

DOE/NASA CONTRACTOR  
REPORT

DOE/NASA CR-161560

SOLAR HOT WATER SYSTEM INSTALLED AT DAY'S INN MOTEL,  
JACKSONVILLE, FLORIDA

Prepared from documents furnished by

Day's Inn of America, Inc.  
2751 Buford Highway, N. E.  
Atlanta, Georgia 30324

Under Contract DOE EG-77-G-01-1632

Monitored by

National Aeronautics and Space Administration  
George C. Marshall Space Flight Center, Alabama 35812

For the U. S. Department of Energy



(NASA-CR-161560) SOLAR HOT WATER SYSTEM  
INSTALLED AT DAYS INN MOTEL, JACKSONVILLE,  
FLORIDA Final Contractor Report (Days Inn  
of America, Inc.) 32 p HC A03/MF A01

N81-10523

Unclass

CSCL 10A G3/44 29051

**U.S. Department of Energy**



**Solar Energy**

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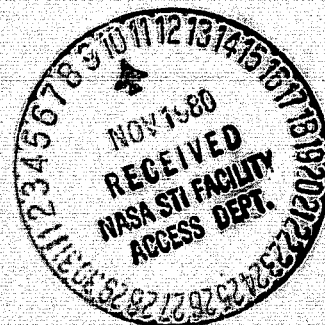
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1. REPORT NO. <b>DOE/NASA CR-161560</b>		2. GOVERNMENT ACCESSION NO.		3. RECIPIENT'S CATALOG NO.	
4. TITLE AND SUBTITLE <b>Solar Hot Water System Installed at Days Inn Motel Jacksonville, Florida.</b>				5. REPORT DATE <b>September 1980</b>	
				6. PERFORMING ORGANIZATION C/OE	
7. AUTHOR(S)				8. PERFORMING ORGANIZATION REPORT #	
9. PERFORMING ORGANIZATION NAME AND ADDRESS <b>Days Inn of America, Inc. 2751 Buford Highway, N. E. Atlanta, Georgia 30324</b>				10. WORK UNIT NO.	
				11. CONTRACT OR GRANT NO. <b>EG-77-G-01-1632</b>	
12. SPONSORING AGENCY NAME AND ADDRESS <b>U. S. Department of Energy Conservation and Solar Energy Washington, D. C. 20585</b>				13. TYPE OF REPORT & PERIOD COVERED <b>Contractor Report - Final</b>	
				14. SPONSORING AGENCY CODE	
15. SUPPLEMENTARY NOTES <b>This work was done under the technical supervision of Mr. Valmore Fogle, George C. Marshall Space Flight Center, Alabama.</b>					
16. ABSTRACT <p>This final report describes the solar energy hot water system installed in the Days Inns of America, Inc., Days Inn Motel (120 rooms) I-95 and Cagle Road Jacksonville, Florida. The solar system was designed by ILI, Incorporated to provide 65 percent of the hot water demand. The system is one of eleven systems planned under this grant. Water [in the Solar Energy Products, Model CU-30ww liquid flat plate collector (900 square feet) system] automatically drains into the 1000 gallon lined and vented steel storage tank when the pump is not running. Heat is transferred from storage to Domestic Hot Water (DHW) tanks through a tube and shell heat exchanger. A circulating pump between the DHW tanks and heat exchanger enables solar heated water to help make up DHW standby losses. All pumps are controlled by differential temperature. This system was turned on June 19, 1979. The solar components were partly funded (\$15,823 of \$31,823 cost) by the Department of Energy under Grant EG-77-G-01-1632 with the technical management being done by NASA/George C. Marshall Space Flight Center, Huntsville, Alabama.</p>					
17. KEY WORDS			18. DISTRIBUTION STATEMENT <b>UC-59a</b> <b>Unclassified-Unlimited</b>   <b>WILLIAM A. BROOKSBANK, JR.</b> <b>Mgr., Solar Energy Applications Projects</b>		
19. SECURITY CLASSIF. (of this report) <b>Unclassified</b>		20. SECURITY CLASSIF. (of this page) <b>Unclassified</b>		21. NO. OF PAGES <b>34</b>	
				22. PRICE <b>NTIS</b>	

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## **Section I**

## SOLAR ENERGY SYSTEM

The solar energy system installed by ILI, Inc. at the Days Inn Motel, Cagle Road, Jacksonville, Florida was fully operational June 19, 1979.

The installed system is for the production of hot water which will be supplied to the 120 unit section of the Days Inn. The hot water is for bathroom associated loads, i.e., showers, baths, shaving, etc. On the roof 960 ft<sup>2</sup> of modular collectors are mounted in steel frames. The modular collectors are copper absorber plates painted flat black, the glazing is water white glass, the absorber plate is insulated on the back. All this is packaged in an aluminum box. The collector array piping is reverse return, graded to drain all water in the collectors and piping into the 1,000 gallon storage tank when the collector circulator pump is not operating. All piping is type L hard drawn copper tubing isolated with dielectric unions at copper/galvanized interfaces. The storage tank in the mechanical room is 1,000 gallon nominal capacity. It is not a pressure vessel so it is vented through the top to the atmosphere. The tank has been sand blasted and lined with two coats of a USDA approved potable phenolic lining. The pumps are end suction centrifugal, 115 VAC, 3500 RPM open drip proof construction. The zone valves at the hot water tank are by TACO. The controls are by ILI, Inc. The 1,000 gallon tank is insulated with 3" of urethane and enclosed in a stud/sheetrock enclosure. Piping on the roof is insulated with expanded closed cell rubber and piping in the mechanical room is insulated with jacketed fiberglass insulation. During drain down two vacuum breakers admit air to speed drainage and prevent any vapor problems.

When the absorber plate of a specific collector becomes 12°F warmer than the bottom of the 1,000 gallon tank, the collector circulator pump turns on removing water from the 1,000 gallon tank to fill all the piping and collectors and begins to remove the heat from the black copper absorber plates. When the temperature difference drops to 5°F, the collector pump turns off and all piping and collectors on the roof drain back to the tank.

Currently there are 3 - 120 gallon hot water tanks that serve 120 motel units. At the bottom of each tank is a sensor continuously monitoring the temperature there. Also a on/off valve is associated with each of the three tanks. When the temperature at the top of the 1,000 gallon storage tank is 30°F greater than the temperature at the bottom of any of the 120 gallon tanks, two pumps turn on and a

valve opens for each 120 gallon tank whose bottom is 30°F cooler than the top of the 1,000 gallon tank. As the 1,000 gallon tank is non-pressurized and the domestic water lines are pressurized, a heat exchanger is used to transfer stored solar energy to the domestic hot water tanks. The first of the two pumps moves hot water from the top of the 1,000 gallon tank through the shell side of the heat exchanger where the heat is to be removed then back to the bottom of the 1,000 gallon tank. The second pump moves water from the bottom of any or all three of the 120 gallon tanks through the tube side of the heat exchanger where heat is added. The water is returned through an activated automatic valve to the top of the 120 gallon tanks. When the temperature difference decreases to 15°F, any respective zone valve will close. If all zone valves have been given the signal to close, the two pumps automatically turn off. This all occurs independent of what the solar collection system may be doing.

# PREDICTED SYSTEM PERFORMANCE

MONTH	BUILDING LOAD(MMBTU)	SOLAR SUPPLIED (MMBTU)	% SOLAR
JANUARY	34.25	18.73	55
FEBRUARY	34.25	21.50	63
MARCH	34.25	23.87	70
APRIL	34.25	26.30	77
MAY	34.25	26.42	77
JUNE	34.25	24.91	73
JULY	34.25	25.59	75
AUGUST	34.25	25.06	73
SEPTEMBER	34.25	21.89	64
OCTOBER	34.25	20.73	61
NOVEMBER	34.25	18.27	53
DECEMBER	34.25	15.45	45



## **Section II**

## MAINTENANCE

1. **MONTHLY CHECK SIGHT GLASS.** When the tank is hot and the collectors are drained (end of a bright day), the water level observed in the sight glass should be below but within 1" (one inch) of the bottom of the black tape. If the level is over 1" (one inch) below the bottom of the black tape on the sight glass, water should be added. Add the water through the drain valve on the suction of the far right pump in the control box. Connect a hose between this drain valve and a spigot in the room (there are four to the left of the large tank). Open the valves at both ends of the hose and leave both open until the water level observed in the sight glass is even with the bottom of the black tape. Turn off both valves at the ends of the hose and remove the hose to prevent tampering or overfilling.
2. **BI-MONTHLY CHECK AUTOMATIC VALVES.** This test will determine if the valves are stuck open. Switch the bottom three small switches on the left side of the grey control box to the middle position (OFF). Wait about 1 minute. On the side of each green valve operator is a black lever. Move the lever towards the pipe and then away from the pipe - resistance should be felt moving the lever towards the pipe (you are manually opening the valve). If the lever will move only about half way and then stop - the valve is frozen shut. If no resistance is felt moving the lever - the valve is frozen open. Repeat for all three valves. Now, switch the three bottom left switches to the HAND position (push switch to the left). Wait about 2 minutes. Operating the same levers on the valves, no resistance should be felt. If resistance is felt pushing the lever towards the pipe the valve is not opening. If this condition exists see if 24VAC is being delivered to the actuator (green box on valve). If 24VAC is being delivered, replace the actuator. If 24VAC is not being delivered consult ILI, Inc. After completion of this test, return ALL the small switches to the AUTO position (far right).
3. **CHECK CONTROL CARDS.** If operation is questioned. Insure all switches are in AUTO position (far right). To check, the sensor at the bottom of each tank is put in ice water - the light corresponding to that sensor should turn on (if it is out); put it in boiling water - the light should turn off (if it is on). The bottom 3 of the 4 small red indicator lamps correspond to the tanks - 1, 2, 3, respectively from top to bottom.
4. **PERIODICALLY RECORD TEMPERATURES.** Record at least monthly. Pick a clear day and record every 2 or 3 hours. This is a record operation of the system and will help identify any problem that might otherwise go unnoticed.
5. **PUMP MOTORS.** The motors and pumps are permanently lubricated and require no oiling. A pump seal leaking will cause a wet spot on the floor. A burned out pump motor will illuminate one of the three lamps on the front of the control box when the pump is signaled to turn on. To turn the pumps on, first insure the breaker is on and the power switch is on. To manually turn on P-1, switch the top small switch to the far left (HAND POSITION). The small red lite below the switch should turn on along with the pump. Return the switch to the far right position AUTO POSITION). Switching any of the other three small switches to the (HAND POSITION) will operate P-2 and P-3. Return the switch to the far right (AUTO POSITION).
6. **EMERGENCY TURN OFF.** The switch at the top left of the grey control box will disconnect all power to the solar unit (FAR RIGHT IS OFF).

IF LEAKAGE IS THE CAUSE FOR EMERGENCY TURN OFF first close valves #5, and #6. This isolates the solar system from the city water supply and building distribution. Next close valves #1, #3, and #4. This isolates the hot water tank from the piping system. When the cause of the leak has been remedied and the valves are re-opened, valve #4 is not to be fully opened. With the power on, turn any of three bottom small switches to HAND; this turns on P-2's is 8 PSI. Return the switch to the AUTO position. All switches should now be in the AUTO or ON position.

RETURN TO PREPARATION - If the system was turned off during the day, for over 15 minutes, with the sun out, the system should not be turned on until sunset. The reason for this is with the sun out and the collector plate dry, the collector plate will get very hot. If water is pumped to the collectors while they are very hot, it would flash into steam and possibly damage a collector.

To return to safe operation put all the small switches to the middle position. Turn the power switch to ON. If the sun is not out or the system has been off for less than 15 minutes turn the top small switch to the left, the collector circulator pump should turn on. Switch the top small switch back to AUTO and leave there. One at a time, push the bottom three small switches to the left, and return to the middle position. The two other pumps should operate. After testing, all three switches, push all three to the right (AUTO). The system is now in the fully automatic position.

## 7. PUMP FUSE CHECK.

A. S-1 must be on. Switch S-2 to HAND if the light labeled P-1 turns on then the fuse is blown; replace if required. If not, return the switch to AUTO. This tests P-1.

B. S-1 must be on. Switch S-3 to HAND if the light(s) labeled P-2 or P-3 turn on, then the fuse(s) are blown; replace if required. If not, return the switch to AUTO. This tests P-2 and P-3.

TIME & DATE	COLL. IN	COLL. OUT	SHELL HX IN	SHELL HX OUT	TUBES HX IN	TUBES HX OUT	COLL $\Delta$ P	SHELL $\Delta$ P	TUBES $\Delta$ P
1:15 pm 6/20/79	138°F	146°F	145°F	138°F	130°F	137°F	16 psi	9 psi	20 psi
2:05 pm 6/20/79	145°F	153°F	151°F	143°F	130°F	141°F	16 psi	9 psi	20 psi
2:52 pm 6/20/79	147°F	157°F	151°F	143°F	130°F	140°F	16 psi	9 psi	18 psi
5:24 pm 6/20/79	OFF 143°F	137°F	139°F	132°F	125°F	132°F	--	9 psi	18 psi

### **Section III**

## **EQUIPMENT**

### **PUMPS**

1	-	BELL & GOSSETT	1535 - 351S	115VAC
2	-	BELL & GOSSETT	1535 - 352S	115VAC

### **VALVES**

3	-	TACO	#557	24VAC
---	---	------	------	-------

### **TANK**

1	-	ILI, Inc.	1000 Gallon Rectangular Lined
---	---	-----------	-------------------------------

### **HEAT EXCHANGER**

1	-	ILI, Inc.	Shell and Tube 1000/1000
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### **CONTROL CARDS**

4	-	ILI, Inc.	SC110# Differential Controller
---	---	-----------	--------------------------------

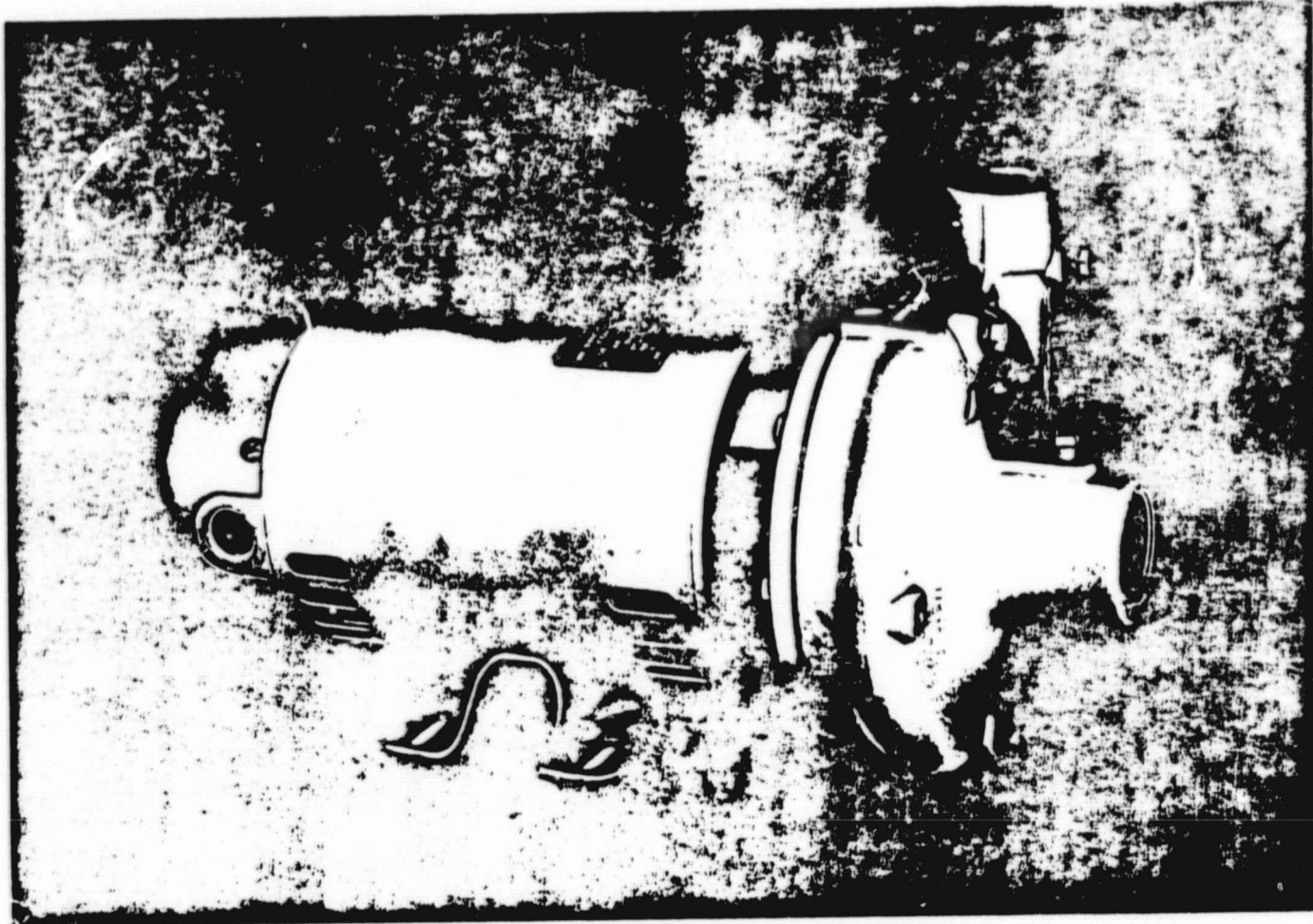
### **SENSORS**

8	-	HONEYWELL Sensors	C773A / C773C / C773D
---	---	-------------------	-----------------------

### **COLLECTORS**

30	-	SOLAR ENERGY PRODUCTS Collectors	CU30 - WW
----	---	----------------------------------	-----------

ILI, Inc.  
5965 Peachtree Corners East  
Norcross, GA 30071  
(404) 449-5900



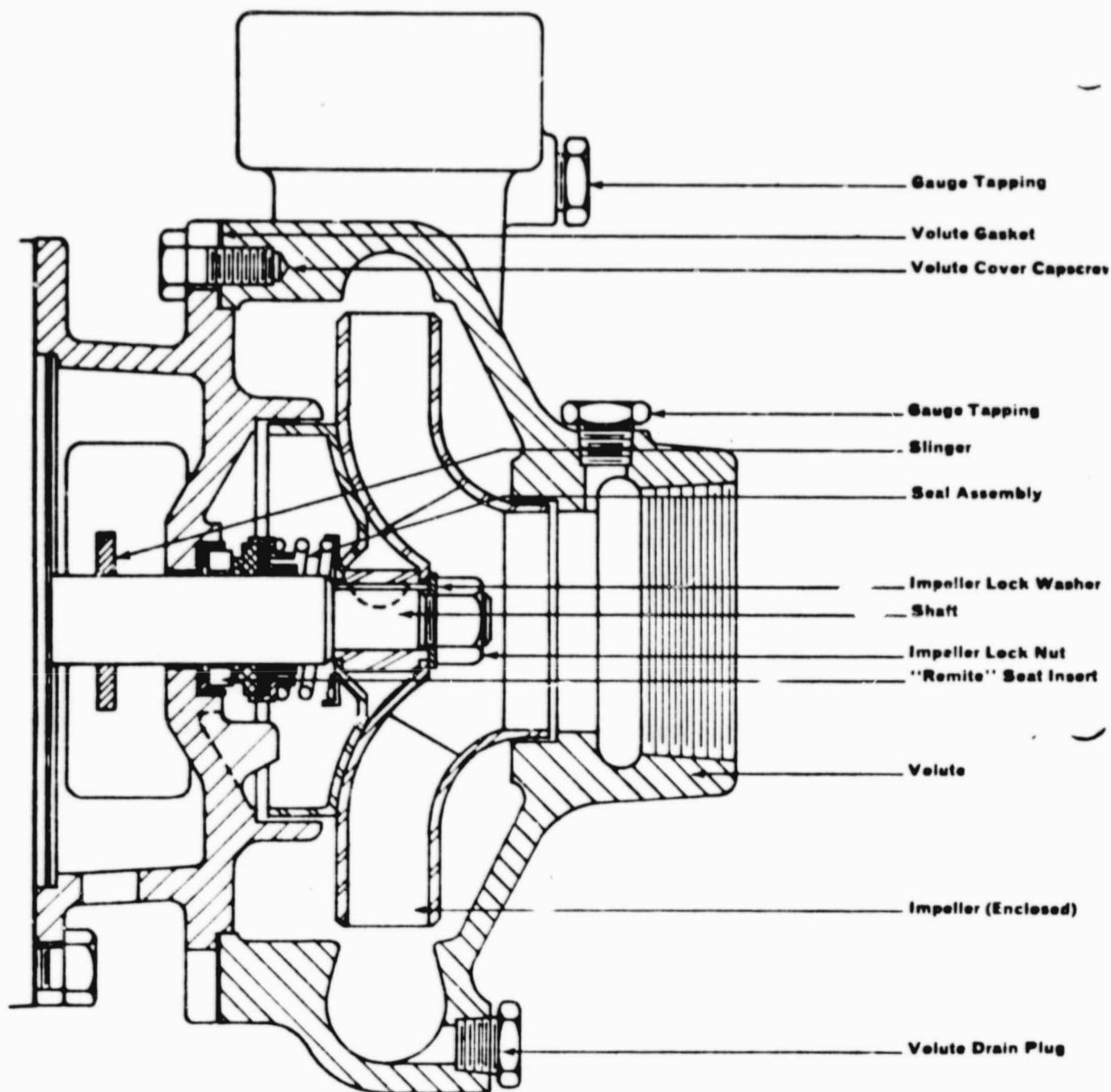
# Series 1535 Uni-Built Centrifugal Pump

A close-coupled industrial pump fabricated to exacting specifications. Featuring heavy-duty ball bearing motors. Bronze fitted construction, stainless steel shafts. For applications on cooling towers, refrigeration, industrial and general service. Available from stock—distribution points located throughout the United States.

OF TOTAL PAGE 10  
OF 10 OF 10

**BELL & GOSSETT ITT**  
FLUID HANDLING DIVISION

# B&G Series 1535—Uni-



## Construction Materials FOR PARTS IN CONTACT WITH FLUIDS PUMPED

Volute.....	Cast Iron.
Bracket.....	Cast Iron.
Impeller.....	Brass
Impeller Key.....	Steel.
Impeller Lock Washer.....	Steel.
Impeller Lock Nut.....	Brass
Pump Shaft.....	Stainless Steel

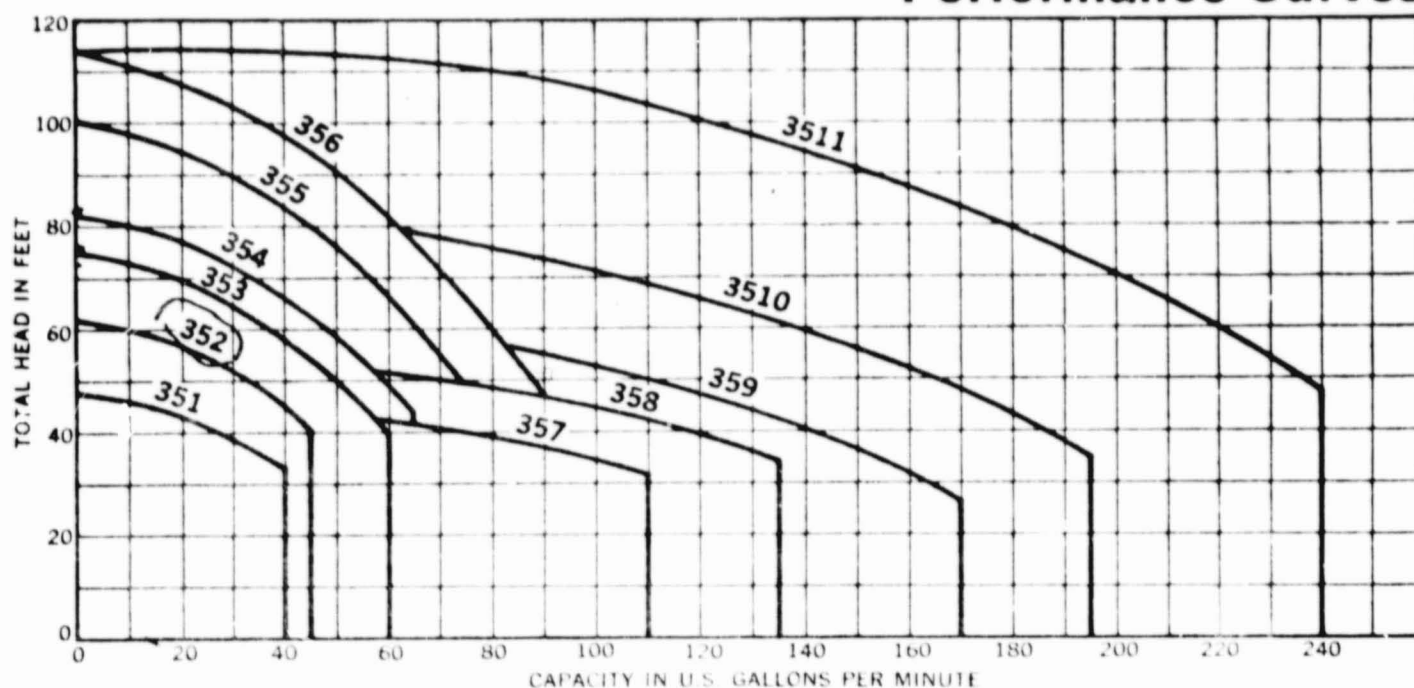
### SEAL ASSEMBLY

Seal Cage.....	Brass
Bellows.....	Synthetic Rubber
Seal Ring.....	Carbon
Spring.....	Stainless Steel
Seat Insert.....	Remite
Seat Insert Gasket.....	Synthetic Rubber

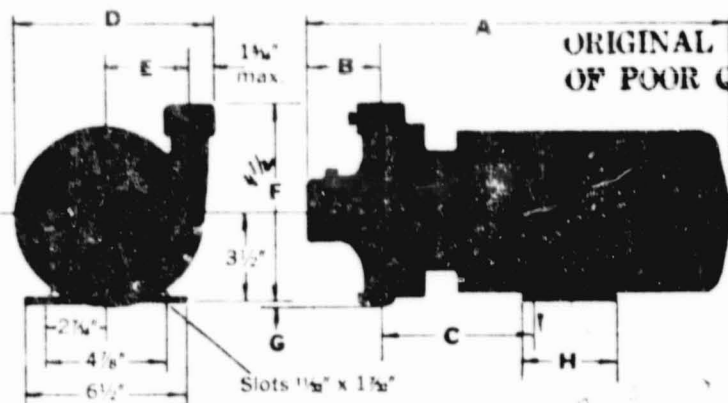


# uilt Centrifugal Pumps

## Performance Curves



Add "S" to pump number when ordering single phase pumps. Add "T" to pump number when ordering three phase pumps.



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## Dimensions

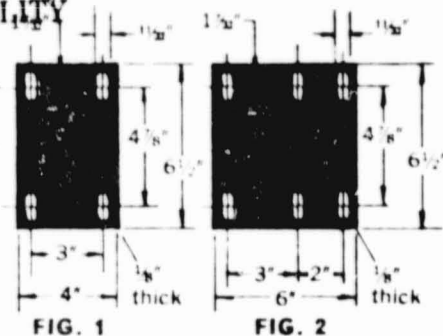


FIG. 1

FIG. 2

Bronze Fitted Construction. Motors—Open Dripproof. Single Phase—Unit Number ending in "S", 115/230 Volt, 60 Cycle, 1 Phase. Three Phase—Unit Number ending in "T", 200 Volt or 230/460, 60 Cycle, 3 Phase. (Please specify)  
All Single Phase Motors have built in overload protectors. 3500 RPM. 175 PSI Maximum Working Pressure.

MODEL NO.	H.P.	SUCTION SIZE	DISCHARGE SIZE	DIMENSIONS IN INCHES							
				A	B	C	D	E	F	G	H
351S	1/8	1 1/4	1	15	2 1/16	5	8	3 1/8	8	1/4	FIG. 1
351T	1/8	1 1/4	1	15	2 1/16	5	8	3 1/8	8	1/4	FIG. 1
352S	1/8	1 1/4	1	15	2 1/16	5	8	3 1/8	8	1/4	FIG. 1
352T	1/8	1 1/4	1	15	2 1/16	5	8	3 1/8	8	1/4	FIG. 1
353S	3/4	1 1/4	1	15 1/2	2 1/16	5	8	3 1/8	8	1/4	FIG. 1
353T	3/4	1 1/4	1	15 1/2	2 1/16	5	8	3 1/8	8	1/4	FIG. 1
354S	1	1 1/4	1	16	2 1/16	5	8	3 1/8	8	1/4	FIG. 1
354T	1	1 1/4	1	16	2 1/16	5	8	3 1/8	8	1/4	FIG. 1
355S	1 1/2	1 1/4	1	16 1/16	2 1/16	5 1/16	8	3 1/8	8	1/4	FIG. 2
355T	1 1/2	1 1/4	1	16 1/16	2 1/16	5 1/16	8	3 1/8	8	1/4	FIG. 2
356T	2	1 1/4	1	16 1/16	2 1/16	5 1/16	8	3 1/8	8	1/4	FIG. 2
357S	1	2	1 1/2	16 1/4	2 1/16	5	8 1/8	3 1/8	8 1/4	1/2	FIG. 1
357T	1	2	1 1/2	16 1/4	2 1/16	5	8 1/8	3 1/8	8 1/4	1/2	FIG. 1
358S	1 1/2	2	1 1/2	17 1/16	2 1/16	5 1/16	8 1/8	3 1/8	8 1/4	1/2	FIG. 2
358T	1 1/2	2	1 1/2	16 1/16	2 1/16	5 1/16	8 1/8	3 1/8	8 1/4	1/2	FIG. 2
359T	2	2	1 1/2	16 1/16	2 1/16	5 1/16	8 1/8	3 1/8	8 1/4	1/2	FIG. 2
3510T	3	2	1 1/2	17 1/16	2 1/16	5 1/16	8 1/8	3 1/8	8 1/4	1/2	FIG. 2
3511T	5	2	1 1/2	18 1/16	2 1/16	5 1/16	8 1/8	3 1/8	8 1/4	1/2	FIG. 2

2 HP through 5 HP units are not available in single phase.



Plant ID. No. 001-302

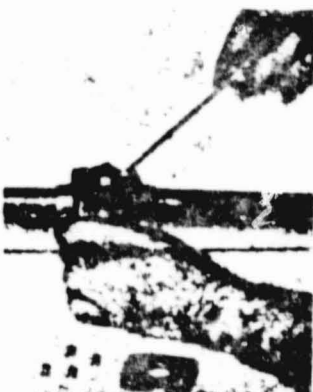
## TO SERVICE



1 — Twist off Power Head



2 — Remove the 4 Screws from hold down plate



3 — Pry out seat assembly

## TO RE-ASSEMBLE

Reverse above procedure pushing down on seat assembly and hold down plate against return spring.

# NUMBER IS-100-4-1

## APPLICATION

The Taco Zone Valve is an electrically operated valve used for zone control of Hydronic Heating and/or Cooling Systems. It controls the flow of water in a room or zone in response to the demands of the room or zone thermostat. This valve is a precisely made device and must be installed with care.

## RATING

Working Pressure (PSIG at Valve including Pump Head) — 125 PSI 125 PSI 125 PSI

Maximum Differential Across Valve (Pump Head-Feet of water) — 150 Ft. 65 Ft. 65 Ft.

Recommended Temperature Range — Max. — 240 F 240 F 240 F  
Min. — 40 F 40 F 40 F

Electrical Rating — Amps. — 1.0 Max. 1.0 Max. 1.0 Max.  
Volts — 24 24 24

SIZE	FLOW RANGE — GPM				PRESS. DROP THRU VALVE FEET OF PIPE EQUIV.
	3 Ft./Sec.	4 Ft./Sec.	5 Ft./Sec.	6 Ft./Sec.	
1/2"	2	3	4	5	10
3/4"	4	6	7	8	20
1"	8	10	13	15	70
1 1/4"	12	15	18	21	160

## INSTALLATION

Valves should be installed vertically, to simplify replacement or cleaning of the seat, if ever required at some future date. The vertical installation permits drawing a vacuum in the system and replacing or cleaning the seat without draining the system.

Valve may be sweat into the line without taking apart, provided, care is taken to prevent overheating. Follow these simple instructions: —

1. Use a torch with sharp, pointed flame.
2. Clean surfaces thoroughly and use a good grade of flux.
3. Use 50-50 or 60-40 solder. If grades of solder requiring higher temperatures are used, such as silver solder, the valve must be dismantled.
4. Avoid excessive use of flux.

## THERMOSTAT

Use a No. 568 Taco Thermostat (designed specifically for Taco-Zone Valves) with Heat Anticipator set at " D ". Other suitable two wire (SPST) Thermostats may also be used if Heat Anticipator can be set at 0.9 Amps to match valve rating.

## TRANSFORMER

Use a No. 569 Taco Transformer or other make rated at 115/24V-40VA. One transformer can accommodate a maximum of 3 Taco-Zone Valves.

## MANUAL OPENING LEVER

For gravity circulation thru valve, push lever in Power Head all the way down. Push back up to restore to automatic operation. Lever moves easily when valve is open. Resistance is encountered when valve is closed.

**CAUTION:** Addition of certain chemical additives to systems utilizing Taco equipment, voids the warranty.

## IMPORTANT NOTE

Never remove Power Head while thermostat is calling for heat. If necessary to remove Power Head, move thermostat to lowest setting, wait a minute, then proceed.

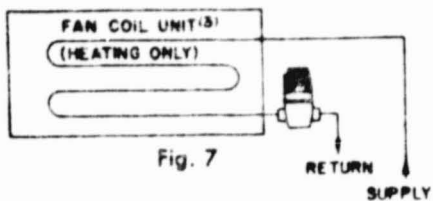
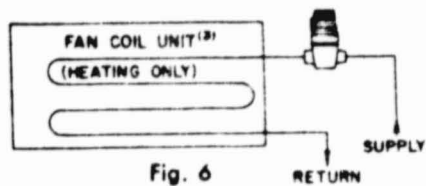
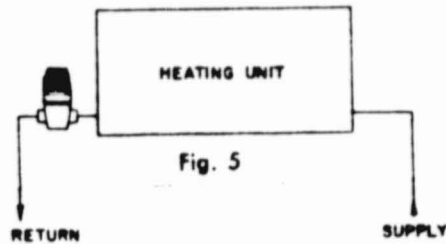
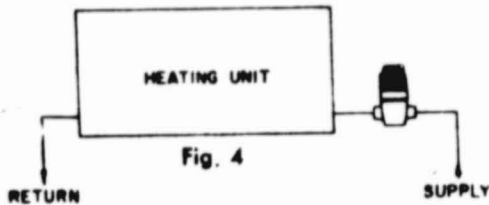
## TACO, INC.

1160 Cranston Street  
Cranston  
Rhode Island 02920

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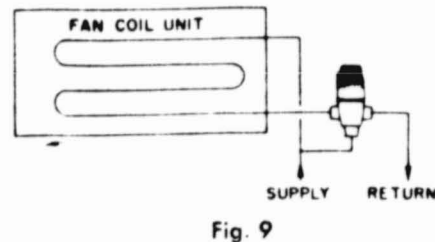
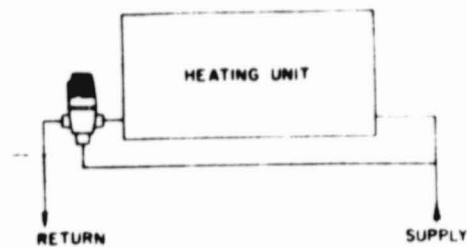
Taco Heaters of Canada, Ltd.  
3090 Lenworth Drive  
Cooksville, Ontario

## 2 WAY MODELS

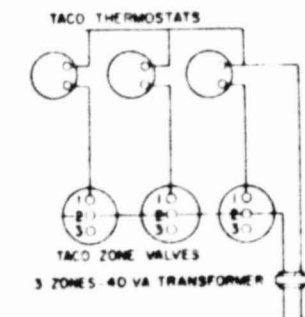


(w) May also be used for cooling if by-pass is provided in piping to prevent chiller freeze-up.

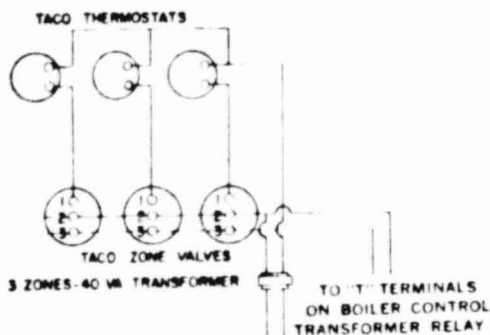
## 3 WAY MODELS



## TYPICAL WIRING DIAGRAMS

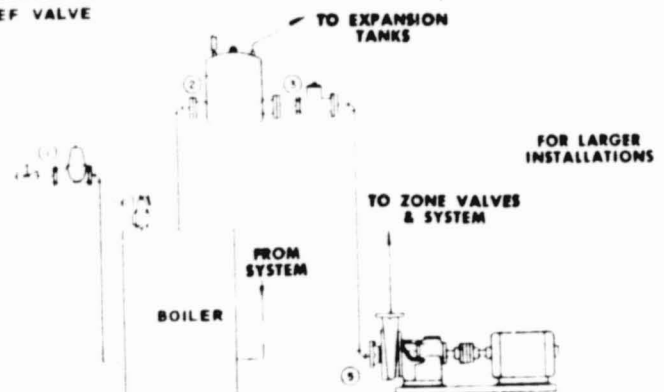
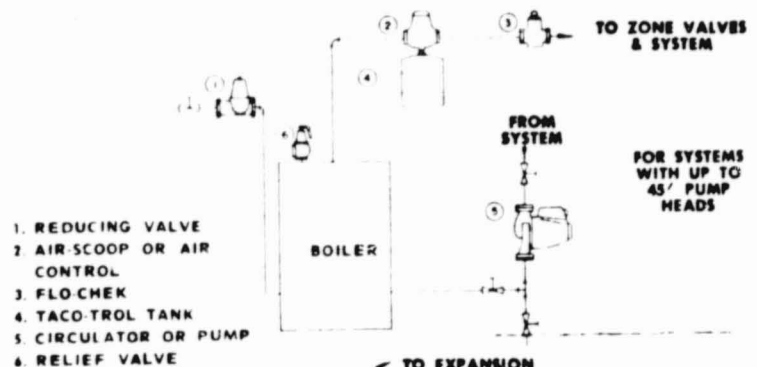


BASIC WIRING DIAGRAM  
CONTINUOUSLY OPERATING PUMP

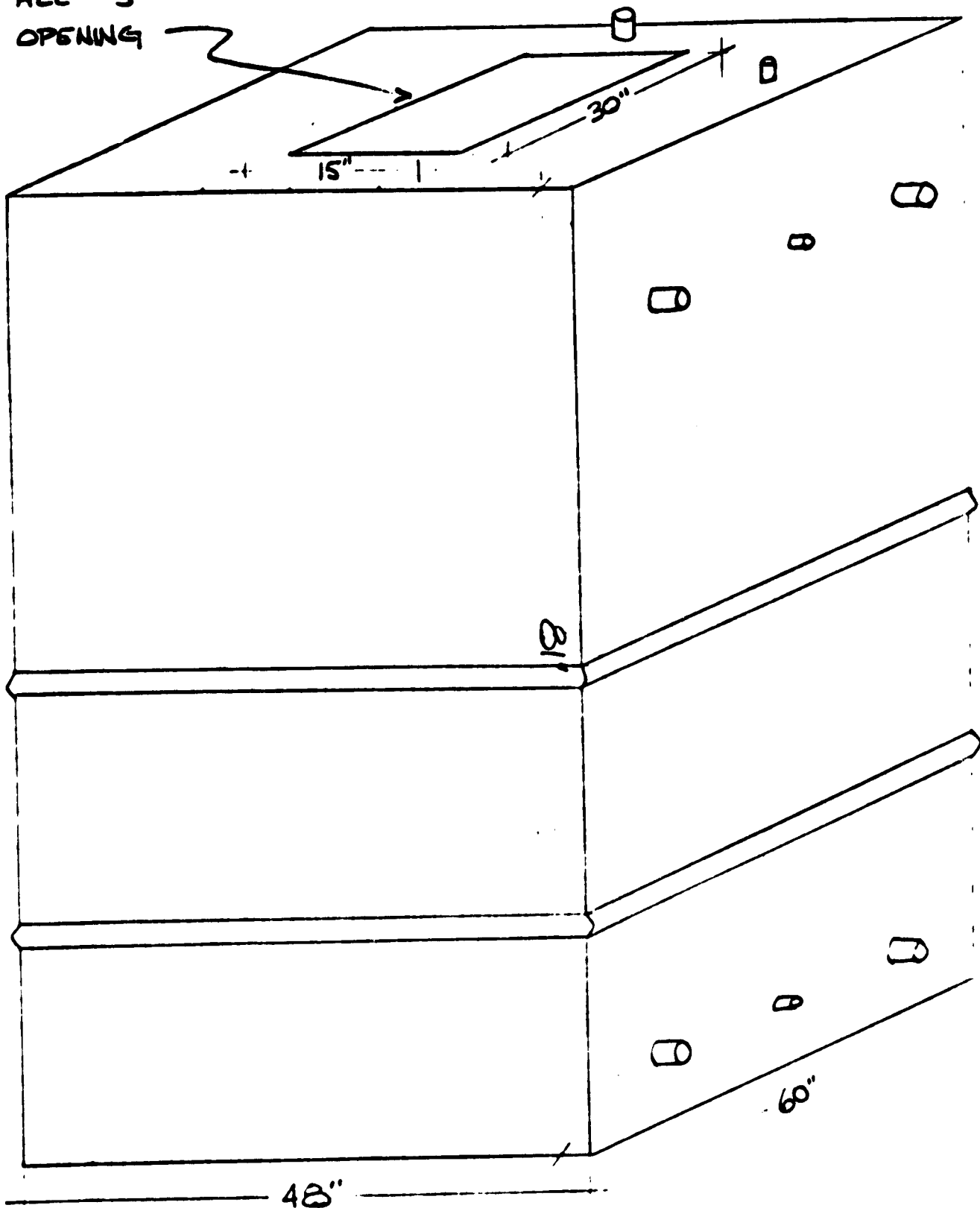


BASIC WIRING DIAGRAM  
INTERMITTANT OPERATING PUMP

## TYPICAL BOILER HOOK-UPS



ALL  
OPENING



ILI 1000 GALLON TANK

# Honeywell

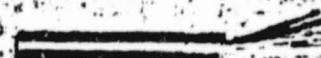
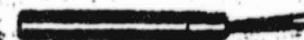
THE C773 IS A PLATINUM FILM SENSOR WHICH HAS A POSITIVE TEMPERATURE COEFFICIENT. ON A RISE IN AMBIENT TEMPERATURE THE RESISTANCE OF THE SENSOR INCREASES.

- ☐ C773A contains a single sensor for storage tank or solar collector mounting.
- ☐ C773B contains a double sensor for storage tank or solar collector applications.
- ☐ C773C contains a single sensor with a flattened end and mounting hole for easy solar collector installation.
- ☐ C773D contains a double sensor with a flattened end and mounting hole for easy solar collector installation.
- ☐ Available with a medium or high ambient temperature range (specify when ordering).
- ☐ Immersion well and remote sensor wiring compartment available separately.

ORIGINAL PAGE IS  
OF POOR QUALITY

R.L.  
10-77 (03)

## ELECTRONIC TEMPERATURE SENSORS



C773A-D

# SPECIFICATIONS

## IMPORTANT

THE SPECIFICATIONS GIVEN IN THIS PUBLICATION DO NOT INCLUDE NORMAL MANUFACTURING TOLERANCES. THEREFORE, THIS UNIT MAY NOT MATCH THE LISTED SPECIFICATIONS EXACTLY. ALSO, THIS PRODUCT IS TESTED AND CALIBRATED UNDER CLOSELY CONTROLLED CONDITIONS, AND SOME MINOR DIFFERENCES IN PERFORMANCE CAN BE EXPECTED IF THOSE CONDITIONS ARE CHANGED.

### TRADELINE MODELS AVAILABLE:

C773A Temperature Sensor. Single sensor mounts in storage tank using immersion well or on collector with mounting clip.

C773B Temperature Sensor. Double sensor mounts in storage tank using immersion well or on collector with mounting clip.

C773C Temperature Sensor. Single sensor has flattened end with mounting hole for collector installation.

C773D Temperature Sensor. Double sensor has flattened end with mounting hole for collector installation.

### LEADWIRE:

C773A,C—two black 18 inch [457.2 mm], No. 22, NEC Class 1.

C773B,D—two black, two white, 18 inch [457.2 mm], No. 22 stranded, NEC Class 1.

TEMPERATURE RANGE: Minus 50 to plus 450 F [minus 46 to plus 232 C].

DIMENSIONS: See Figs. 2 and 3.

### ACCESSORIES:

Immersion Well—for mounting sensor in storage tank. See Table 1 and Fig. 1.

Remote Sensor Wiring Compartment—for wiring storage tank sensor, Part No. 111892F.

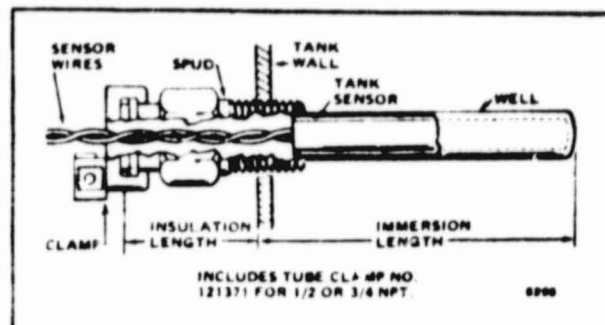


FIG. 1—TANK SENSOR INSERTED IN IMMERSION WELL.

TABLE 1—IMMERSION WELL TABLE

IMMERSION LENGTH		INSULATION LENGTH		SELECT WELL MATERIAL AND ORDER NUMBER BELOW			
in.	mm	in.	mm	COPPER		STAINLESS STEEL	
				1/2 NPT	3/4 NPT	1/2 NPT	3/4 NPT
3-3/8	85.7	1-1/2	38.1	121731A	121371B	121371E	121371F
3-3/8	85.7	1-1/2	38.1	—	121371K*	—	—
3-3/8	85.7	3	76.2	121371L	121371M	—	—
3-3/8	85.7	4	101.6	122554A*	122555A*	—	—
5-3/8	136.5	4	101.6	122554B*	122555B*	—	—
6	152.4	1-1/4	31.8	112620BB	—	—	—

\*Has plastic sleeve on insertion well.

continued on page 3

## ORDERING INFORMATION

WHEN PURCHASING REPLACEMENT AND MODERNIZATION PRODUCTS FROM YOUR TRADELINE WHOLESALE OR YOUR DISTRIBUTOR, REFER TO THE TRADELINE CATALOG OR PRICE SHEETS FOR COMPLETE ORDERING NUMBER, OR SPECIFY—

1. Order number.
2. Accessories (immersion well remote sensor wiring compartment).

IF YOU HAVE ADDITIONAL QUESTIONS, NEED FURTHER INFORMATION, OR WOULD LIKE TO COMMENT ON OUR PRODUCTS OR SERVICES, PLEASE WRITE OR PHONE:

1. YOUR LOCAL HONEYWELL RESIDENTIAL DIVISION SALES OFFICE (CHECK WHITE PAGES OF PHONE DIRECTORY).
2. RESIDENTIAL DIVISION CUSTOMER SERVICE  
HONEYWELL INC., 1885 DOUGLAS DRIVE NORTH  
MINNEAPOLIS, MINNESOTA 55422 (612) 842-7800

(IN CANADA—HONEYWELL CONTROLS LIMITED, 740 ELLESMERE ROAD, SCARBOROUGH, ONTARIO M1P 2V9)  
INTERNATIONAL SALES AND SERVICE OFFICES IN ALL PRINCIPAL CITIES OF THE WORLD.



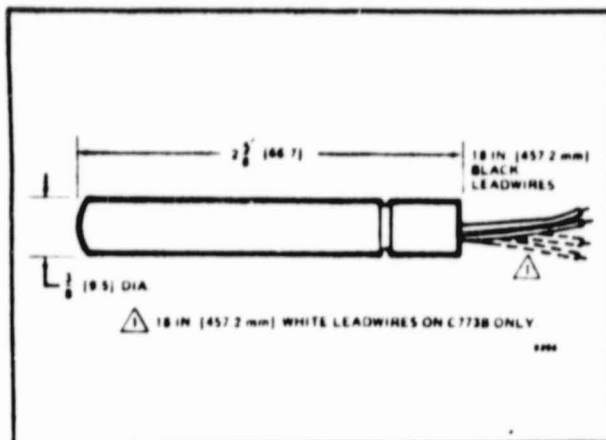


FIG. 2—C773A,B DIMENSIONS IN INCHES [MIL- METRES IN BRACKETS].

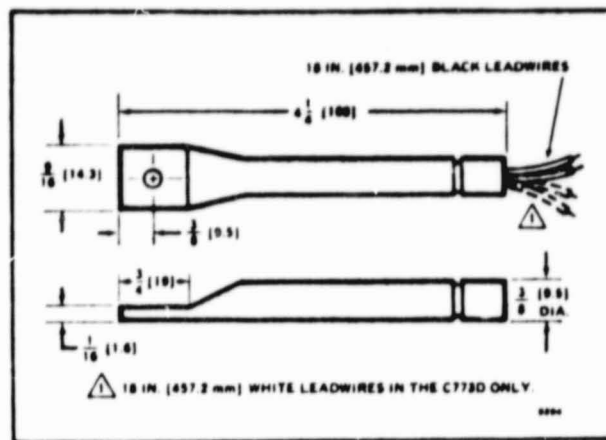


FIG. 3—C773C,D DIMENSIONS IN INCHES [MIL- METRES IN BRACKETS].

## INSTALLATION

### CAUTION

1. Installer must be trained and experienced.
2. Disconnect power supply before connecting wiring to prevent electrical shock or equipment damage.
3. Always conduct a thorough checkout as outlined in the instructions with the primary control when installation is complete.

### LOCATION

Follow the system manufacturer's recommendations for the best location of the sensor. Each sensor should be located so that it experiences the most useful temperature for proper system operation.

### MOUNTING SENSOR

Mount C773A,B as a storage tank sensor using an immersion well as follows:

1. Drain system fluid to a point below the sensor fitting.
2. Screw the well into the threaded fitting. Use an approved pipe dope or Teflon tape to seal the threads.
3. Refill system and check for leaks.
4. Insert the sensor probe into the immersion well until it bottoms. See Fig. 1.
5. Attach retainer clamp over groove on well spud. Fit wires in clamp groove and lightly tighten screw. Do not overtighten.

Install C773A,B as a collector sensor using the mounting clip provided and No. 8 screw. Mount C773C,D as a collector sensor using the flattened end with mounting hole and a No. 8 or 10 screw.

Temperatures in excess of 450 F [232 C] will damage the sensor. Shield the sensor against possible overtemperature conditions prior to system operation. Do not mount collector sensor to collector fluid channels.

### WIRING

## WARNING

1. Shield the sensor against possible overtemperature conditions prior to system operation.
2. On unglazed collectors mount the sensor with leadwires down to keep sensor from accumulating water.
3. Wire additions to the leadwires must be capable of withstanding a temperature of 450 F [232 C].

All wiring must comply with applicable codes and ordinances. The C773 can be used for numerous applications in solar energy systems. Fig. 4 shows the sensors wired to an R7412 Differential Temperature Controller.

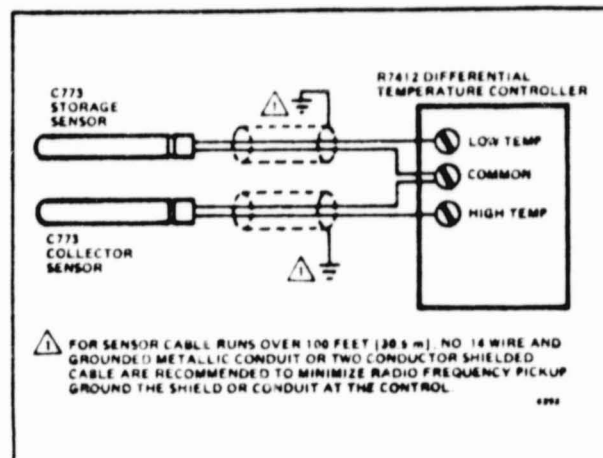


FIG. 4—WIRING C773 TO R7412 DIFFERENTIAL TEMPERATURE CONTROLLER.

For the C773B and C773D Temperature Sensors, the two black leadwires belong to one sensor and the two white leadwires belong to the other sensor.

If the amount of sensor cable used exceeds 100 feet (30.5 m), use No. 14 wire and grounded metallic conduit or two conductor shielded cable. Connect the shield or conduit to ground at the controller. Grounded metallic

conduit or shielded cable (such as Belden 5762 or equivalent) minimizes possible radio frequency signal interference.

Remote Sensor Wiring Compartment (Part No. 111892F) is available for tank sensor wiring (see Accessories).

## OPERATION AND CHECKOUT

### OPERATION

The C773 is a platinum film sensor packaged in a copper capsule. The sensor has a positive temperature coefficient; on a rise in ambient temperature the resistance of the sensor increases (Fig. 5).

### CHECKOUT

Make certain that each sensor is securely mounted. When observing the system in operation, check that the sensors are correctly located. Each sensor should be located so that it experiences the most useful temperature for proper system operation.

To determine the temperature which the sensor is experiencing, use a high resistance ohmmeter (20,000 ohm/volt or greater) to measure the resistance of the sensor. This measurement may be converted to a temperature reading using Fig. 5. Check a variety of temperature locations to insure that the sensor reading is providing the most accurate temperature for proper system operation.

If the sensors are not providing correct temperature readings because of location, change the location and mount properly.

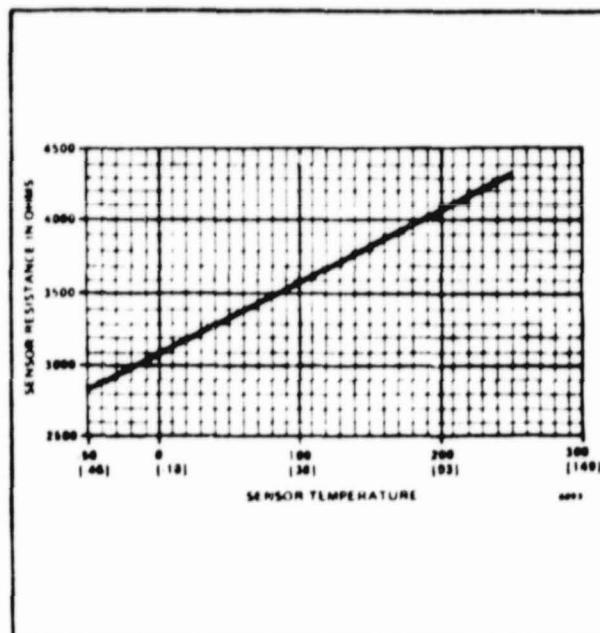


FIG. 5—CONVERTING SENSOR RESISTANCE INTO DEGREES F (C).





## FEATURES: SUNFIRED™ CU30-WW SOLAR COLLECTOR

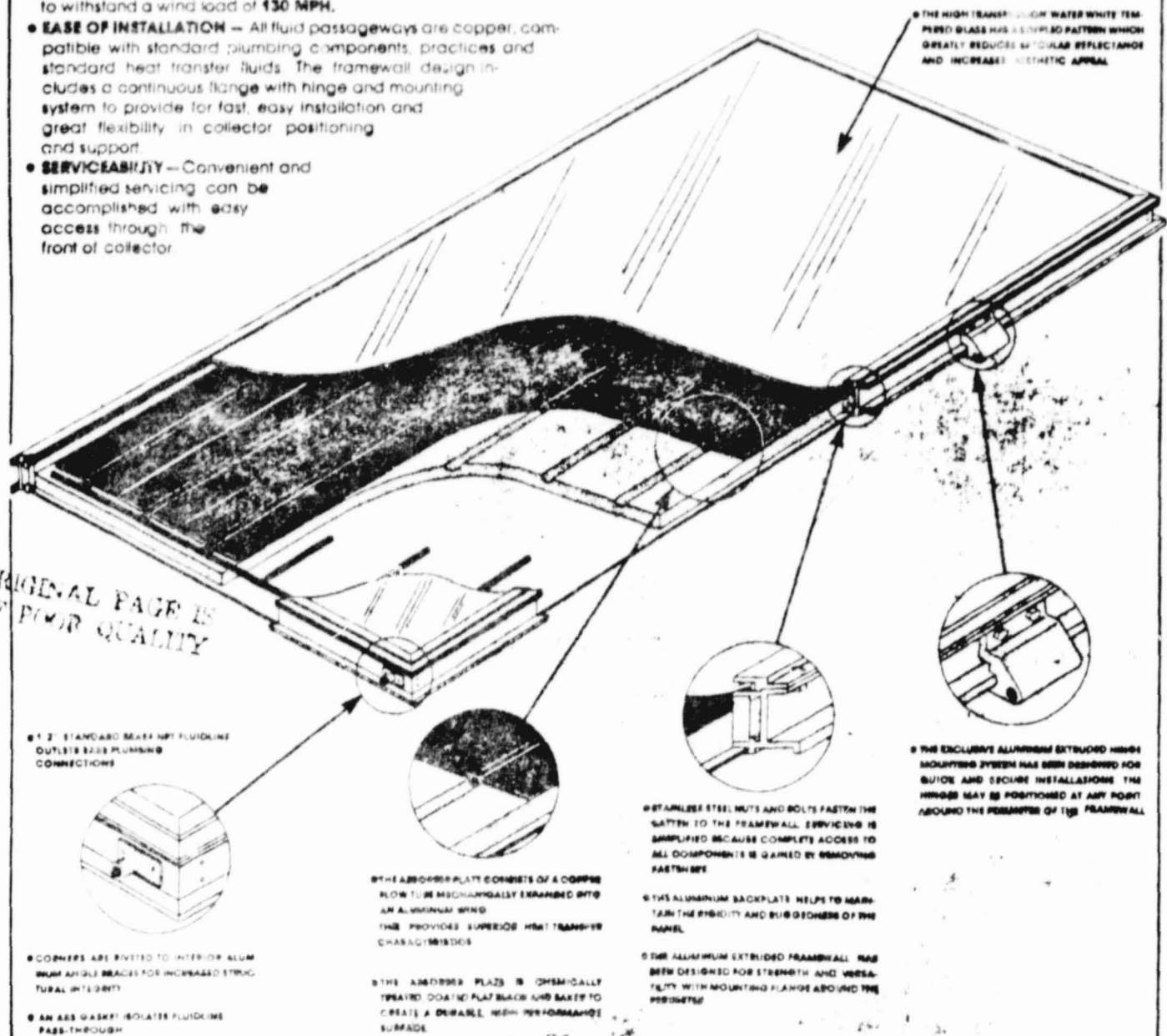
**FEATURE FOR FEATURE** — The Sunfired™ CU30 is carefully designed and constructed of the finest quality materials to provide dependable performance with a maximum service life expectancy.

- **PERFORMANCE** — Our advanced design absorber plate combines copper flow tubes mechanically expanded into a highly conductive aluminum extruded wing, closed cell isocyanurate insulation, high transmissivity tempered glass cover plate, and a highly absorptive durable plate coating to assure outstanding thermal performance (See Test Analysis page 8). The CU30 may be used in open or closed systems with working pressures to 150 p.s.i. and provides thermal performance stability to 300°F. An outstanding feature of the CU30 is the advanced design of the custom aluminum extruded framewall. The framewall has been designed for strength and versatility in mounting, in either saw-tooth or integrated roofing application.
- **DURABILITY** — The anodized aluminum frame, non-degrading tempered glass cover plate, water-resistant closed cell insulation and copper flow passageways all provide for design service life of 30 years, when properly operated.
- **STRUCTURAL INTEGRITY** — The CU30 series collectors are designed to withstand a wind load of 130 MPH.
- **EASE OF INSTALLATION** — All fluid passageways are copper, compatible with standard plumbing components, practices and standard heat transfer fluids. The framewall design includes a continuous flange with hinge and mounting system to provide for fast, easy installation and great flexibility in collector positioning and support.
- **SERVICEABILITY** — Convenient and simplified servicing can be accomplished with easy access through the front of collector.

- SEP's Systems have been approved for use in HUD's SOLAR DOMESTIC HOT WATER INITIATIVE by the Polytechnic Institute of New York and Florida Solar Energy Center.
- Independent testing has been conducted by Desert Sunshine Exposure Tests, Inc. in accordance with ASHRAE 92-77 testing standards.
- SEP's Systems meet the testing standards set by the American National Standards Institute (ANSI S198.1-1977).
- SEP's Sunfired™ CU30-WW solar collector has been approved by the Research Committee of LAPMO (S-1886).

### LIMITED WARRANTY

The Sunfired™ CU30 Solar Collector is warranted against defects in materials and workmanship for five years from date of purchase (except for freeze damage, glass breakage and damage due to aggressive heat transfer fluid).





# SPECIFICATIONS: SUNFIRED™ CU30-WW SOLAR COLLECTOR

<b>CU30-WW</b>	
<b>OUTSIDE DIMENSIONS:</b>	98.5" x 48.5" x 2.57"
<b>APERTURE AREA (sq. ft.):</b>	29.9
<b>GROSS FRONTAL AREA</b>	32.67
<b>DRY WEIGHT (lbs.):</b>	180
<b>COVER PLATE</b>	
<b>Material</b>	Water White glass
<b>Lights Per Panel</b>	(1) 85.5 lbs
<b>Iron Oxide Content (%)</b>	0.01
<b>Thickness (inches)</b>	3/16
<b>Dimensions (inches/light)</b>	46 x 96
<b>Solar Transmission (%)</b>	91
<b>Tensile Strength (psi)</b>	6400 (tempered)
<b>Elastic Modulus (psi 10<sup>6</sup>)</b>	10.5

**COVER PLATE GASKET:** Silicone gasket seal bonded to framewall and cover plate batten, UV stable

## BACK PLATE

**Material:** 0.032 mill finish aluminum sheet  
**Weight:** 13.0 lbs

## FRAMEWALL, BATTEN, AND MULLION

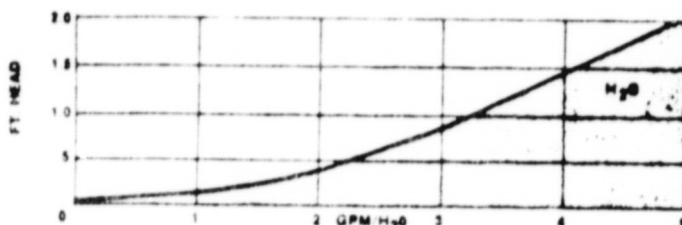
**Materials:** aluminum alloy extrusion, Alloy no. 6063-T5  
**Weight:** 35 lbs  
**Finish:** Clear anodized

## ABSORBER PLATE

**Material:** 0.5" I.D. - 0.026 wall copper flow tubes mechanically expanded into extruded aluminum wings for superior thermal conductivity. Flow tubes brazed to 1/2 inch copper headers unless specified otherwise. All welded surfaces are copper or brass.

**Fluid Capacity:** 0.84 gallons

**Flow Characteristics:** 0.05ft. head at 0.75 gpm flow rate (water).



THE ABOVE CURVE ILLUSTRATES PRESSURE DROP ACROSS THE CU30 PANEL WITH WATER AS THE TRANSFER FLUID.

**Surface:** Assembled plate is chemically treated and coated flat black unless specified otherwise.

**Solar Absorptivity:** 0.98

**Emissivity:** 0.89

**Weight:** 49 lbs

## INSULATION

**Material:** 1-1/8 inch isocyanurate foam board, routed to receive flow tube pattern.

**Thermal Conductivity:** 0.09 Btu-in. ft<sup>2</sup>/F

**Flame Spread Classification:** 20

**Weight:** 7.0 lbs

**DESIGN LIFE:** Material selection and design considerations allow an expected service life of thirty (30) years, when the panel is operated properly.

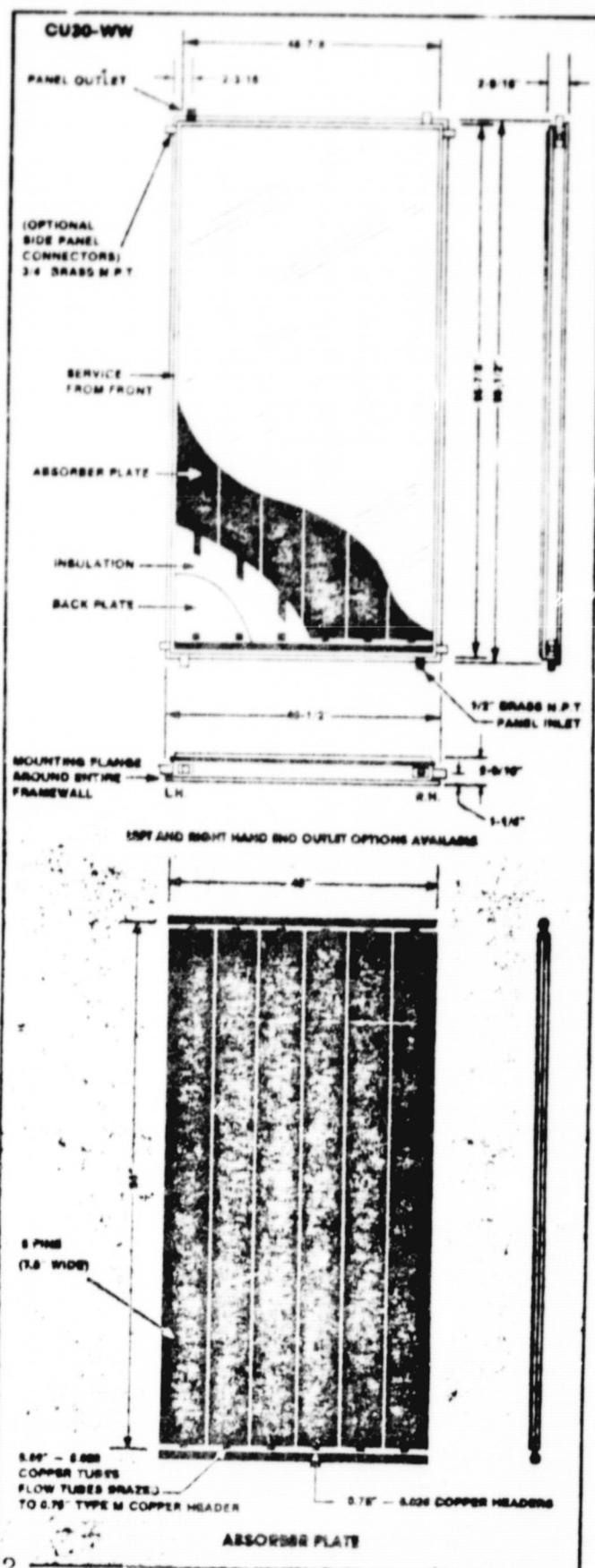
## OPTIONS

**CU30-HRM Mounting System:** Aluminum extruded mill finish hinges (4) designed to mate with any section of framewall. Aluminum standoffs (2) and mounting brackets (4) suitable for fixed position or adjustable mounting (from 0° to 90°+). Weight 9.0 lbs.

**CU30-SO:** Four 1/2" brass threaded outlets with parallel internal 1 I.D. - 0.035 wall copper headers.

Left hand and right hand 1/2" brass NPT end outlets.

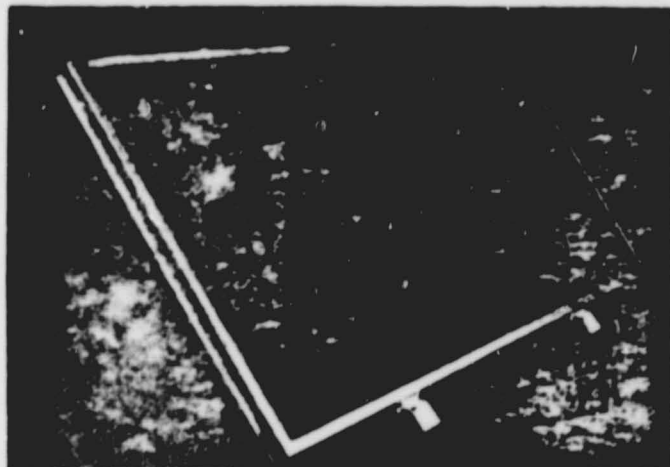
**CN30-** 1/2" cupronickel flow tubes for aggressive heat transfer fluids.





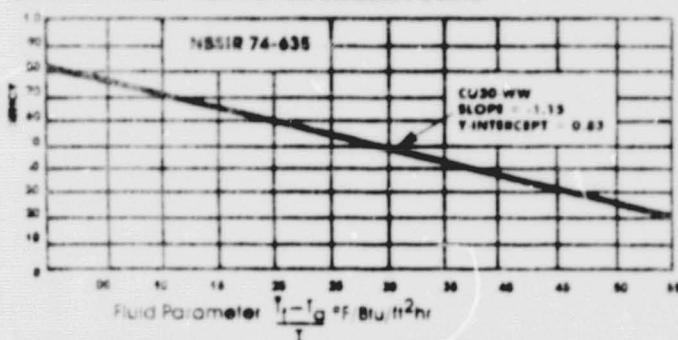
## SPECIFICATIONS: SUNFIRED™ CU30-WW SOLAR COLLECTOR

### CU30-WW FLAT PLATE SOLAR COLLECTOR

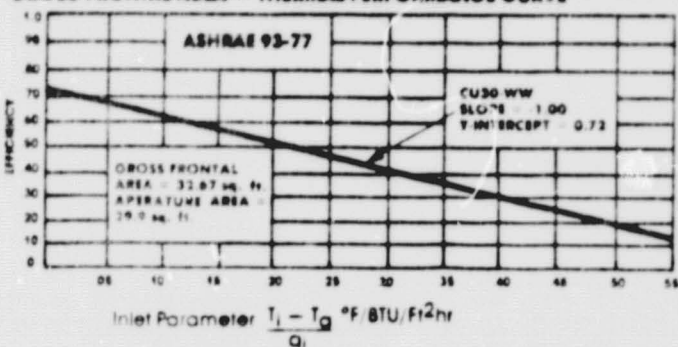


Testing performed in accordance with NBSIR 74-635, ASHRAE 93-F and ASHRAE 93-77 by Desert Sunshine Exposure Tests, Inc., Phoenix, Arizona.

#### APERTURE AREA - THERMAL PERFORMANCE CURVE



#### GROSS FRONTAL AREA - THERMAL PERFORMANCE CURVE



$T_a$  = ambient temperature  
 $I$  = solar insolation

$$T_f = \frac{T_{in} + T_{out}}{2} \text{ of collector fluid}$$

#### THERMAL PERFORMANCE CURVE EXPLANATION

The above thermal performance curve has been derived from tests conducted by Desert Sunshine Exposure Tests, Inc.

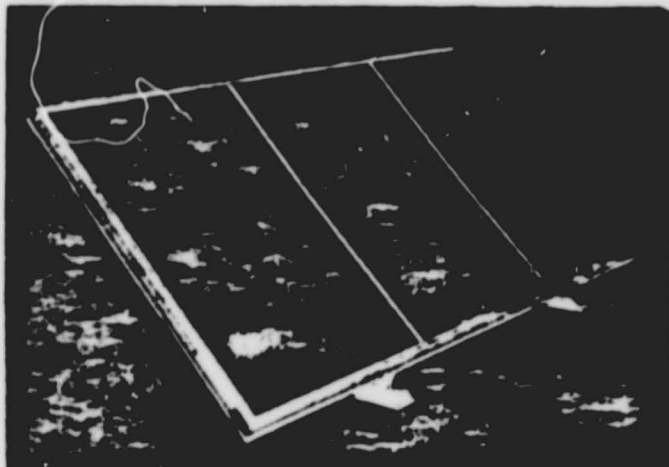
Test data available upon request

Instantaneous solar collector efficiency of the CU30 solar collector is found by operating the panel under stable conditions and monitoring inlet and outlet temperatures and the mass flow rate. The panel inlet and outlet temperatures are averaged and the ambient air temperature is subtracted from the result. This number is then divided by the incident solar radiation Btu/ft². The resulting value is plotted along the x-axis of the graph. The value to be plotted on the y-axis is the actual efficiency of the panel: output (outlet temperature minus inlet temperature °F multiplied by the flow rate lb./hr.) divided by input (insolation Btu/ft²). These values plotted at different inlet temperatures provide an instantaneous performance curve.

#### THERMAL PERFORMANCE STABILITY

Thermal distortion of the solar collector during operation and periods of stagnation to temperatures of 300°F will not cause significant deterioration of panel's performance.

### CU30-PL FLAT PLATE SOLAR COLLECTOR



Testing performed in accordance with NBSIR 74-635 by Energy Design Associates, Inc., Gainesville, Florida.



## SPECIFICATIONS SUMMARY: CU30 SUNFIRED™ SOLAR COLLECTOR

The CU30 Flat Plate solar collector panels shall be capable of absorbing solar radiation and transferring the resulting heat into a heat transfer fluid circulating through the panel. The absorber plate shall consist of a grid pattern of aluminum "fin" extrusions with copper flow tubes mechanically expanded into the fins, providing positive thermal contact of minimum 67% of tube surface. The enclosure box shall be constructed of clear anodized aluminum with the mounting flange extending around the entire perimeter of the panel. Insulation shall be 1-1/8" closed cell isocyanurate rigid foam board. The cover plate shall be tempered water white glass with transmissivity of .91. The panel fluid connections shall be thermally isolated 1/2" NPT brass nipple.

#### THERMAL PERFORMANCE

The panel's operation shall be independently tested according to ASHRAE 93-77 test standards. The panels shall have a linear analysis thermal efficiency described by the equations:

$$EFF = 0.83 - 1.15 \frac{(T_f - T_a)}{I} \quad (\text{NBSIR 74-635})$$

$$EFF = 0.72 - 1.10 \frac{(T_f - T_a)}{q_i} \quad (\text{ASHRAE 93-77})$$

$$EFF = 0.696 - 0.584 (IP) - 0.872 (IP)^2$$

#### DURABILITY

The panel shall be capable of withstanding stagnation temperatures of 300°F without significant degradation. The panel shall be designed to withstand wind loads to 130 mph, when properly mounted. The absorber plate shall be designed to allow fluid drainage for freeze protection and shall be capable of withstanding working pressures of 150 psi. The panels shall have a design service life of 30 years.

#### SERVICEABILITY

The glass cover plate shall be removable from the front of the panel with simple hand tools. The absorber plate and other components shall then be removable through the front of the panel.



# **Solar Energy Products, Inc.**

## **Warranty**







## DOMESTIC HOT WATER SYSTEMS WARRANTY

### I. SYSTEM WARRANTY

Solar Energy Products, Inc. warrants its Solar Domestic Hot Water Systems with the following conditions and limitations:

#### A. Conditions of System Warranty

1. This warranty is extended to consumers who purchase Solar Domestic Hot Water Systems directly from SEP or from any of SEP's Authorized Dealerships and to all subsequent owners of these systems, so long as the system remains in its original installation.
2. This warranty covers **Authorized** installations only when they are installed, operated and maintained according to the procedures described in the SEP Installation, Operation and Maintenance Manual and the Authorized SEP Dealer Policy Manual.
3. This warranty covers **Unauthorized** installations only when they are installed, operated and maintained according to the procedures described in the SEP Installation, Operation and Maintenance Manual.
4. The **Warranty Registration Card** for Sunfired™ Energy Systems must be signed and completed by the Purchaser and the Installer and returned by the Purchaser within (10) days of the completion of each of the required Warranty Validation Inspections.
5. The **Warranty Validation Inspection** form must be completed by the installer, approved by the Purchaser and returned within (10) days of completion of each of the Warranty Validation Inspections.

#### B. Coverage of System Warranty

1. **Authorized Installations**  
Warranty applies when the system is installed by an Authorized SEP Dealer properly licensed to install Solar Domestic Hot Water Systems.
  - a. One year full warranty from date of initial installation completion against failure of the Solar System, including any component or assembly where such failure is caused by a defect in materials, manufacture, installation, or corrosion of the absorber plate or coolant passages. This warranty covers the full cost of parts, labor, shipping (to the site), handling (necessary to remedy the defect), replacement at the site (if necessary), and field inspection (within a reasonable time of the complaint to verify failure, establish probable cause, and determine corrective action by the Authorized SEP Dealer.)
2. **Unauthorized Installations**  
Warranty applies when the system is installed by a properly licensed contractor but **not** by an Authorized SEP Dealer.
  - a. One year limited warranty from date of initial installation completion against failure of the solar system, including any component or assembly where such failure is caused by a defect in materials, manufacture, or corrosion of the absorber plate or coolant passages. This warranty covers the full cost of all parts and shipping (to the site).
3. **Unwarranted Installations**  
Systems installed by unlicensed personnel and/or those with no building permit.

### II. COMPONENTS WARRANTY

SEP warrants the following components, along with each component's manufacturer. Please refer to the manufacturer's warranty cards.

#### A. Collector Limited Warranty

Solar Energy Products, Inc. warrants the Solar Energy Products, Inc. Collector, including any component or assembly for a period of **five years** from date of installation against failure of the collector caused

by a defect in materials or manufacture, but not glass breakage. This warranty covers the full cost of all parts, labor, shipping (to the site), handling (necessary to remedy defect), replacement at the site (if necessary) and is unaffected by change of ownership as long as the collector remains in the original installation.

**NOTE:** Collector is not warranted against damage from exposure to freeze conditions.

#### B. Absorber Plate and Coolant Passages

Solar Energy Products, Inc. warrants the Solar Energy Products, Inc. Collector absorber plate and coolant passages for a period of five years, from the date of installation, against failure due to corrosion **ONLY** when, in Closed Systems original fluid and any makeup consists of 50:50 mixture of Prestone II®, manufactured by Union Carbide Corp. (or any copper compatible heat exchange fluid as determined by the Copper Development Association) and distilled water or water testing from 9.4 to 7.0 pH. In Open Systems water having a pH between 9.4 and 7.0 is acceptable. This warranty covers, for the first year only, the full cost of all parts (including the cost of furnishing a new absorber plate), labor, shipping (to the site), handling (necessary to remedy the defect), and replacement at the site (if necessary). This warranty covers for the **second through fifth years** the full cost of all parts (including the cost of furnishing a new absorber plate), labor, and shipping to the site. The warranty goes with the collector and is unaffected by change of ownership so long as the collector remains in the original installation.

#### C. Differential Controls Limited Warranty

Solar Energy Products, Inc., and Hawthorne Industries warrant Solar Energy Products, Inc. differential controls for a period of **one year** from date of purchase against failure due to defect in materials or manufacture, providing that the product has not been repaired, serviced, altered, subjected to misuse, neglect, accident or improper installation (by anyone other than the manufacturer). This warranty covers the full cost of parts, labor and shipping, and is unaffected by change in ownership, so long as the controller remains in the original installation.

#### D. Pumps Limited Warranty

Solar Energy Products, Inc., and Grundfos Corp. warrant all Grundfos Pumps sold by Solar Energy Products, Inc. for a period of **eighteen months** from date of purchase against failure caused by defect in materials or manufacture, provided that they are properly installed and used with manufacturer's recommendations, and have not been repaired or altered outside the Grundfos Pumps Corporation factory. This warranty covers the full cost of all parts, labor and shipping and is unaffected by the change in ownership, so long as the pump remains in its original installation.

#### E. Storage Tanks and Storage Tanks With Built-In Heat Exchangers Limited Warranty

Solar Energy Products, Inc., Mor-Flo Industries, Inc., Ruud Manufacturing Co. and Rheem Manufacturing Co. warrant storage tanks and storage tanks with built-in heat exchangers sold by Solar Energy Products, Inc., for a period of five years from date of completion of installation against failure caused by defect in material, manufacture, or natural corrosion provided that the heat exchanger solution is maintained per instructions. This warranty covers the full cost of parts, labor and shipping and is unaffected by change in ownership, so long as the storage tanks and storage tanks with built-in heat exchangers remain in their original installations.

### III. AUTHORIZED SEP DEALER WARRANTY REQUIREMENTS

Authorized SEP Dealers are responsible and obligated to comply with all local, state and federal consumer warranty requirements.

Installations must be performed by properly licensed personnel in accordance with all known governing building ordinances.

Authorized SEP Dealer is responsible and obligated to be adequately insured for completed operations liability.

Authorized SEP Dealer is responsible and obligated to perform 30 day warranty inspection on water inspection at the end of 365 days of system operation.

### WARRANTY SCHEDULE FOR SOLAR ENERGY PRODUCTS, INC., DOMESTIC HOT WATER SYSTEMS

ITEM	System Including All Components and Assemblies		Collector	Absorber Plate Coolant Passages Collector		Differential Controls	Pumps	Storage Tank and Heat Exchanger
WARRANTOR	Authorized Dealer/Installer		Mfg. Vendor	Mfg. Vendor		Mfg. Vendor	Mfg. Vendor	Mfg. Vendor
WARRANTOR'S NAME			SEP	SEP		Hawthorne SEP	Grundfos SEP	Mor Flo RHEEM SEP
INSTALLATION	Auth	Unauth						
WARRANTY PERIOD	1 yr	1 yr	5 yrs	1 yr	20 yrs	1 yr *	18 mos *	5 yrs *
WARRANTY COVERS FAILURE DUE TO:								
Defect Material	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Manufacture	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Installation	Yes	No	No	No	No	No	No	No
CORROSION:								
Absorber & Passages	Yes	Yes	No	Yes *	Yes *			
COSTS COVERED BY WARRANTY:								
Parts	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Labor	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes
Shipping	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Handling	Yes	No	Yes	Yes	No	No	No	No
Inspection	Yes	No	No	No	No	No	No	No
Replace at Site	Yes	No	Yes	Yes	No	No	No	No
SUBSEQUENT OWNER COVERED	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

\* Not warranted when damage is caused by use of unacceptable transfer fluid

#### WARRANTOR'S NAME

Solar Energy Products, Inc.  
Grundfos Pumps Corporation  
Mor-Flo Industries, Inc.  
RHEEM Water Heating Division, City, Inc., Co.  
RHEEM Water Heating Division, City, Inc., Co.

#### ADDRESS

1208 N.W. 8th Avenue, Gainesville, FL 32601  
2555 Clovis Avenue, Clovis, CA 93612  
18450 South Miles Road, Cleveland, OH 44128  
7600 South Kedzie Avenue, Chicago, IL 60652  
7600 South Kedzie Avenue, Chicago, IL 60652

#### PHONE

(904) 377-6527  
(209) 299-9741  
(216) 663-7300  
(312) 434-7500  
(312) 434-7500



**Solar Energy Products, Inc.**

Supplier of Solar Energy Equipment

1208 N.W. 8th Avenue - Gainesville, FL 32601 • (904) 377-6527

**INDEPENDENT LIVING INCORPORATED (ILI)  
SOLAR ENERGY SYSTEMS  
CERTIFICATE OF LIMITED WARRANTY**

**A. A FIVE YEAR WARRANTY**

Each ILI Solar Energy System, which consists of the compressor, collectors, energy storage tank, control unit, domestic hot water tank, water coil and expansion device, is warranted by Independent Living, Inc. (ILI) to be free from defects in material and workmanship for five (5) years or for the time warranted by the original equipment manufacturer, whichever is shorter, from the date of shipment, and, if found upon inspection by ILI to be defective, will be repaired at ILI's expense, provided that the defective material is returned, all transportation charges prepaid, to the nearest ILI Authorized Repair Station. The location of said repair station can be obtained by telephoning (Area Code 404) 455-0927.

**B. TWELVE MONTH COMPONENT WARRANTY**

Each solar system component is warranted by ILI to be free from defects in material and workmanship for twelve (12) months from the date of shipment and, if found upon inspection by ILI to be defective, will be repaired or replaced at ILI's option and expense, provided that the defective part is returned, all transportation charges prepaid, to the nearest ILI Authorized Repair Station. The location of said repair station can be obtained by telephoning ILI (Area Code 404) 455-0927.

**C. TWELVE MONTH INSTALLATION WARRANTY**

During the first year after installation, the system has no defects in workmanship, or if so, will repair the system. This warranty is not valid if any modification is made to the ILI installed solar energy system and made by anyone other than ILI or its designated representative.

**D. GENERAL WARRANTY CONDITIONS AND LIMITATIONS**

This warranty does not cover any field labor for replacement or repair of parts, or for inspection, removal, transportation to and from the ILI Authorized Repair Station or reinstallation of component or water source heat pump. Replacement or repair under this warranty will not extend the above warranty periods.

This warranty is extended to protect the user from equipment defects only, and ILI assumes no liability under the terms of this warranty for parts which fail because of misapplication, improper installation, improper maintenance, abuse, corrosion, improper voltage, or acts of God or other causes beyond the control of ILI.

ILI neither assumes nor authorizes any person to assume for it any obligation or warranty other than those stated herein.

Any suggestion to the contrary notwithstanding, ILI shall not, in any event, have any liability under this warranty unless and until it has been paid in full for the product supplied. The warranty period shall begin to run as described above, however, whether or not payment has been made.

**E. LIMITATION OF WARRANTIES**

IT IS EXPRESSLY UNDERSTOOD THAT THIS WARRANTY IS MADE IN LIEU OF ANY AND ALL OTHER REPRESENTATIONS, CONDITIONS AND WARRANTIES, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO THOSE OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, WHETHER ARISING FROM STATUTE, COMMON LAW, CUSTOM OR OTHERWISE, AND THAT THE PROCEDURE SET FORTH IN THIS LIMITED WARRANTY SHALL BE THE EXCLUSIVE REMEDY AVAILABLE TO ANY PERSON, NOTWITHSTANDING THE PRECEDING SENTENCE, IF THIS WARRANTY IS DEEMED TO BE FOR A CONSUMER PRODUCT AS DEFINED IN 15 U.S.C. 2301, et seq. THEN, IN THAT EVENT, NO IMPLIED WARRANTY, INCLUDING BUT NOT LIMITED TO THOSE OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, SHALL EXTEND BEYOND THE PERIODS SPECIFIED ABOVE IN SECTION A AND B.

**F. CONSEQUENTIAL DAMAGES**

ILI SHALL NOT, IN ANY EVENT, BE LIABLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES ARISING OUT OF OWNERSHIP, USE OR OPERATION OF THIS EQUIPMENT, WHETHER A CLAIM FOR SUCH DAMAGES IS BASED UPON WARRANTY, CONTRACT, TORT OR OTHERWISE.

**G. GLASS**

This warranty does not cover any glass damage at any time regardless of the cause.



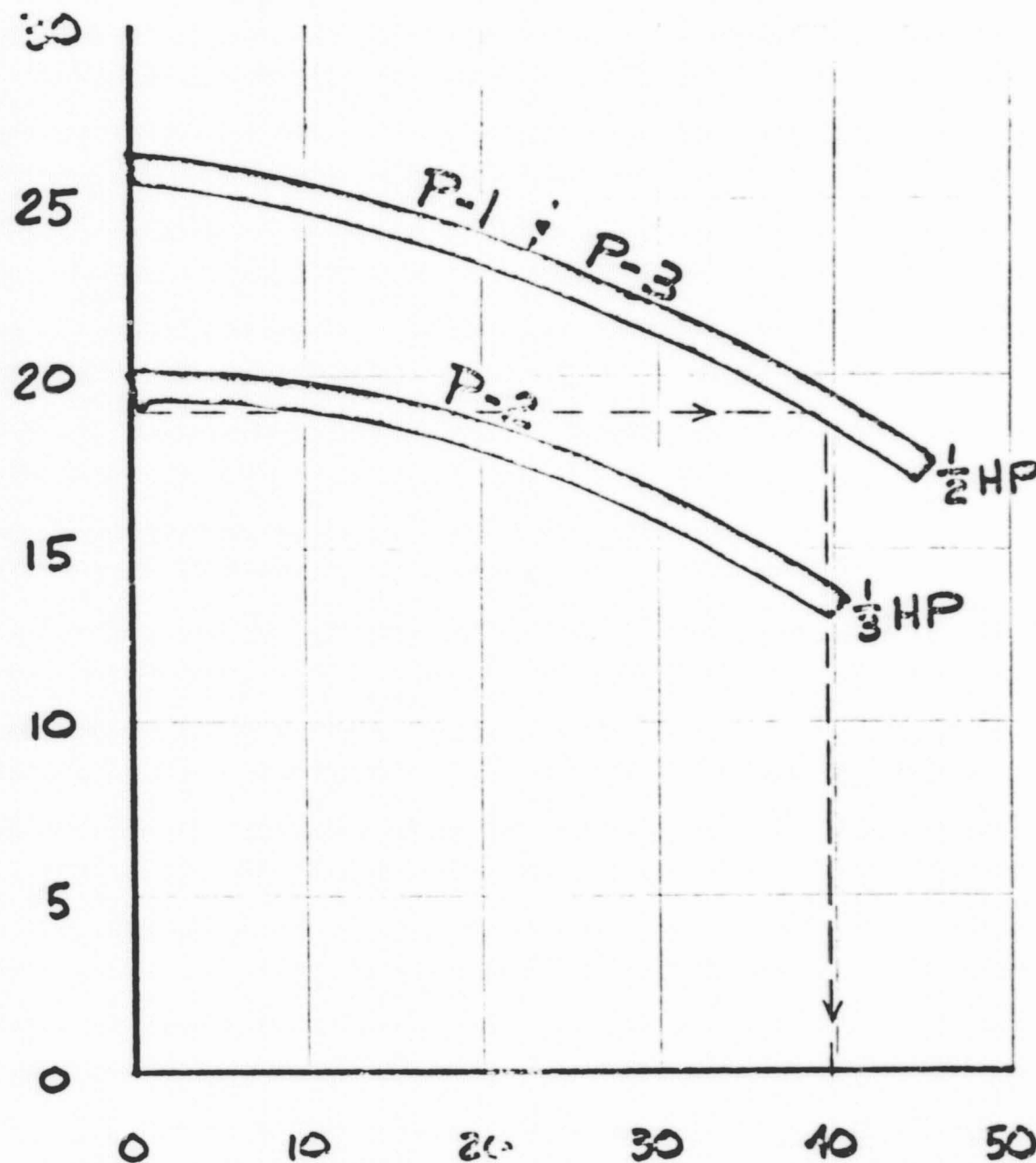
**Independent Living, Inc.**

Suite 2200 Two Exchange Place, 2300 Peachford Road  
Atlanta, Georgia 30341 / Tel. (404) 455-0927





$\Delta P = \text{PUMP DISCHARGE (PSI)} - \text{SUCTION (PSI)}$



1. FIND PUMP AND CURVE
  2. FIND  $\Delta P$  BY SUBTRACTING PUMP SUCTION PSI FROM DISCHARGE PSI
  3. READ  $\Delta P$  ACROSS TO PUMP LINE, THEN DOWN TO GPM
- EXAMPLE:  $\frac{1}{2}$  HP,  
 19 PSI =  $\Delta P$  ∴ 39 GPM  
 NOTE IF VACUUM ON SUCTION IS INDICATE  
 $\Delta P = \text{DISCHARGE PSI} + \frac{1}{2} \times (\text{INCHES HG.})$

CAPACITY IN GALLONS PER MINUTE