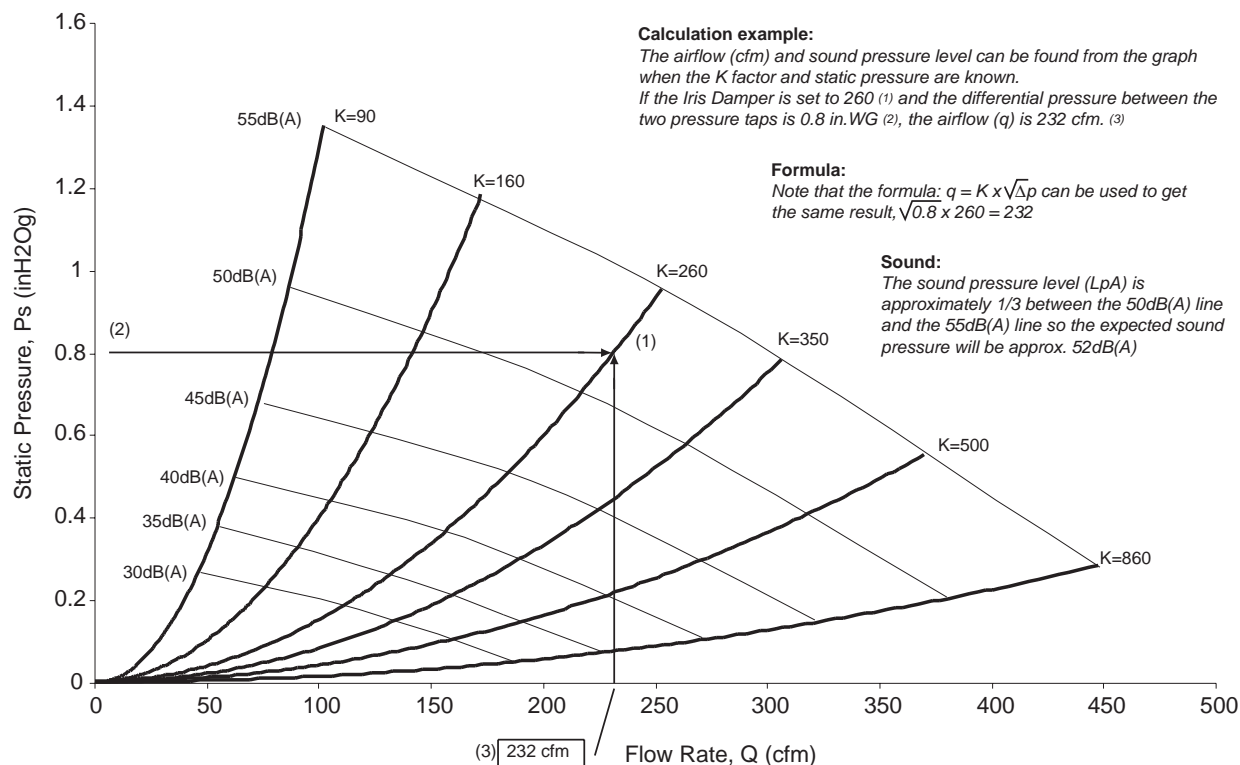
Adjusting airflow/pressure is a simple matter of positioning the calibrated control lever on the outside of the Iris Damper.

Flow can be determined from the K factor and a differential pressure measurement. Use the lever on the damper to select the K factor.

Airflow is found from the formula: $q = K \times \sqrt{\Delta p}$, where 'q' is the airflow in cfm and Δp is the differential pressure in in.w.g. found by connecting a manometer or other pressure instrument to the two pressure taps provided on the Iris Damper.

Alternatively, you may use the graph method to find airflow. Each model in the Fantech Iris Damper series has its own specific airflow and sound characteristics graph.

IR6 - Calculation Example



Sound Power Level L_w

Sound power level (L_w) for each frequency band can be found by applying the formula: $L_w = L_pA + K_{ok}$

Sound Data

SIZE	Mid-frequency (octave band) Hz						
	63	125	250	500	1K	2K	4K
IR4	11	10	3	-2	-8	-16	-24
IR5	7	8	2	-4	-11	-19	-27
IR6	9	6	1	-5	-11	-18	-27
IR8	9	5	1	-5	-12	-17	-24
IR10	6	1	-4	-3	-4	-17	-24
IR12	3	1	-4	-4	-9	-13	-19
IR16	3	1	-4	-4	-9	-13	-19
IR20	14	8	2	-3	-8	-11	-14
IR25	12	6	1	-3	-8	-11	-14
Tolerance	+/- 6	+/- 5	+/- 2	+/- 2	+/- 2	+/- 2	+/- 3

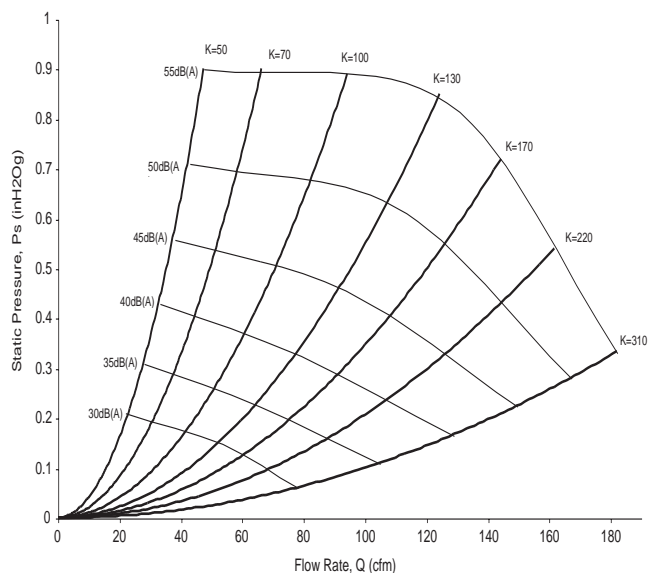
From the example above, sound pressure level (L_pA) is 52dB(A).

Sound power level (L_w) can now be found from the table.

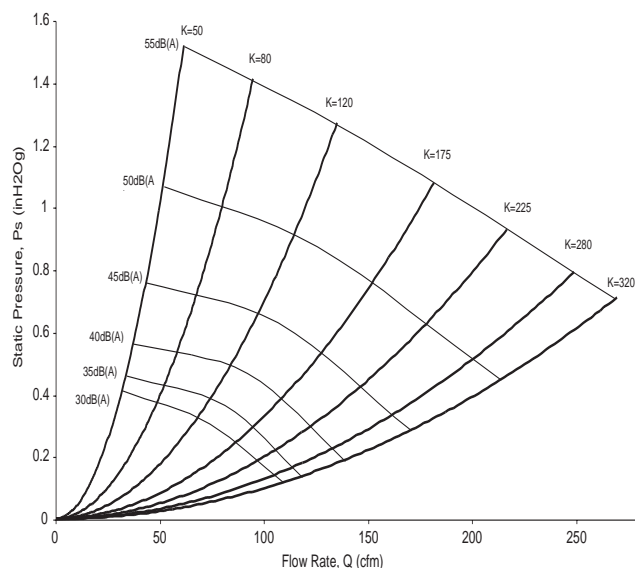
The sound power level (L_w) in the 500Hz octave band is:

L_pA (from graph) + K_{ok} (correction factor from table) = L_w
or $52 + (-5) = 47\text{dB(A)}$.

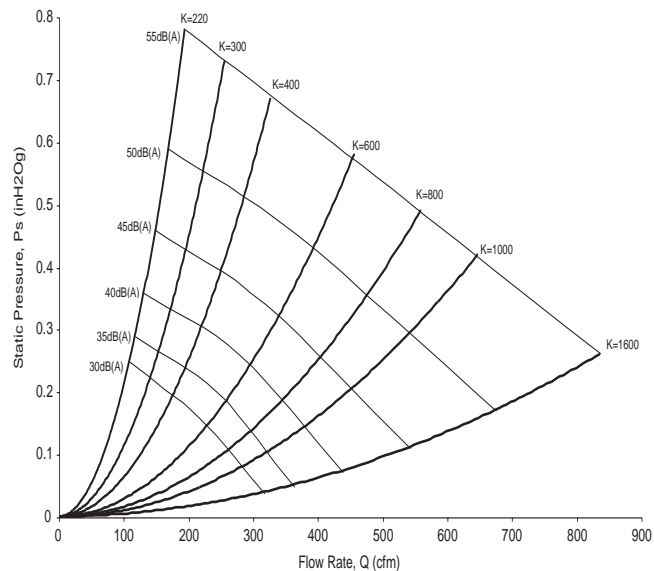
IR4



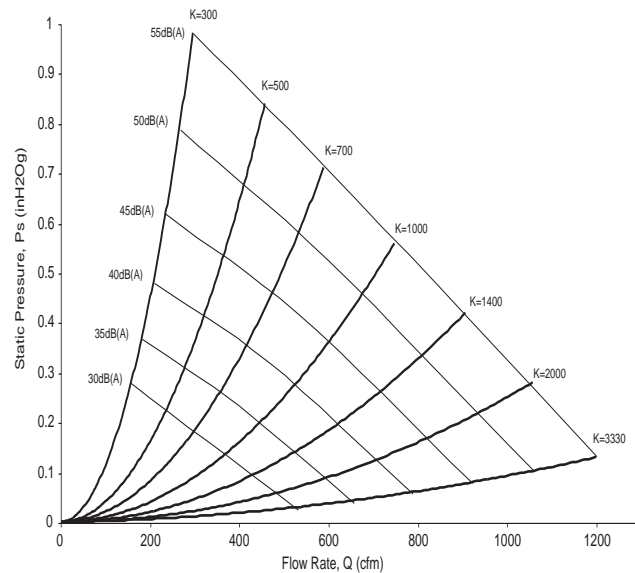
IR5



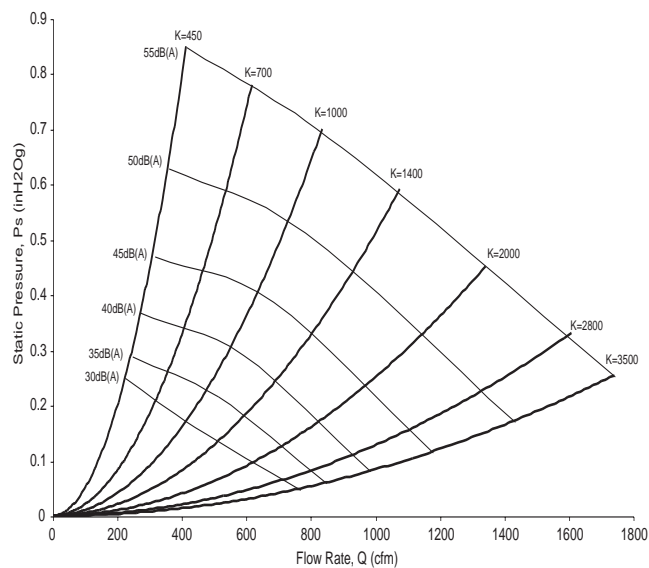
IR8



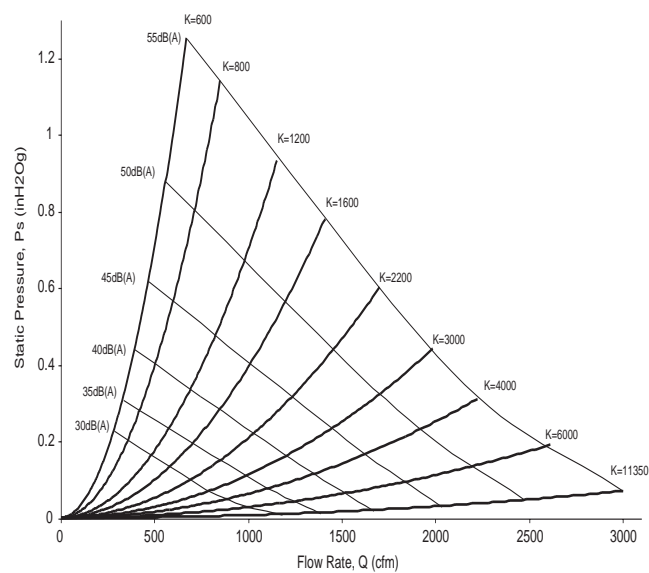
IR10



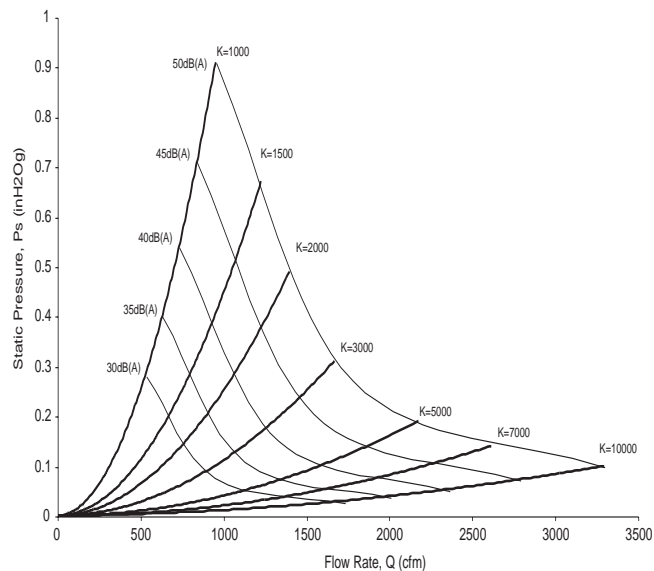
IR12



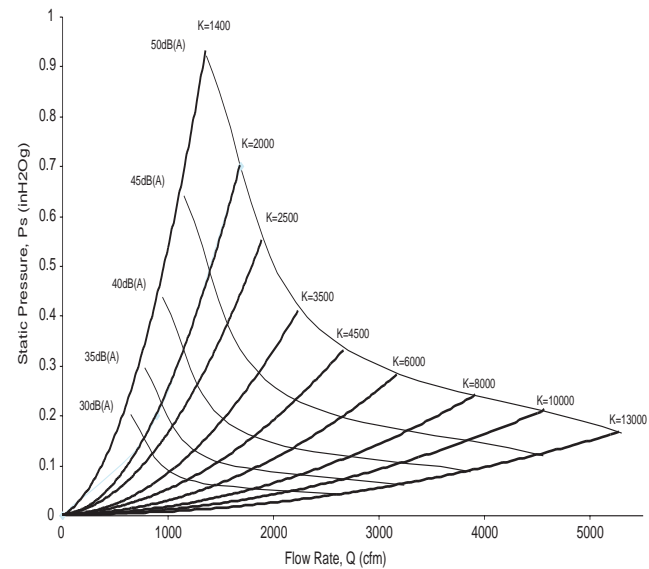
IR16



IR20



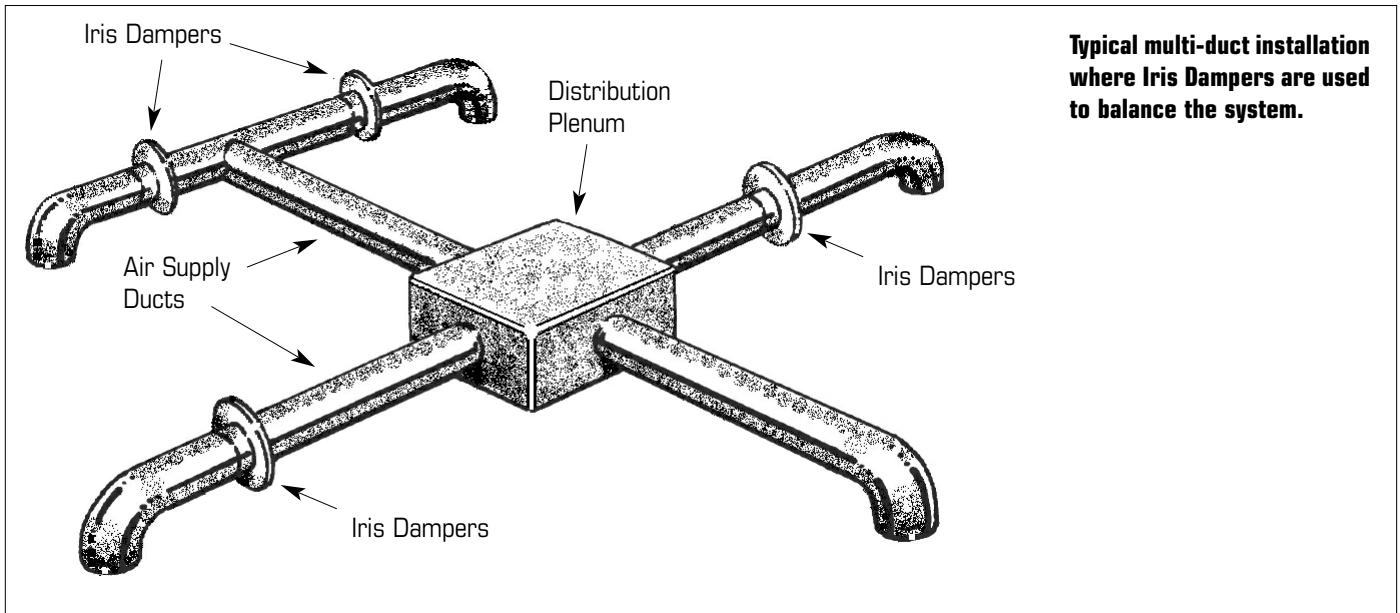
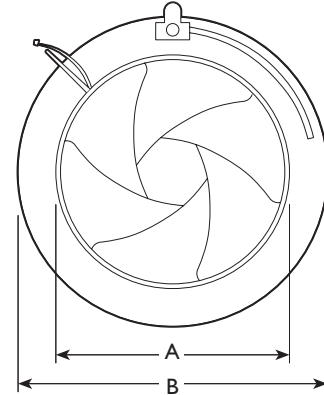
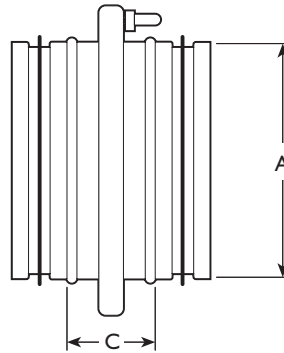
IR25



Dimensions

MODEL	Measurements			
	UPC#	A	B	C
IR4	63040	4	6 1/2	2 1/4
IR5	63050	5	8 1/4	2 1/2
IR6	63060	6	9	2
IR8	63080	8	11 1/4	2 1/4
IR10	63100	10	13	2 3/4
IR12	63120	12	16	2 3/8
IR16	63160	16	22	3 1/4
IR20	63200	19 3/4	25 3/8	2 3/8
IR25	63250	24 3/4	32	2 3/8

All Dimensions are in inches



Installation note:

For precise metering of airflow, the Iris Damper should be located at minimum 1 diameter before or after an elbow, 3 diameters before a 'T', 1 diameter after a 'T', and 3 diameters before an outlet register.



Fantech

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www.fantech.net; info@fantech.net

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Phone: 800.565.3548; 506.743.9500
Fax: 877.747.8116; 506.743.9600
www.fantech.ca; info@fantech.ca

SOLAR PANELS & BATTERY SPECIFICATIONS

I- Solar cell specifications

1. **Copy of manufacturer's solar cell and module specification sheet(s)**
(Attached)

2. **Manufacturer's name and contact information**

SunPower Corp.
3939 N 1st Street
San Jose, California 95134 USA
Main: (408) 240-5500
Fax: (408) 240-5400
Sales: 1-877-SUN-0123 (1-877-786-0123)

3. **Stock number, type, or description**

SPR-215-BLK
SPR-220-BLK

4. **Manufacturer's quote for cell or module area**

Module Area
SPR-215-BLK: $1.559 * 0.798$ (1.24408 m^2)
SPR-220-BLK: $1.559 * 0.798$ (1.24408 m^2)

5. **Manufacturer's quote for performance**

		SPR-215-BLK	SPR-220-BLK
Peak Power	P_{\max}	215.0 [W]	220.0 [W]
Rated Voltage	V_{mp}	39.8 [V]	39.8 [V]
Rated Current	I_{mp}	5.4 [A]	5.53 [A]
Open Circuit Voltage	V_{oc}	48.3 [V]	48.3 [V]
Short Circuit Current	I_{sc}	5.8 [A]	5.95 [A]
Series Fuse Rating		15.0 [A]	15.0 [A]
Maximum System Voltage		600 [V] (UL) 1000 [V] (IEC)	600 [V] (UL) 1000 [V] (IEC)
Temperature Coefficients Power		-0.38% [$^{\circ}\text{C}$]	-0.38% [$^{\circ}\text{C}$]
Voltage		-136.8 [mV/ $^{\circ}\text{C}$]	-136.8 [mV/ $^{\circ}\text{C}$]
Current		2.3 [mA/ $^{\circ}\text{C}$]	2.3 [mA/ $^{\circ}\text{C}$]
Module Efficiency		17.3%	17.7%
PTC Rating		197.6 [W]	203.2 [W]

6. **Cost (US\$) per watt for each cell or module.**

(\$3.5/watt)
SPR-215-BLK: \$752.5
SPR-220-BLK: \$770.0

II. Battery specifications

1. Copy of manufacturer's battery specification sheet(s)

See Attached

2. Material Safety Data Sheets (MSDS) obtained from the manufacturer
See Attached

3. Manufacturer's name and contact information

Rolls Battery Engineering
PO Box 671,
Salem, MA 01970
USA

Phone: 1-800-681-9914
Fax: 1800-681-9915

4. Stock number, type, or description
Surrette 6-CS-25PS (Lead Acid)
5. Module voltage (e.g., 6 V, 12 V, or 24 V)
6 Volts
6. Bus voltage
48 Volts
7. Number of modules to be used in the house
16 modules
8. Manufacturer's specifications,

capacity (kWh) : $6[V] * 2050 [Amp-Hr] * 8 [units] = 98,400[Wh]$

Weight (lb.): $318 [lbs] * 16 = 5088 lbs$

Total cost (US\$): \$ 11,92

9. Spill and damage protocols and procedures (if these are not provided in the MSDS, the team must obtain this information from the manufacturer and submit it with the MSDS).

SPR-215-BLK RESIDENTIAL PV MODULE

The SunPower SPR-215-BLK is designed specifically for on-grid residential systems where a combination of high module efficiency and outstanding appearance is desirable. Utilizing 72 series-connected A-300 solar cells, the SPR-215-BLK delivers industry-leading power density in a unique all-black module package with exceptionally uniform appearance.

SunPower modules—innovative design, proven materials, outstanding performance.

FEATURES & BENEFITS

- All-black module package eliminates harsh reflections and other noticeable cosmetic module features to provide optimum array appearance
- Unique all-back contact solar cells with conversion efficiency up to 21.5%
- Low voltage-temperature coefficient, exceptional low-light performance, and high sensitivity to light across the entire solar spectrum maximize yearly energy delivery
- Highest quality, high-transmission tempered glass provides enhanced stiffness and impact resistance
- Aerospace style cell interconnects with in-plane strain relief provide extremely high reliability
- Advanced EVA encapsulation system with multi-layer backsheets meets the most stringent safety requirements for high-voltage operation
- A sturdy, black anodized aluminium frame allows modules to be easily roof-mounted with a wide variety of standard mounting systems



SPR-215-BLK RESIDENTIAL PV MODULE
An unequaled combination of power and grace



LISTED UL 1703, Class C Fire Rating



IEC 61215, Safety Class II Certified

SPR-215-BLK RESIDENTIAL PV MODULE

ELECTRICAL CHARACTERISTICS AT STANDARD TEST CONDITIONS (STC)

STC is defined as: irradiance of 1000W/m², spectrum AM 1.5g and cell temperature of 25°C

Peak Power^{1,2} P_{max} 215W

Rated Voltage V_{mp} 39.8V

Rated Current I_{mp} 5.40A

Open Circuit Voltage V_{oc} 48.3V

Short Circuit Current I_{sc} 5.80A

Series Fuse Rating 15A

Maximum System Voltage 600V (UL)

1000V (IEC)

Temperature Co-efficients Power -0.38%/°C

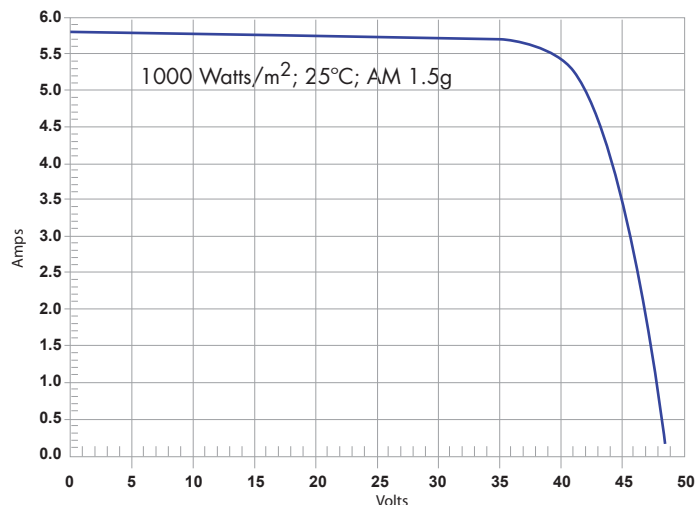
Voltage -136.8mV/°C

Current 2.3mA/°C

Module Efficiency 17.3%

PTC Rating 197.6W

IV CURVE



¹ Peak Power Tolerance: +/- 8%

² Power guaranteed for 25 years. See SunPower Limited Warranty for details.

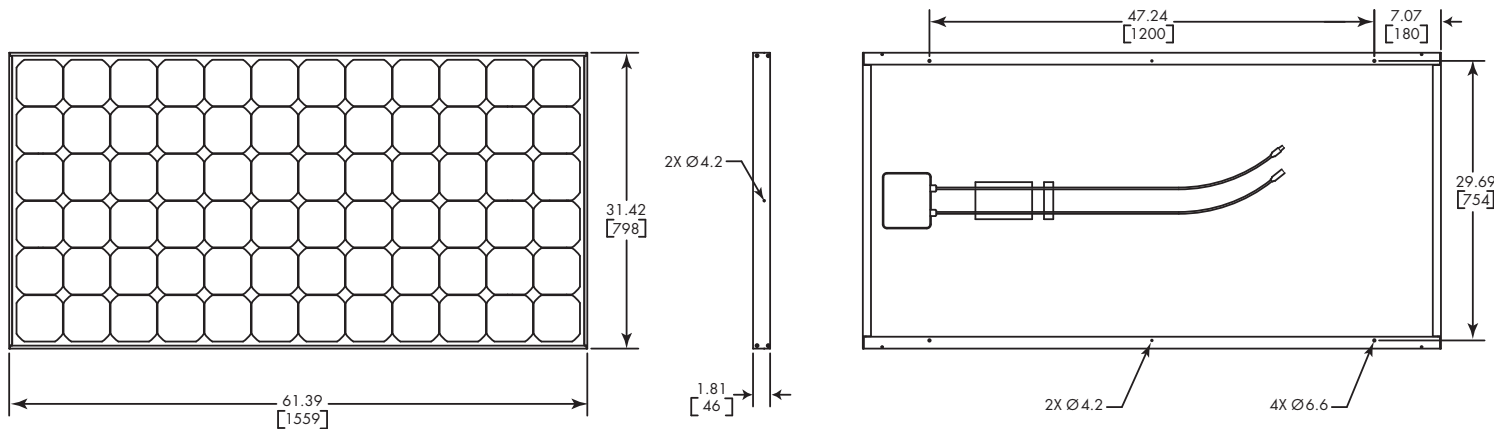
MECHANICAL SPECIFICATIONS

Length (mm) x Width (mm) 1559 x 798

Thickness, including junction box (mm) 46

Weight (kg) 15

DIMENSIONS



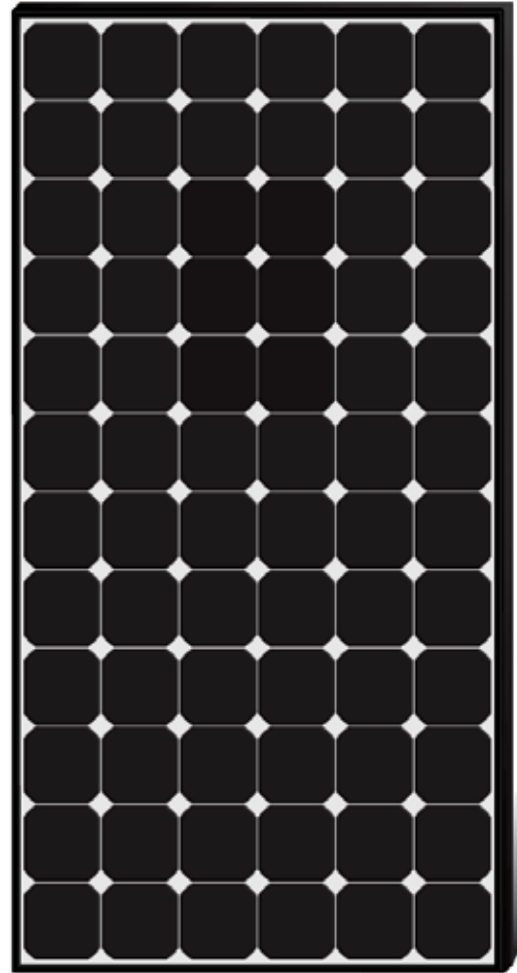
SPR-220 HIGH EFFICIENCY PV MODULE

The SunPower SPR-220 module is designed for use in on-grid residential and commercial systems where the highest module efficiency and energy delivery are critical. Utilizing 72 series-connected A-300 solar cells, the SPR-220 delivers extremely high power density with total module efficiency approaching 18%. Reduced voltage-temperature coefficient, exceptional low-light performance and high sensitivity to light across the entire solar spectrum mean maximum yearly energy harvest.

SunPower modules—innovative design, proven materials, outstanding performance.

FEATURES & BENEFITS

- Unique all-back contact solar cells with conversion efficiency up to 21.5%
- Low voltage-temperature coefficient enhances high-temperature operation
- Exceptional low-light performance and high sensitivity to light across the entire solar spectrum maximize yearly energy delivery
- Highest quality, high-transmission tempered glass provides enhanced stiffness and impact resistance
- Superior aesthetics - back contact cells with no front side gridlines and a black anodized frame
- Aerospace style cell interconnects with in-plane strain relief provide extremely high reliability
- Advanced EVA encapsulation system with multi-layer backsheet meets the most stringent safety requirements for high-voltage operation
- A sturdy, black anodized aluminium frame allows modules to be easily roof-mounted with a variety of standard mounting systems



SPR-220 HIGH EFFICIENCY PV MODULE
Unprecedented power density and exceptional energy production per peak kW



LISTED UL 1703, Class C Fire Rating



IEC 61215, Safety Class II Certified

SPR-220

HIGH EFFICIENCY PV MODULE

ELECTRICAL CHARACTERISTICS AT STANDARD TEST CONDITIONS (STC)

STC is defined as: irradiance of 1000W/m², spectrum AM 1.5g and cell temperature of 25°C

Peak Power^{1,2} P_{max} 220W

Rated Voltage V_{mp} 39.8V

Rated Current I_{mp} 5.53A

Open Circuit Voltage V_{oc} 48.3V

Short Circuit Current I_{sc} 5.95A

Series Fuse Rating 15A

Maximum System Voltage 600V (UL)

1000V (IEC)

Temperature Co-efficients Power -0.38%/°C

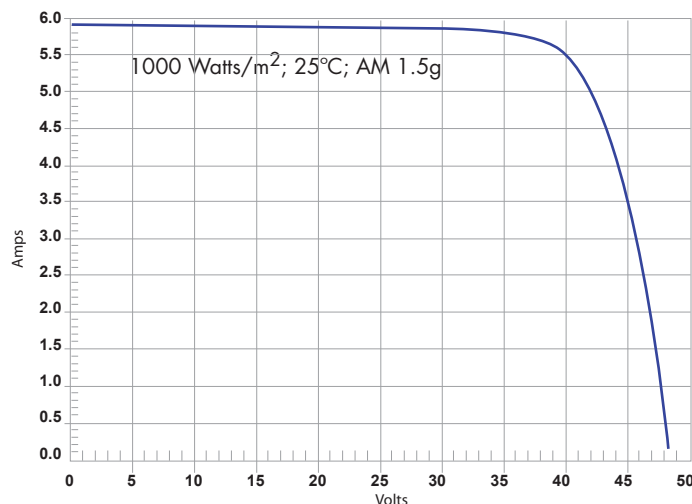
Voltage -136.8mV/°C

Current 2.3mA/°C

Module Efficiency 17.7%

PTC Rating 203.2W

IV CURVE



¹ Peak Power Tolerance: +/- 8%

² Power guaranteed for 25 years. See SunPower Limited Warranty for details.

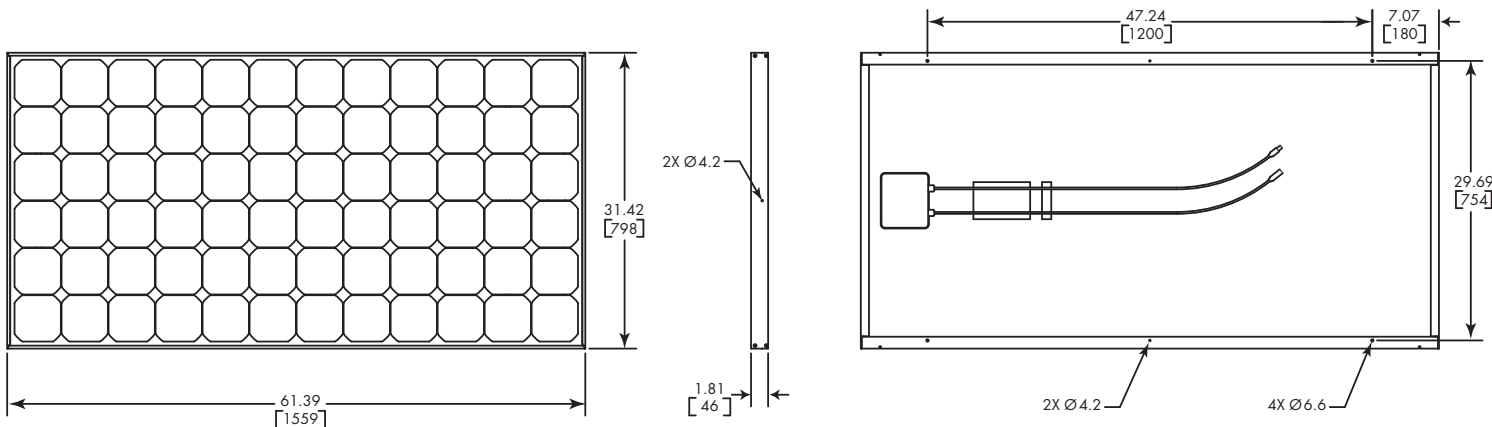
MECHANICAL SPECIFICATIONS

Length (mm) x Width (mm) 1559 x 798

Thickness, including junction box (mm) 46

Weight (kg) 15

DIMENSIONS



MATERIAL SAFETY DATA SHEET

SECTION I - PRODUCT IDENTIFICATION

Product identifier: Lead/Acid Battery

Product use: Lead Acid Storage Battery

Chemical family: Lead Acid Storage Battery

Supplier's name and address:
and address:

Surette Battery Co. Ltd.
P.O. Box 2020, 1 Station Road
Springhill, N.S.
B0M 1X0
(902) 597-3767

Manufacturer's name

Refer to Supplier

Emergency Telephone #: CANUTEC (613) 996-6666

WHMIS CLASS

Exempt (Manufactured Article)

SECTION II - HAZARDOUS INGREDIENTS

<u>Ingredients</u>	<u>LC₅₀, ppmLD₅₀, mg/kg</u>		<u>(Rat,ihl.)</u>	<u>(Rat,oral)</u>
	<u>CAS #</u>	<u>wt. %</u>		
Lead	7439-92-1	34	n/av	n/av
Lead dioxide	1309-60-0	31	n/av	n/av
Sulfuric acid	7664-93-9	34 510 mg/m ³ /2H		2140

SECTION III - PHYSICAL DATA

Physical state, odour and appearance: A transparent to opaque case and sealed cover fitted with side or top terminals and vent caps, odourless.

Odour threshold: n/ap

Coefficient of water/oil distribution: n/ap

Boiling point: n/ap

pH: n/ap

Evaporation rate (n-BuAc=1.0): n/ap

Solubility in water (w/w): n/ap

Specific gravity (at °C): n/ap

Vapour pressure: n/ap

Melting/freezing point: n/ap

Vapour density (Air=1.0): n/ap

Volatiles, %: n/ap

SECTION IV - FIRE AND EXPLOSION DATA

Conditions of flammability: n/ap

Sensitivity to mechanical impact/static discharge: n/ap

Lower/upper flammable limits (% by volume): n/ap

Hazardous combustion products: n/ap

Unusual fire and explosion hazards: For battery acid - Evolution of explosive Hydrogen gas on contact with most metals.

Means of extinction: n/ap

Flash point (Method): None.

Auto-ignition temperature: n/ap

SECTION V - REACTIVITY DATA

=====
Stability: n/ap **Incompatible materials:** n/ap **Conditions of reactivity:** n/ap
Hazardous decomposition products: For battery acid - If heated above 340°C, sulfuric acid will decompose to sulfur trioxide and water.
=====

SECTION VI - TOXICOLOGICAL PROPERTIES

****Routes of exposure and acute/chronic effects****

Exposure limits: ACGIH-TLV Not applicable for this article.

Inhalation: n/ap

Skin contact: n/ap

Eye contact: n/ap

Ingestion: n/ap

Chronic effects: None known.

Carcinogenicity: Lead and lead dioxide are listed as carcinogens, however there is not possibility for exposure under normal conditions of use.

Teratogenicity, mutagenicity, other reproductive effects: n/av

Sensitization to material: Product is not known to cause allergies.

Synergistic materials: None known.

SECTION VII - FIRST AID

=====
Applies to the battery fluid only:

Inhalation: Remove victim to fresh air. If breathing difficulty does not improve rapidly, get patient to a doctor.

Skin: Wash skin with mild soap and water. Rinse thoroughly. See a doctor if irritation persists.

Eyes: Flush with plenty of water for at least 20 minutes. Get medical attention immediately.

Ingestion: Get immediate medical attention. Do not induce vomiting.

SECTION VIII - PREVENTIVE MEASURES

=====
For the battery fluid only:

Spill, leak or release: Use full protective clothing, including boots and protective equipment. Contain spill in order to prevent contamination of sewage system or waterway. Pump into mark containers for reclamation or disposal. If possible, neutralize on a dry basis with suitable alkali such as lime, soda ash, or sodium bicarbonate, then flush with water in accordance with applicable regulations.

Waste disposal: Consult federal, provincial and local regulations for allowed means of disposal.

PROTECTIVE EQUIPMENT

For the battery fluid only:

Respiratory protection: Cartridge type mask or self-contained breathing apparatus approved by NIOSH, depending on exposure.

Engineering controls: Local exhaust is required. Mechanical ventilation (general) - not compulsory.

Protective gloves: PVC or Neoprene.

Eye protection: Chemical splash goggles or face shield.

Other protective equipment: Safety shoes worn with rubber/neoprene boots or steel-toed rubber/neoprene boots to be worn over socks. Place pants' legs over boots to keep acid out of boots. Other equipment - Depending on exposure and on workplace standards. Safety showers and eye wash station should be installed in storage and handling areas.

STORAGE AND HANDLING

Handling procedures and equipment: Avoid contact with skin, eyes and clothing. Protect containers from physical damage. Wear protective equipment during handling. When

diluting, slowly add acid to water (never water to acid) while stirring to avoid spattering or boiling. Wash thoroughly after handling, Emptied containers retain vapour and product residue.

Storage requirements: Store in a cool, dry area. Store away from sources of ignition. Keep container closed and protect from contact with water to avoid possible violent reaction.

Special shipping instructions: TDG - Batteries, wet filled with acid, Class 8, UN2794, P.G. III

SECTION IX - PREPARATION INFORMATION

Prepared by: Surrette Battery Co. Ltd.

Telephone #: (902) 597-3767

Preparation date: February 1, 2007

Additional notes or references:

Abbreviations:

ACGIH: American Conference of Governmental Industrial Hygienists

IARC: International Agency for Research on Cancer

n/ap not applicable

n/av: not available

NIOSH: National Institute for Occupational Safety and Health

WHMIS: Workplace Hazardous Materials Information System

TDG: Transportation of Dangerous Goods Act and Regulations

TLV: Threshold Limit Values

References:

1. Van Nostrand Reinhold, Dangerous Properties of Industrial Materials, Seventh Edition, N. Irving Sax.
 2. Canadian Centre for Occupational Health and Safety. RTECS (Registry of Toxic Effects) and CHEMINFO databases.
 3. International Agency for Research on Cancer Monographs, Supplement 7, 1988.
-
-



Rolls

Applications

Residential

Communications

Remote Monitoring

Navigation Aids

Water Pumping

Utilities

Refrigeration

Uninterrupted power

Solar

Series 5000

Up to 20 Year Life Span

Non-breakable

Environmentally Friendly

Next-Generation Batteries for Renewable Energy Management

Rolls Battery Engineering, based in Salem, Massachusetts, has been manufacturing deep cycle batteries of the highest quality for more than 60 years. Our series 5000 system of batteries, manufactured specifically for solar and other renewable energy applications, are designed to offer up to 20 years of life thanks in part to its "Non-Breakable" Dual Container (Modular) Construction.



Specs-at-a-Glance:

Voltage: various configurations

Plate Alloy: 4% Antimony

Post Type: Flag (Typical)

Charge Voltage (77F): Float 2.2 - 2.23 VPC, Bulk 2.37 - 2.4 VPC

Specific Gravity: 1.265

Electrolyte: Sulfuric Acid

Feature:

Dual Container Modular Construction

- Benefits:**
- Elimination of stray current
 - Environmentally friendly
 - No acid leakage
 - Easy on-site assembly/disassembly, with no special tools or skills required
 - Drastic reduction in connections, which eliminates many points of failure, increasing charging efficiency



Feature:

Coupling our thick plate design with the highest density active material

Benefit:

- Unsurpassed cycling service - 15 year average life

Feature:

Enveloped Separators

- Benefits:**
- Ability to remove sediment chamber, eliminating separator misalignment, treeing or shorting
 - Also allows for higher plates to be used in the same sized cell, which yields greater capacity



Feature:

Increased Liquid Reserve

Benefit:

- Less maintenance



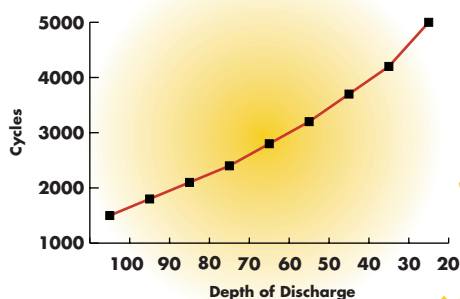
Rolls



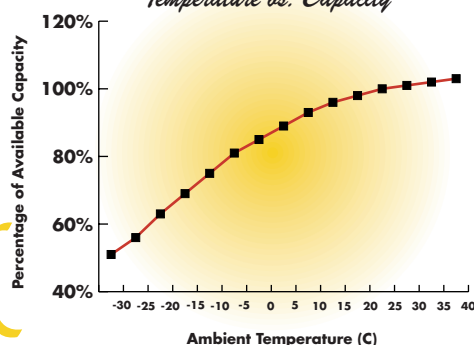
Series 5000 - *Solar* Dual Container Construction

Rolls Series 5000 batteries are enhanced by their non-breakable dual container construction. Each cell is assembled in its own inner container - eliminating breakage due to rough handling and abuse, acid leakage, and short circuits due to the accumulation of moisture and dirt and other foreign objects. Cell replacement is clean and quick - allowing the battery to be assembled or repaired on location, without special skills or tools.

Cycle Life - Series 5000



Temperature vs. Capacity



Series 5000

Model	CAP. 100 Hour 1.75 VPC	CAP. 20 Hour 1.75 VPC	Lt. Inches	Wd. Inches	Ht. Inches	Wt. Wet Lbs.	Wt. Dry Lbs.
4 Volt 2 Cell							
4-CS-17PS	682	546	14 3/8	8 1/4	18 1/4	128	98
4KS-21PS	1379	1104	15 3/4	9 3/4	24 3/4	230	186
6 Volt 3 Cell							
6-CS-17PS	683	546	22	8 1/4	18 1/4	221	178
6-CS-21PS	854	683	22	9 3/4	18 1/4	271	217
6-CS-25PS	1025	820	22	11 1/4	18 1/4	318	254
8 Volt 4 Cell							
8-CS-17PS	683	546	28 1/4	8 1/4	18 1/4	294	238
8-CS-25PS	1025	820	28 1/4	11 1/4	18 1/4	424	342
12 Volt 6 Cell							
12-CS-11PS	446	357	22	11 1/4	18 1/4	272	220

Warranty Information:

The Rolls Warranty - Series 5000
Failure within 36 months from date placed in service yields FREE replacement, not including freight charges from factory to destination. After the first 36 months of service, defective batteries will be adjusted for a period of up to 120 months from date first in service at prices in effect at time of adjustment. Certain Restrictions Apply - contact your local representative for more details.

Contact:

Rolls Battery Engineering, 8 Proctor Street, P.O. Box 671, Salem, Massachusetts, USA, 01970. Tel: (978) 754-3333 Fax: (978) 741-8456
Or your nearest distributor:

Sunny Boy 6000U



The leading grid-tied photovoltaic inverters in Europe and America



Exceptional reliability,
efficiency and energy
capture ratio

5-year comprehensive
warranty

Rugged stainless steel
outdoor enclosure standard

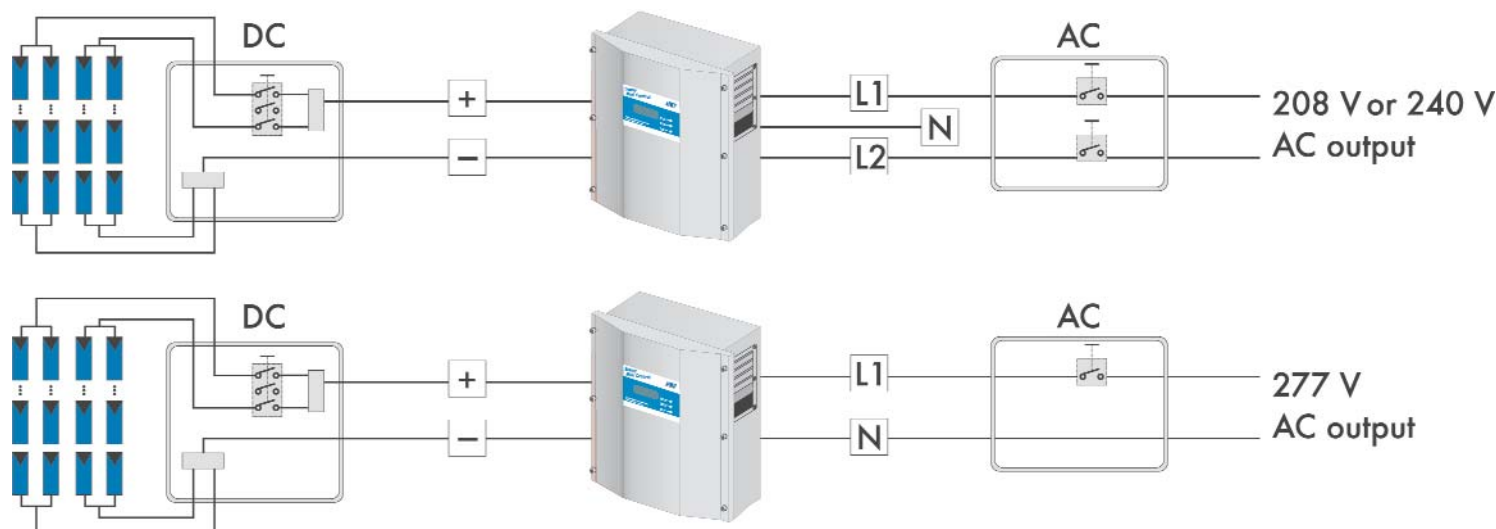
Easy to install wall
mount bracket system

Comprehensive SMA
communications and
data collection options

SMA's modular
commercial inverter
design is expandable
to virtually any size system

The most popular grid-tied photovoltaic inverter in Europe, is now available in North America. Sunny Boy's extensive track record in some of the world's most demanding markets has made it the favorite among PV professionals everywhere. Over 250,000 Sunny Boy inverters have been installed throughout the world. Superior design, rock-solid German engineering and exceptional real-world efficiency have made Sunny Boy inverters the top choice for American solar designers.





The SB6000U is SMA's latest addition to the Sunny Boy family of utility interactive inverters. The SB6000U is designed for use with PV, fuel cell, wind-turbine, hydro-turbine and micro-turbine technologies. The SB6000U follows SMA's modular system design philosophy for utility, commercial and residential PV installations from 6kW and up. Automatic sensing of the site utility voltage makes installation on almost any utility system trouble-free. Just wire the inverter into any 208, 277 or 240 VAC system, make one internal jumper setting and the SB6000U does the rest. The wide DC input voltage range allows connection to almost any type or model of PV module. Our proven peak-power-point tracker results in maximum energy capture. The SB6000U uses the same SMA communication accessories as every other inverter in the Sunny Boy family. Choose the system package that best suits your needs. SMA offers a variety of hardware and software solutions from low cost wireless monitoring, to complex data acquisition systems that integrate large numbers of inverters with external sensors to networked PC's and the internet.

Specifications

Inverter Technology	PWM true sine-wave, current source	Power Factor	Fixed, unity
AC Input Voltage	Automatic sensing	Peak Inverter Efficiency	> 95%
	277 VAC Nominal (244-305 VAC)	Cooling	Temperature regulated fan cooling
	240 VAC Nominal (211-264 VAC)	Power Consumption	0.1W nighttime
	208 VAC Nominal (183-229 VAC)		7W standby
AC Input Frequency	59.3-60.5 (60Hz)	Ambient Temperature Rating	-25° to +45° C
AC Maximum Output Power	6000W (at 277 or 240 VAC)	Enclosure	NEMA 3R
	5200W (at 208 VAC)	Dimensions	16.9 W x 23.6 H x 9.8 D (in)
AC Maximum Output Current	25A (22A at 277 VAC)		430 W x 600 H x 250 D (mm)
DC Input Voltage	234-600 VDC	Weight	137 lbs
DC Minimum Input Voltage	207-256 VDC		62 kg
	(dependent on AC line voltage)		
DC Voltage Ripple	Less than 5%	Compliance	Meets requirements of
DC Maximum Current	25A		IEEE-519, IEEE-929,
Peak Power Tracking Voltage	250-480 VDC		IEEE-1547
PV Start Voltage (adjustable)	300 VDC (277 or 240 VAC)		UL 1741
	270 VDC (208 VAC)		
Maximum Recommended PV Power	7500W (STC)		
Current THD	Less than 4%		

Available From:

SMA America, Inc
Grass Valley, CA USA
info@sma-america.com
www.sma-america.com

**Solar Today...
Energy Tomorrow**



- > Certified to the new UL1741/IEEE 1547
- > 10 yr. standard warranty
- > Improved CEC efficiency
- > Integrated load-break rated DC disconnect switch
- > Integrated fused series string combiner
- > Sealed electronics enclosure & Opticool
- > Comprehensive SMA communications and data collection options
- > Ideal for residential or light commercial applications
- > Rugged cast aluminum outdoor rated enclosure



Sunny Boy 3000 / 4000

The best in their class

SMA is proud to introduce our new line of inverters updated with our latest technology and designed specifically to meet the new IEEE 1547 requirements. Compact design makes them ideal for residential use and the integrated DC disconnect makes installation more cost effective. They are field-configurable for positive ground systems making them more versatile than ever. Increased efficiency means better performance and shorter payback periods. With over 500,000 fielded units, Sunny Boy has become the benchmark for PV inverter performance and reliability throughout the world.

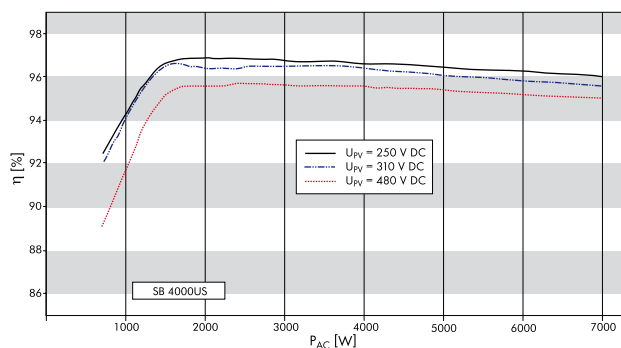


Technical Data

Sunny Boy 3000 / 4000

	SB 3000US	SB 4000US
Input Data (DC)		
Max. Recommended Array Input Power (DC @ STC)	3750 W	5000 W
Max. DC Voltage	500 V	600 V
Peak Power Tracking Voltage	180 - 400 V @ 208 V 200 - 400 V @ 240 V	220 - 480 V @ 208 V 250 - 480 V @ 240 V
DC Max. Input Current	17 A	18 A
DC Voltage Ripple	< 5%	< 5%
Number of Fused String Inputs	4	4
PV Start Voltage (adjustable)	228 V	285 V
Output Data (AC)		
AC Nominal Power	3000 W	3500 W @ 208 V / 4000 W @ 240 V
AC Maximum Output Power	3000 W	4000 W
AC Maximum Output Current	15 A @ 208 V, 12.5 A @ 240 V	17 A @ 208 V, 16.6 A @ 240 V
AC Nominal Voltage / Range	183 - 229 V @ 208 V 211 - 264 V @ 240 V	183 - 229 V @ 208 V 211 - 264 V @ 240 V
AC Frequency / Range	60 Hz / 59.3 Hz - 60.5 Hz	60 Hz / 59.3 Hz - 60.5 Hz
Power Factor	1	1
Efficiency		
Peak Inverter Efficiency	96.6 %	96.8 %
CEC weighted Efficiency	95.0 % @ 208 V 95.5 % @ 240 V	95.5 % @ 208 V 96.0 % @ 240 V
Mechanical Data		
Dimensions W x H x D in inches	17.8 x 13.8 x 9.3	17.8 x 13.8 x 9.3
Weight / Shipping Weight	88 lbs / 94 lbs	88 lbs / 94 lbs
Ambient temperature range	-13 to +113 °F	-13 to +113 °F
Power Consumption: standby / nighttime	< 7 W / 0.1 W	< 7 W / 0.1 W
Topology	PWM, true sinewave, current source	PWM, true sinewave, current source
Cooling Concept	Convection, regulated fan cooling	Convection, regulated fan cooling
Mounting Location Indoor / Outdoor (NEMA 3R)	● / ●	● / ●
Features		
LCD Display	●	●
Lid Color: aluminum / red / blue / yellow	● / ○ / ○ / ○	● / ○ / ○ / ○
Communication: RS485 / Wireless	○ / ○	○ / ○
Warranty: 10-year	●	●
Compliance: IEEE-929, IEEE-1547, UL 1741, UL 1998, FCC Part 15 A & B	●	●
Specifications for nominal conditions	● Included ○ Option — Not available	

Efficiency Curves



Sunny Island 4248U



SMA's new off grid inverter - A technological leap into the future



Optimized for high ambient temperatures

Very high overload capability

High efficiency

Integrated DC breaker

Intuitive user interface

Output load shedding

DC and AC coupling of energy sources

Nearly silent operation

Automatic generator start

Battery protection

Insect proof

Easy installation and commissioning

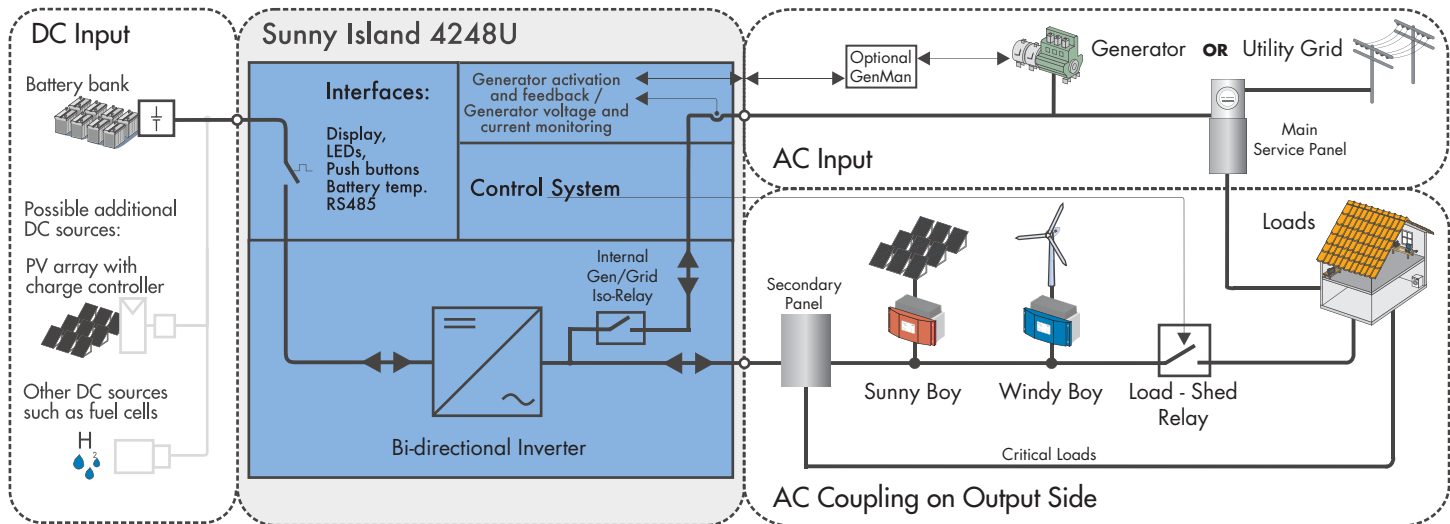
Non volatile parameter settings

Compatible with the Sunny Family of products

The new Sunny Island 4248U battery based inverter is the first off-grid inverter from SMA for use in the U.S. Perfect sine wave off-grid electricity is now available with high efficiency, robust power and outstanding reliability. Simple to install and use, yet loaded with powerful and advanced features, the Sunny Island 4248U is designed to meet the needs of off-grid as well as back-up power system applications.

Whenever and wherever electric power is needed, the new Sunny Island 4248U will perform!





The Sunny Island 4248U provides a continuous power output of 4200 watts at 25°C and 3400 watts even at scorching temperatures up to 45°C. That's enough power to comfortably energize most household appliances with power to spare. Large critical loads such as water pumps and refrigerators can be easily powered by the Sunny Island 4248U. This inverter operates silently and can be powered from multiple sources: wind, utility grid (for back-up power), hydro, solar electric and is even compatible with fuel cells. A number of communication options provide flexible remote system monitoring. The optional SMA "GenMan" (Generator Management Box) provides advanced control of even the most basic generators. The Sunny Island 4248U also works in conjunction with grid tied Sunny Boy solar systems to provide a powerful and efficient back up power solution.

The internal battery charger can supply up to 100A to the battery when in charge mode. Transition from charge to invert mode is a lightning fast 20ms, so even your computers will stay on-line. A pass-through relay with a rating of 60A at 120V is also included. Two Sunny Island 4248's may be paralleled to support 240VAC split-phase load centers. Once installed, the Sunny Island 4248U will run with basically no maintenance for years to come. With its state-of-the-art software and non-volatile memory, just set it and forget it.

Technical Data

Electrical / Mechanical data

Nom. Battery Voltage:	V _{DC,nom}	48 V
Battery Voltage Range:	V _{DC}	41 - 63 V
Nom. AC Voltage:	V _{AC,nom}	120 V
AC Voltage Range:	V _{AC}	105 - 132 V
Nom. AC Frequency:	f _{AC,nom}	60 Hz
AC Input Charge Current:	I _{AC,chg}	40A @ 25 °C 28A @ 45 °C
Max. AC pass through current (transfer relay):		60 A
Consumption (no load operation):		<22 W
Consumption (standby):		<4 W
Total harmonic distortion:		<3 %

Temperature Range

-20°C to +45°C / -4.0°F to +113.0°F

Enclosure: IP30

Weight: 39 kg / 86 lbs

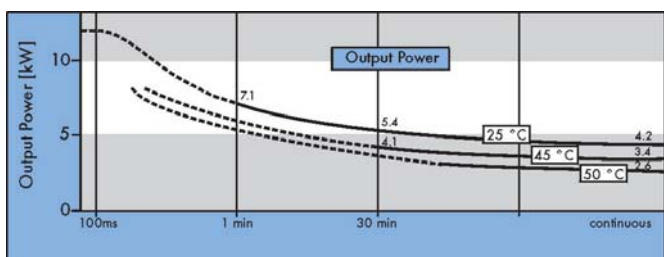
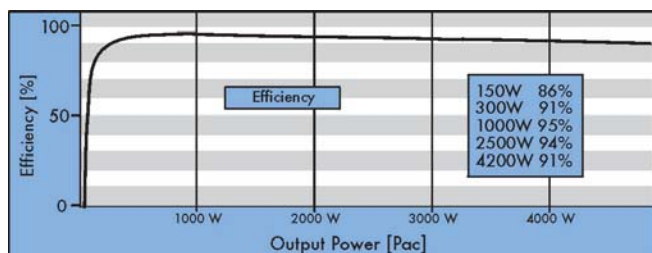
Size: W 390 x L 590 x H 245 millimeters
W 15.35 x L 23.22 x H 9.64 inches

Interfaces

- 2 LEDs; 2-line LCD; 4 push buttons
- 1 dry contact output for load shedding
- 1 dry contact for generator start
- 1 generator-ready opto isolated input

Accessories

- Remote battery temperature sensor (included)
- Generator Management Box (optional)
- 1 RS232/485 galvanic isolated for communication(optional)



SMA America, Inc.

12438 Loma Rica Drive
Grass Valley, CA 95945
phone: 530.273.4895
email: info@sma-america.com
www.sma-america.com

Solar Today ...
Energy Tomorrow



Solar Water Heating Domestic Hot Water Domestic Cold Water System

Prepared by:

Rannie Daffon & Sang Hoon Lee
08.07.2007

Domestic Hot Water and Domestic Cold Water	3
1. INTRODUCTION	3
2. COMPONENT SPECIFICATIONS	4
2.1. Tanks.....	4
2.2. Pumps	5
2.3. Major Components.....	5
2.4. Other Components.....	5
2.5. Piping and Connectors.....	6
3. COMPONENT FUNCTIONALITY DESCRIPTION	Error! Bookmark not defined.
3.1. Main Water Line	Error! Bookmark not defined.
3.1.1 Liquid Level Sensor LVL-1.....	Error! Bookmark not defined.
3.1.2 Temperature Sensor THRM-1	Error! Bookmark not defined.
3.1.3 Shut Off Valve SHTV-1	Error! Bookmark not defined.
3.1.4 Main Water Filter FLTR-1	Error! Bookmark not defined.
3.1.5 Check Valve CHK-1	Error! Bookmark not defined.
3.1.6 Main Pump PMP-M1	Error! Bookmark not defined.
3.1.7 Pressure Relief Valve RLFV-1C	Error! Bookmark not defined.
3.1.8 Pressure Regulator PREG-1	Error! Bookmark not defined.
3.1.9 Cold Water Shut Off Valve SHTV-4.....	Error! Bookmark not defined.
3.2. Hot Water Line	Error! Bookmark not defined.
3.2.1 Domestic Hot Water Tank.....	Error! Bookmark not defined.
3.2.2 Tank Temperature Sensor Temp TEMP-DHW.....	Error! Bookmark not defined.
3.2.3 Expansion tank EXP-2.....	Error! Bookmark not defined.
3.2.4 Pressure Relief Valve RLFV-2H	Error! Bookmark not defined.
3.2.5 Check Valve CHK-2.....	Error! Bookmark not defined.
3.2.6 Shut Off Valve SHTV-5.....	Error! Bookmark not defined.
3.2.7 Instant Hot Water Kit.....	Error! Bookmark not defined.
3.3. Pre-heating Mat (PHM) Loop	Error! Bookmark not defined.
3.3.1 Glycol Fluid	Error! Bookmark not defined.
3.3.2 PHM Circulating Pump PMP-PVL.....	Error! Bookmark not defined.
3.3.3 Expansion Tank EXP-4.....	Error! Bookmark not defined.
3.3.4 Temperature Sensor TMP-PHM.....	Error! Bookmark not defined.
3.3.5 Pressure Switch PSWT-PHM	Error! Bookmark not defined.
3.3.6 Preheating Mat PHM.....	Error! Bookmark not defined.
3.4. Evacuated Tubes Loop (EVT) Loop.....	Error! Bookmark not defined.
3.4.1 Glycol Fluid	Error! Bookmark not defined.
3.4.2 Evacuated Tubes Circulating Pump PMP-EVAC	Error! Bookmark not defined.
3.4.3 Expansion Tank EXP-4.....	Error! Bookmark not defined.
3.4.4 Temperature Sensor TMP-EVAC	Error! Bookmark not defined.
3.4.5 Pressure Switch PSW-EVAC.....	Error! Bookmark not defined.
3.4.6 Evacuated Tubes EVT	Error! Bookmark not defined.
3.5. Heat Exchangers and Heat Sinks	Error! Bookmark not defined.
3.5.1 Heat Exchanging Loops.....	Error! Bookmark not defined.
3.5.2 Heat sinks	Error! Bookmark not defined.
3.6. Control Sensors and Devices	Error! Bookmark not defined.
3.6.1 Cold Water Loop	Error! Bookmark not defined.
3.6.2 Hot Water Loop.....	Error! Bookmark not defined.
3.6.3 Evacuated Tubes Loop	Error! Bookmark not defined.
3.6.4 Pre-heating Mat Loop	Error! Bookmark not defined.
3.6.5 Waste Water Loop	Error! Bookmark not defined.
3.7. Wattage.....	Error! Bookmark not defined.
4. PROJECT TIME LINE	Error! Bookmark not defined.

Domestic Hot Water and Domestic Cold Water

1. INTRODUCTION

The Domestic How Water (DHW) and Domestic Cold Water (DCW) provides water supply to the Solar Decathlon House. This system is named DHW-DCW for short, and as the name implies, is responsible for the hot and cold water supply. It has its own sequence of operations that are all and in part coordinated with the overall control logic. It shares information to other subsystems in order to achieve optimum energy usage.

The criterion of the system design is to achieve the most points possible during the competition. The points at risk are as follows:

- 100 points for Shower test. The shower test may be administered up to 10 times during the competition. There will be 1 shower in the morning and 1 in the afternoon. Each test shall deliver at least 15 gallons (56.8 liters) of hot water with at least an average temperature of 110 °F (43.3°C). The point reduces linearly up to zero when the average temp goes down to 100 °F or below.
- 10 points for Washing Clothes: A washer dryer supplied with the studio shall be administered once a day for 5 points each for 2 days. The items to be washed are 12 bath size towels using regular wash cycle without intervention. The water temperature must reach 110 °F at a certain point during washing.
- 10 points for Dishwashing: The Dishwasher will be used for 4 days with up to 2.5 points per day. Similar to the Clothes Washer, it has to use the normal wash settings without intervention and must reach up to 125 °F at a certain pint during washing.

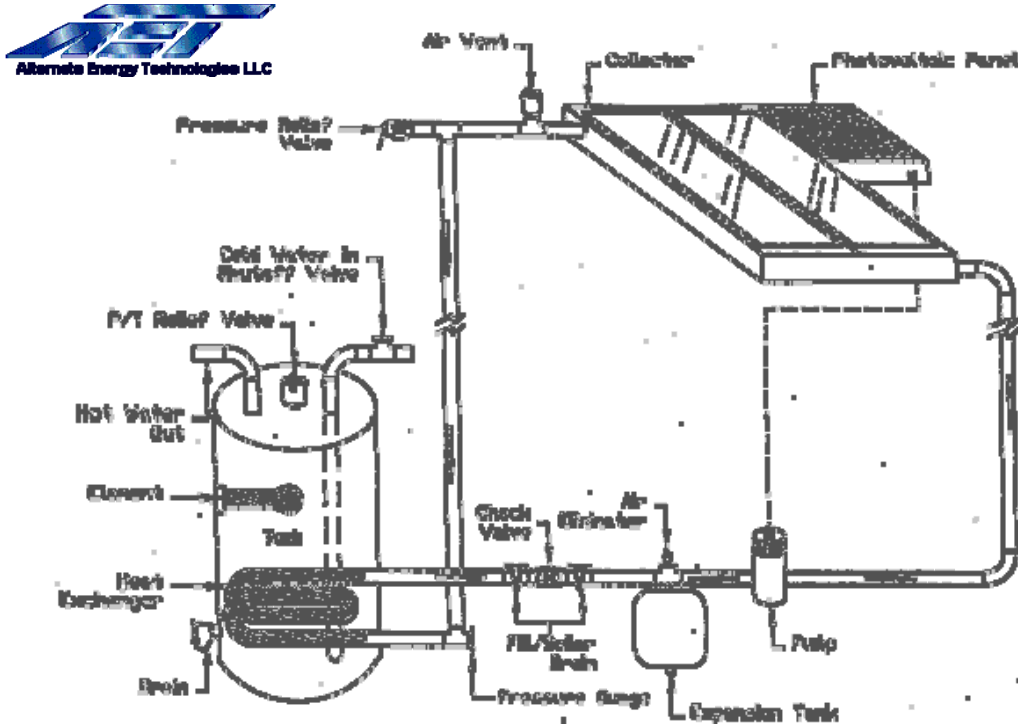
The heart of the water-heating component is an 80-gallon tank that takes heat from the evacuated tubes using solar energy. In the absence of sunlight, or at night, or during cloudy days, a back up electric heater will be used. Water coming from the main tank will be pre-heated by another solar heated loop to reduce energy requirements for water heating. The drain from grey water drain lines like the shower or lavatory will be used to pre-heat the cold water lines.

2. COMPONENT SPECIFICATIONS

There are more information per attached table that includes estimated pricing. Please note that prices may vary and may need updating.

2.1. Tanks

Unit	Manufacturer/Vendor	Model	Purpose	Size	Dimension	Qty	Price	Link
Hot Water Tank	RHEEM / AET altenergystore.com	12R80HE	Solar Heat Exchanger, Electric Water Heater	80 gallon	58.75" T x 24.5" D	1	\$1,350.51	Web site



Conceptual System Diagram



Hot Water Tank

Unit	Manufacturer/Vendor	Model	Purpose	Size	Dimension	Qty	Price	Link
Storage Tank	NORWESCO	40181	Potable Tank (H)	525 gal	54" T x 71"L x 49"D	1	\$400.00 est	Web site
Storage Tank	NORWESCO	40217	Grey Water Storage Tank (H)	325 gal	43" T x 68"L x 38"D	1	\$300.00 est	Web site



Expansion Tank	AET altenergystore.com	12ETK30015	Pre-heating Loop , Evacuated Loop	2.0 gal	app 12 5/8" T x :8"D	2	\$59.17	Web site
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2.2. Pumps

Unit	Manufacturer/Vendor	Model	Purpose	Size	Dimension	Qty	Price	Link
Supply Pump	Tank depot	Economy System Pump is a single stage 1/2 H.P. unit, 115 volts	Main Booster pump	½ HP	N/A	1	\$128.8	Web site
Solar pump	AET altenergystore.com	ELSID5W	Variable Speed, PV powered for Evacuated Tube Loop	Max:250F 150PSI	N/A	2	\$201.56	Web site

2.3. Major Components

Unit	Manufacturer/Vendor	Model	Purpose	Size	Dimension	Qty	Price	Link
Evacuated Tube	Apricus		Evacuated Tubes	30		1	Ask	

2.4. Other Components

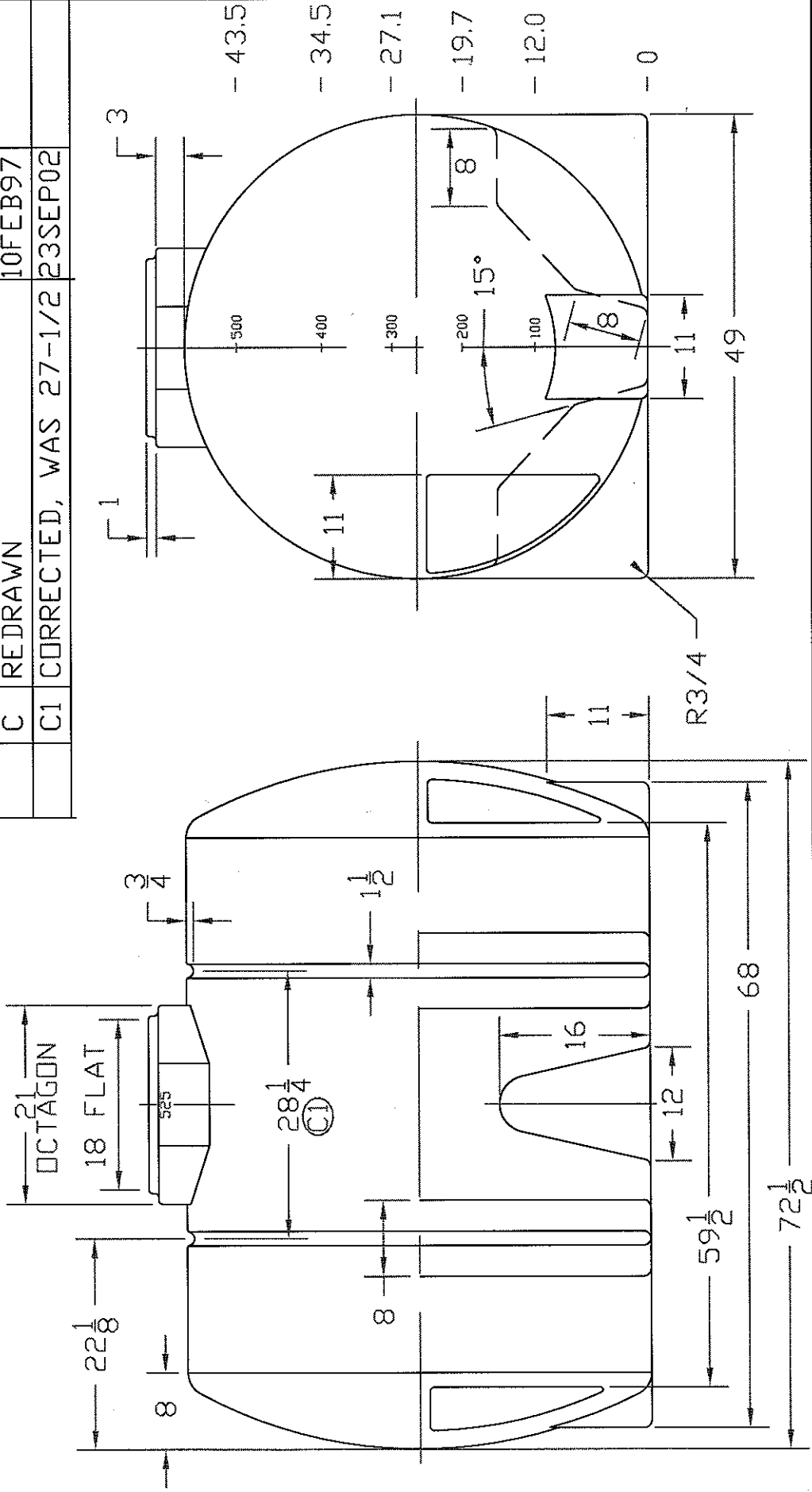
Unit	Manufacturer/Vendor	Model	Purpose	Size	Dimension	Qty	Price	Link
Shut off Valve	Various retail		Main Hot Water, Cold Water, Across Filter, Across Pump Shut off		Ball Valve	6	~\$5-\$10	

Bypass Valve	Various retail		Filter and Pump Bypass		Ball Valve	2	~\$5-\$10	
Check Valve	Various retail		Hot and Cold			2	~\$5-\$10	
Shower Head	Various retail		Low gpm			1		
Faucet, Lavatory	Various retail		Two handle			1		
Kitchen Faucet	Various retail		Single handle			1		
Washer Machine H/C Port	Various retail					1		
Dishwasher port outlet	Various retail					1		
Sink valve 3/8 x3/8	Various retail					2		
Toilet Valve 3/8	Various retail					1		
Whole House Carbon Filter	Various retail							

2.5. Piping and Connectors

Unit	Manufacturer/Vendor	Model	Purpose	Size	Dimension	Qty	Price	Link
PEX Tubing				5/8 in dia		50 ft		
PEX Tubing				½ in dia		200 ft		
PEX Tubing				3/8 in dia		100 ft		
Connectors PEX			Various angles	5/8 dia		10		
Connectors PEX			Various angles	½ in dia		200		
Connectors PEX			Various angles	3/8 dia		100		
Copper Tubing			Evac Loop	3/8 or ½ dia		?		
Copper Tubing			Pre-heating Loop	3/8 or ½ dia		?		
Mounting Clips				various				
Mounting brackets				Various				

REVISIONS			
ZONE	REV	DESCRIPTION	DATE
	C	REDRAWN	10FEB97
	C1	CORRECTED, WAS 27-1/2	23SEP02



NORWESCO
ST. BONIFACIUS, MN

525 GAL HORIZONTAL TANK

NOTE: GALLONAGE MARKS BOTH ENDS

JTP	10FEB97	SIZE	FSCM NO.	DWG NO.	REV
		A			C1
SCALE 1/16				SHEET	