



HR3 Product Bulletin



PRODUCT AT-A-GLANCE

- Original design circa 1979
- Hundreds sold and in the field 1980 – 2000
- Black Island Wind Turbines LLC founded 2011 to restart HR manufacturing
- Measured survival wind speed of 197 mph (88 m/s)

QUICK SPECIFICATIONS

Rated Power:

3 KW at 25 MPH (11.2 m/s)

Swept area:

232 sq ft (21.5 sq m)

Weight:

785 Lbs (356 Kg)

Annual Energy:

6000 KWh @ 13.7 mph (6.1 m/s)

Cut-in:

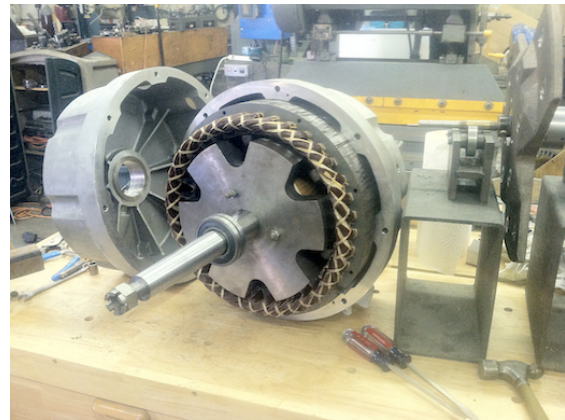
8 mph (3.6 m/s)

DESIGN FEATURES

- 3 Bladed Horizontal Axis
- Passive RPM control - "Tilt Back"
- Direct Drive 3 Phase AC Generator
- Available in 24, 48, & 96 VDC
- Totally Enclosed Ambient Cooled Generator



Lundel generator rotor



Interior view of direct drive generator

DESIGN UPDATES

The original design is time tested, with hundreds in the field, some with 30 + operating years. Black Island, under a DOE/NREL contract, reviewed operational histories and concluded that a few upgrades would be beneficial to the reliability of the turbine. In the case of the 24 VDC version, it was deemed that the brush and slip ring assembly could be enhanced. To increase the ampacity of the slip ring assembly, parallel redundant rings and brushes were employed. Each phase is now conducted via 2 parallel rings each ring with 2 redundant brushes.

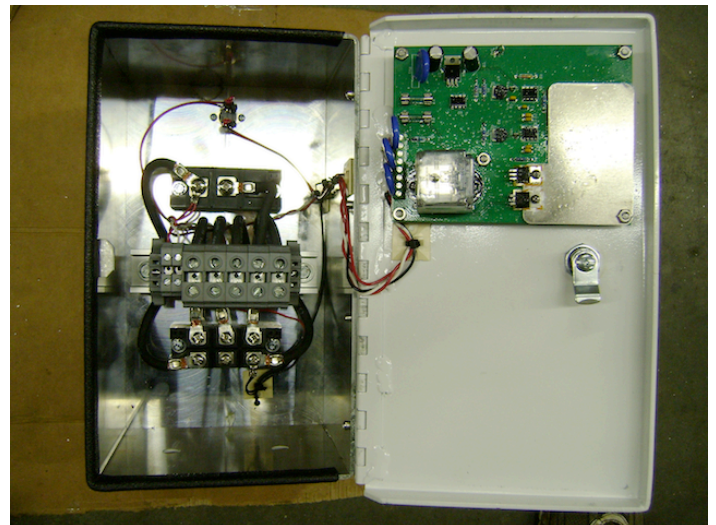


Slip rings: 2 rings/4 brushes per output phase



Rotor Balancing

The original control panel/voltage regulator used pulse-width modulation techniques to regulate the generator output voltage, preventing battery over charge. Many of the original components were either obsolete or unavailable. Black Island utilizes modern power semiconductor modules for rectification and regulation of the generator output.



Control panel interior – 7 connections total - 5 to generator and 2 to load

Shipping

Every turbine is shipped in a fully covered pallet to ensure safe arrival at your site.



Tower Top, Saddle and Control panel, in crate



Generator & hub, tail fin, cold weather option - crated

Miscellaneous



Generator(s) on assembly stand - Hadley, MA mfg facility



(Most of) The Team

(L to R) Jon Lewis, Pat Quinlan, Fred Letson, Bill Stein, Sam Stein



HR3 HIGH RELIABILITY WIND TURBINE PRODUCT BULLETIN

GENERAL DESCRIPTION

3-bladed, horizontal axis, upwind

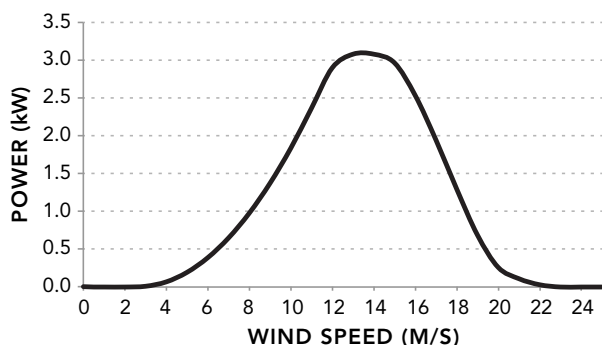
PHYSICAL DESCRIPTION

Weight (less tower) 356 kg (785 lb)
Rotor Diameter 5.0 m (16.4 ft)
Tower Height 12 to 40 m (40 to 130 ft.)

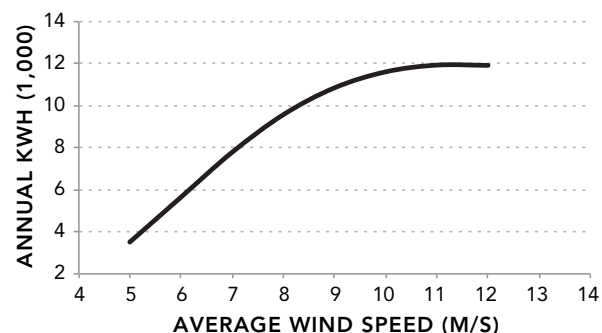
OPERATIONAL CHARACTERISTICS

Cut-in Wind Speed 3.6 m/s (8 mph)
Speed Control Initiation .. 11.5 m/s (26 mph)
System Shutdown 24 m/s (54 mph)
Survival Wind Speed 88 m/s (196 mph)
Rated Output
@ Wind Speed 3.0 kW @ 12.0 m/s (27 mph)
Rotational Speed
@ Rated Output 300 rpm @ 3.0 kW
 C_p @ Rated Output 0.29

POWER CURVE (Standard Conditions)



ANNUAL ENERGY PRODUCTION (Standard Conditions)



ROTOR

Weight (Blades, Hub) 41 kg (90 lb)
Diameter 5.0 m (16.4 ft)
Capture Area 21.5 m² (232 ft²)
Solidity 0.04
Tip Speed Ratio 7.30
 C_p at Rated Output 0.41

BLADES

Material Laminate, birch (aircraft grade)
Planform Linear taper from 200 mm (8 in)
@ r/R = 0.3 to 80 mm (3.1 in) @ tip
Twist Non-linear from 12.5°
@ r/R = 0.3 to 0.5° @ tip
Airfoil G625 from r/R = 0.1 to r/R 0.3,
N60 from r/R = 0.3 to tip (modified)

HUB

Material Cast steel
Type Fixed pitch

GENERATOR

Type 3 ϕ synchronous alternator (lundel rotor)
Nominal Voltage 24/48/96 VDC, inverter-ready
Size 458 mm (18 in) by 368 mm (14.5 in)
Number of Poles 12
Synchronous Speed @ 25 Hz 250 rpm
Rated Power @ Speed 3.0 kW at 300 rpm
Efficiency 70% @ rated speed and output
Weight 133 kg (295 lb)

SPEED CONTROL

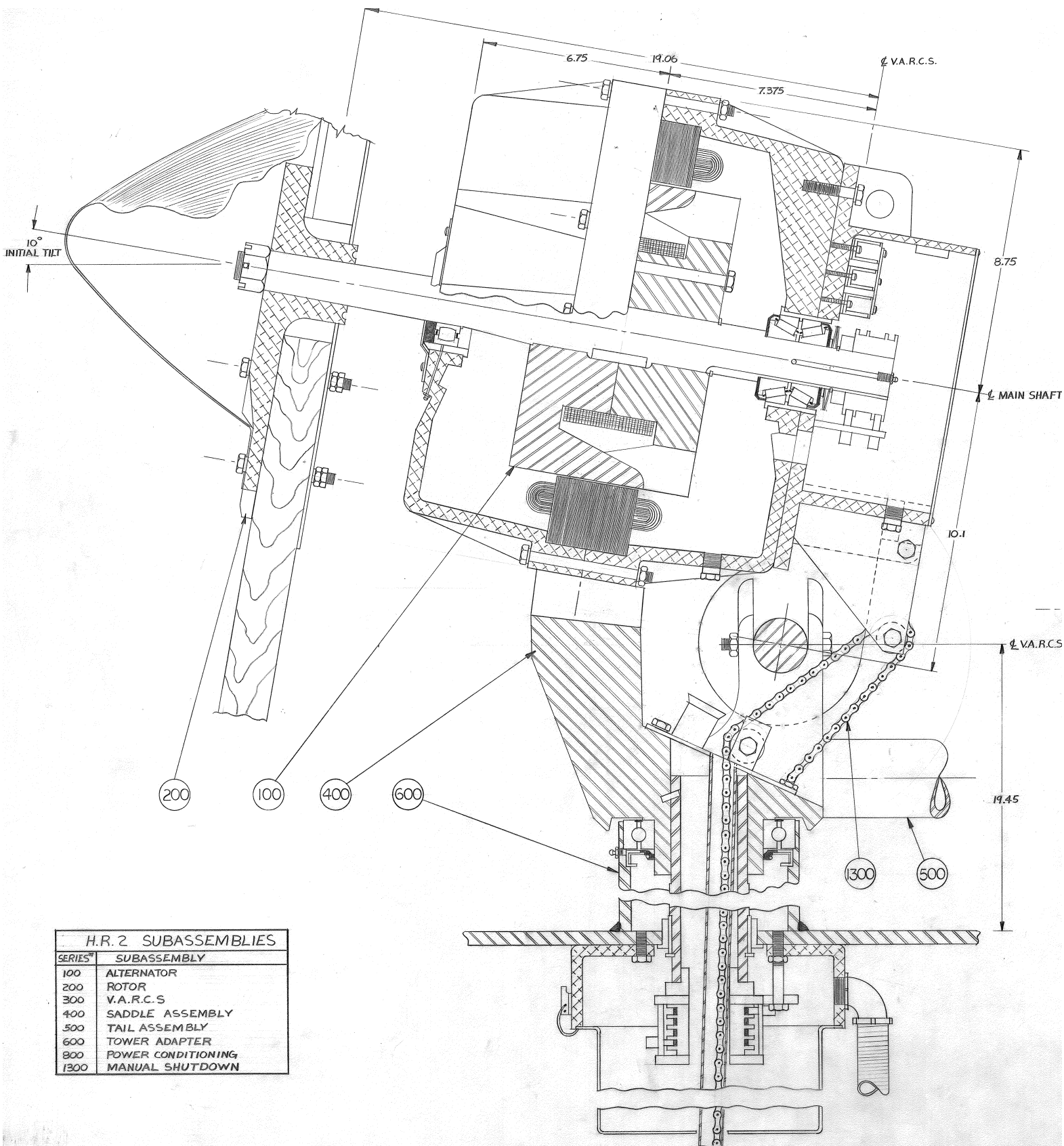
Type Variable Axis Rotor Control System
(VARCS)
Spring Spiral Torsion Spring, K = 71 in lbs/°
Rotor Tilt Range 10° to 90° (from horizontal to vertical)

YAW CONTROL Free yawing

TOWER (Typical mountain-top installation)

Type Unarco Rohn 45 GSR double guyed
Material Galvanized steel
Height 12.2 m (40 ft)
Weight 700 kg (1,555 lb)

Prices and specifications subject to change without notice (06.13.13)



H.R.2 SUBASSEMBLIES	
SERIES	SUBASSEMBLY
100	ALTERNATOR
200	ROTOR
300	V.A.R.C.S.
400	SADDLE ASSEMBLY
500	TAIL ASSEMBLY
600	TOWER ADAPTER
800	POWER CONDITIONING
1300	MANUAL SHUTDOWN