

**HYDRO INDUCTION POWER**

**4000W**

**GRID INTERTIE SYSTEM**

**HYDRO INDUCTION POWER**  
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# **HYDRO INDUCTION POWER GRID TIE SYSTEM**

## **Main Components:**

- ◆ High Voltage (240V) HIP HV4000 Turbine
- ◆ HIP Voltage Controller
- ◆ PVPowered PVP4600 Inverter
- ◆ Diversion Load Resistors (3 x 10 Ohms)

## **Operation of the HIP Voltage Controller:**

The ARE Voltage Clamp is used to control the HIP 4KW Hydro Turbine in a Grid-tie application. The unit is designed to work with the PVPowered 4.6KW inverter. The voltage controller is used to limit the input voltage to the inverter to less than 400 VDC.

## **Normal Operation:**

The GREEN LED will illuminate steadily at hydro startup, when the generator is producing 30VDC or more. Also at startup, the RED LED will flash until the input voltage rises to about 85 VDC.

After the voltage reaches 85 VDC, the YELLOW LED will blink, indicating that the clamp is operating. The YELLOW LED will flash approximately once every two (2) seconds during normal PVP operation or before the inverter starts delivering power to the utility grid, as long as the voltage does not exceed around 355 VDC. The repetition rate of the flash will increase as more power is diverted to the load resistor.

Power will be diverted to the load resistor when the inverter is not on line and the voltage is above 355 VDC, or when the hydro is making more than the inverter can deliver to the utility grid (4.800 W).

## **Alarm Notification:**

The RED LED indicates system status. At startup (about 30 VDC), the in-system processor checks to see if the load resistors are connected. If either of the load resistors is in open circuit, the RED LED will flash. Whichever load resistor is present will be connected as a load across the turbine. This may not prevent the turbine from starting, but it will not allow it to function normally.

During normal operation, the crowbar circuit will activate when the DC voltage applied to the inverter reaches about 385 VDC. The RED LED will be illuminated steadily. The crowbar will reset itself automatically, if the hydro comes to a complete stop and the voltage is reduced to zero.

Turn the hydro down to single nozzle (5/16") before resetting.

## **WIRING INSTRUCTION FOR HIP VOLTAGE CONTROLLER**

*NOTE:* The end customer or installer of this grid-tied hydro energy system is responsible for knowledge of and compliance with all applicable local electrical codes. If there are uncertainties about applicable code requirements, these should be clarified with local agencies before proceeding.

### **Wiring:**

1. Loosen screws holding the cover onto the junction box.
2. Back out the bottom screws about 1/4 inch.
3. Lift the cover off the screws and open like a door to the right.
4. Hang the cover with the circuit side out from the right two cover screws.
5. It is safer to remove the terminal block and the three wires hooked to the capacitors, noting where they are connected, and remove the board while mounting the box. Once the box is mounted, hang the cover with the board facing you on the right hand side of the box while wiring.
6. Connect a safety ground wire to the screw terminal (provided on the rear of the box). Be certain this wire is connected to your system safety ground. Use at least #12 AWG wire for the purpose.
7. Connect the AC wires from the turbine to the three terminals labeled A, B, C in the terminal strip. The order of the wires is not important.
8. Connect load resistor wires from one resistor to the terminals labeled -R2 and +R2. The order of the wires is not important.
9. Connect the inverter input wires to +OUT and -OUT. (If wires aren't colour coded, check them with your meter before connecting them.)
10. Connect +OUT to the positive (+) inverter input.
11. Connect -OUT to the negative (-) inverter input. If these wires are reversed, the inverter can be damaged.
12. Dress all wires that you installed to the left side.
13. Make sure that none of the wires will cross over the circuit board or press against any circuit board components.
14. Lift the cover from the two side screws and rotate the cover so that the mounting holes are aligned with the mounting screws on the box. Make certain the wires remain dressed clear of the circuit board.

15. Locate the cover over the mounting screws and tighten the screws to secure the cover in place.

**NOTE:** This circuit does not contain any form of lightning protection.

16. If you wish to add lightning protection, then surge arresting devices should be connected in parallel with the wires coming from the turbine. The leads should run from the A, B, C terminals to the enclosure ground with leads as short as possible.

**WARNING:**

Resistors get very hot before the intertie connects and during power outages. Cages should be mounted at least 18" from any burnable surfaces, using cement board or metal for protection.

The circuit is totally dependent on the load resistor for proper operation. Be certain the resistor is securely connected. A loose connection can mean the death of your inverter and this voltage clamp device.

## **WIRING INSTRUCTIONS FOR HYDRO TURBINE**

1. Connect and clamp flexible pipe to nozzle tubes (see diagram). Warming the plastic pipe with warm water or propane torch makes it easier to work with.
2. Connect hydro to a fused AC-disconnect, using appropriate wire and fuse.
3. Connect AC wires from disconnect to high voltage controller.
4. Complete wiring of controller as per instructions.
5. Once all wiring is complete with DC-disconnect OFF, start to slowly open valve on one nozzle. The inverter AC and DC disconnects are now integrated into the inverter.
6. Check output of voltage regulator and all connections, before restarting hydro with DC-disconnect ON. *Turning disconnect on when running at full power can damage controller.*
7. Inverter will take 5 minutes to turn on, after which it will take another 5 – 10 minutes to find the maximum powerpoint.
8. Once inverter has connected, continue to open nozzles. Select nozzles so as not to exceed 4KW with all valves open.
9. Check housing for adequate drainage - do not allow wheel to be flooded.
10. Check hydro and connections about an hour after installation, and then monthly for excessive heat, noise, or vibration.
11. Check runner annually: there should be no play or noise from the bearing.

12. Output will increase slightly, when bearings are seated.

13. **WARNING:** Wait 5 minutes after turning off, before working on inverter or controller wires, as the capacitors in the inverter will remain charged.

14. Test regulator seasonally by turning off inverter AC and DC disconnect while hydro is running. Turn hydro off before turning disconnect back on.

**FUSES:**

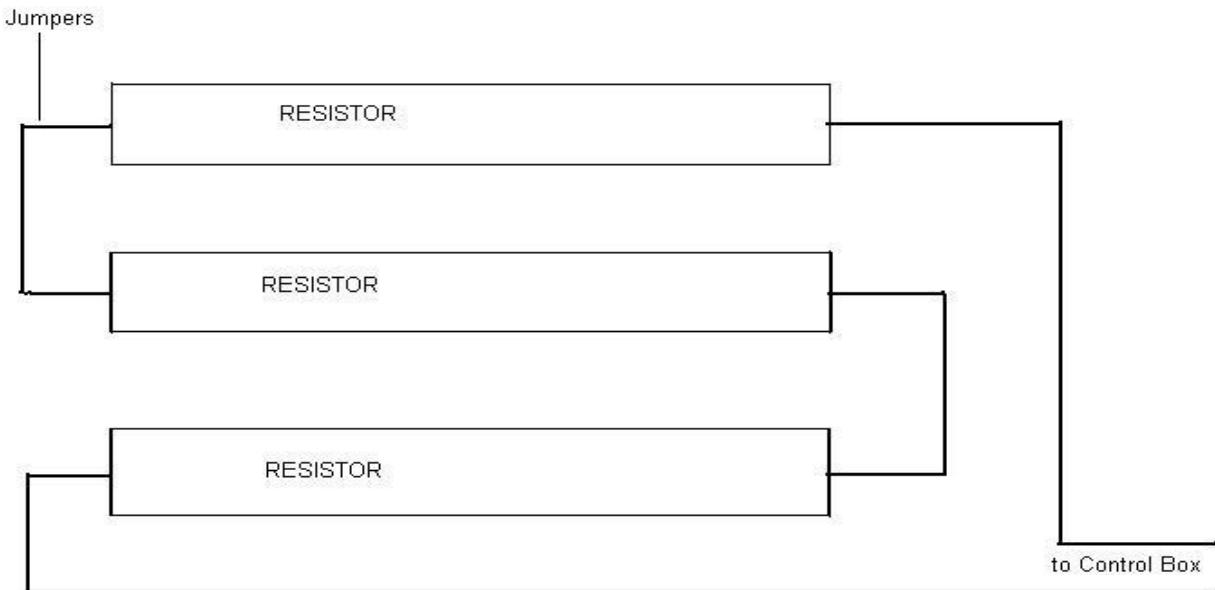
Use 15A fuses with #12 wire.

<b>FLOW THROUGH NOZZLES IN GPM AT VARIOUS HEADS</b>														
Feet	Psi	1/8"	3/16"	1/4"	5/16"	3/8"	7/16"	1/2"	5/8"	3/4"	7/8"	1.0"	RPM for 4" Turbine	
5	2.2	-	-	-	-	6.18	8.4	11	17.1	24.7	33.6	43.9	460	
10	4.3	-	-	d3.88	6.05	8.75	11.6	15.6	24.2	35	47.6	62.1	650	
15	6.5	-	2.68	4.76	7.4	10.7	14.6	19	29.7	42.8	58.2	76	800	
20	8.7	1.37	3.09	5.49	8.56	12.4	16.8	22	34.3	49.4	67.3	87.8	925	
30	13	1.68	3.78	6.72	10.5	15.1	20.6	26.9	42	60.5	82.4	107	1140	
40	17	1.94	4.37	7.76	12.1	17.5	23.8	31.1	48.5	69.9	95.1	124	1310	
50	22	2.17	4.88	8.86	13.6	19.5	26.6	34.7	54.3	78.1	106	139	1470	
60	26	2.38	5.35	9.51	14.8	21.4	29.1	38	59.4	85.6	117	152	1600	
80	35	2.75	6.18	11	17.1	24.7	33.6	43.9	68.6	98.8	135	176	1850	
100	43	3.07	6.91	12.3	19.2	27.6	36.6	49.1	76.7	111	150	196	2070	
120	52	3.36	7.56	13.4	21	30.3	41.2	53.8	84.1	121	165	215	2270	
150	65	3.76	8.95	15	23.5	33.8	46	60.1	93.9	135	184	241	2540	
200	87	4.34	9.77	17.4	27.1	39.1	53.2	69.4	109	156	213	278	2930	
250	108	4.86	10.9	19.9	30.3	43.6	59.4	77.6	121	175	238	311	3270	
300	130	5.32	12	21.3	33.2	47.8	65.1	85.1	133	191	261	340	3590	
400	173	6.14	13.8	24.5	38.3	55.2	75.2	98.2	154	221	301	393	4140	
		HARRIS OR TURGO							TURGO ONLY					

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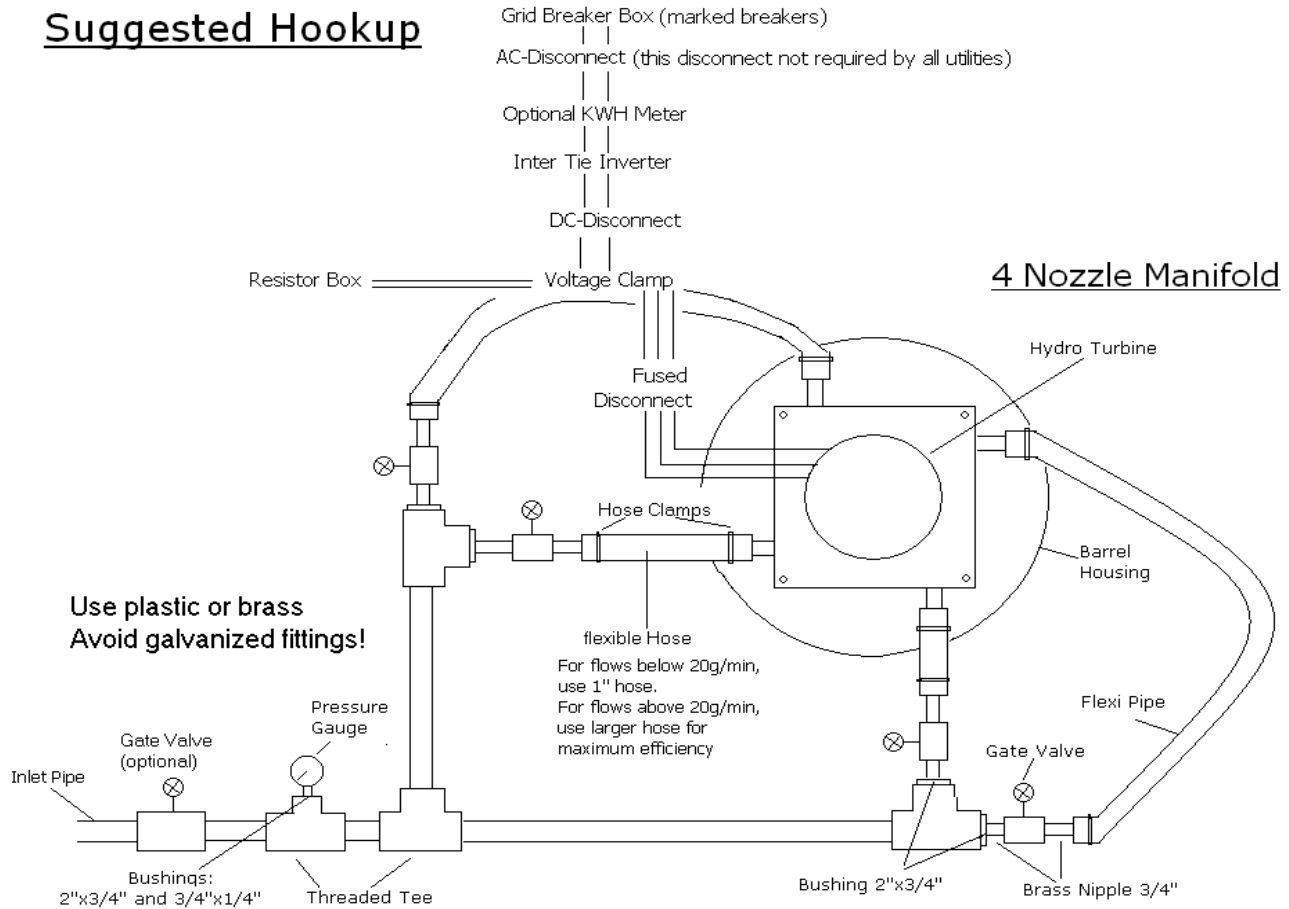
## **HIGH VOLTAGE DIVERSION LOAD 4.5KW**

- Resistors get extremely hot during operation. The resistor box should be mounted on a non-flammable surface and at least 18" away from any flammable surface. Use additional cement board or metal if mounting it on wood, and space the box away from the surface with spacers or nuts.
- Good, tight connections are extremely important. *A bad connection can result in the loss of all of your equipment.*
- Use the high temperature wire provided to wire the resistors and place a conduit connector in the bottom of the cage before mounting the cage to the wall, as you cannot access the bolts once it is mounted.
- The resistors may smell the first time they get hot.
- Check that the room is adequately vented, or is large enough to handle the heat.
- Visually check the connections annually for signs of over-heating, discolouration, or corrosion.
- The holes in the cage are large enough that you can pull on the connections, using a small loop of wire, if you have any doubts as to their integrity.



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## Suggested Hookup



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