NPS™ 100C-24 Wind Turbine General Specification

A08444 Rev A

Revision History

Revision	Description of Change	Date
A	Initial release for customer use. Includes 37m tower.	2014/05/06
B		
C		
D		

Contents

1 Introduction

This document presents key specifications for the Northern Power Systems® NPS 100C-24 Class IIIA wind turbine with a 24.4 meter rotor, a 37 meter tower, and configured for 50 Hz operation.

This turbine must be installed and operated in accordance with the Application Requirements, document A08136. Specifications for the wind turbine are provided in Table 1, with certain details deferred to the appropriate section(s) of this document. This wind turbine is CE compliant and conforms to the appropriate European directives.

Table 1 NPS 100C-24 Class IIIA General Information

General Configuration	
Model	NPS 100C-24
Design Class	IEC WTGS IIIA[1]
Power Regulation	Variable speed; stall control
Orientation	Upwind
Yaw Control	Active
Number of Blades	3
Rotor Diameter	24.4 meters
Performance	
Rated Electrical Power at standard conditions	95 kW
Cut-in Wind Speed	3.0 meters/second (7 miles per hour)
Rated Wind Speed	12.0 meters/second (27 miles per hour)
Cut-out Wind Speed	25.0 meters/second (56 miles per hour)
Acoustic Performance	Acoustic test results per IEC 61400-11 are available on request from Northern Power

[1] International Electrotechnical Commission Wind Turbine Generating System, 61400-1 ed3

Control System	
Controller Type	DSP-based multi-processor embedded platform
Monitoring System	SmartView® Monitoring System
Safety System	Designed to IEC 61400-1ed3, redundant braking
Communications Protocol	Modbus TCP
Tower System	**37 Meter**
Tower Height	35.7 meters (117')
Hub Height	36.8 meters (121')
Tower Configuration	3-section tubular monopole, nested for shipping
	All towers include a Ladder Safety Climb (LSC) system designed to provide a means for safe ascent of an open ladder. When installed according to the provided instructions, this system conforms to OSHA, ANSI (ANSI A14.3), CSA (Z259.2.1) & CE (EN 353-1:2002) requirements. Further details are contained in NPS document A06432.
Unit Mass	
Nacelle and Rotor Mass	7,010 kilograms (15,420 pounds)
Tower Mass (37 meter option)	12,000 kilograms (26,500 pounds)
Standard Conditions	
Elevation	Sea Level
Air Temperature	15 degrees Celsius (59 degrees Fahrenheit)
Air Density	1.225 kilograms per cubic meter (7.647×10^{-2} lb/ft^3)

2 Environmental Specifications

This section provides the environment specifications for the NPS 100C-24 wind turbine.

Table 2 Ambient Turbine Conditions

	Standard Turbine
Operational	-20 ^{o}C to 40 ^{o}C (-4 ^{o}F to 104 ^{o}F)
Storage	-30 ^{o}C to 50 ^{o}C (-22 ^{o}F to 122 ^{o}F)

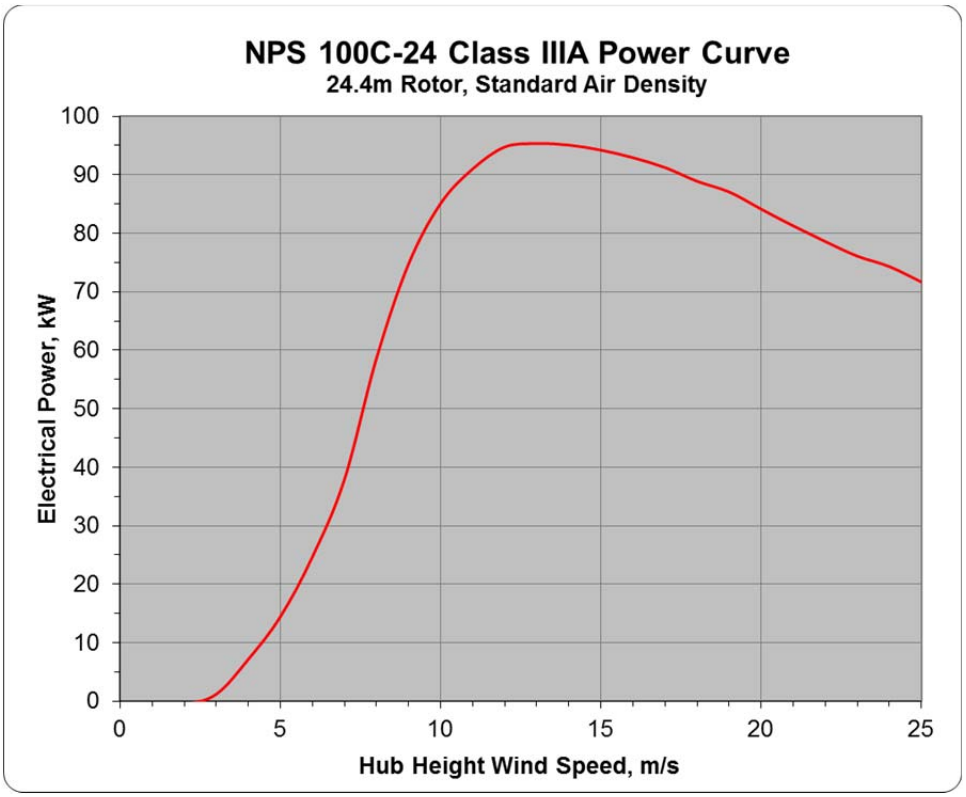
Table 3 IEC WTGS Conditions

Parameter	**Class IIIA**
Maximum Annual Average Wind Speed at hub height, V_{avg}	7.5 meters/second (17 miles/hour)
Reference Wind Speed at hub height, V_{ref} (10-minute average)	37.5 meters/second (84 miles/hour)
Extreme Wind Speed at hub height, V_{e50} (3-second gust, 50-year recurrence period)	52.5 meters/second (117 miles/hour)
Mean Turbulence Intensity at 15 m/s, I_{ref}	0.16 (defined by IEC 61400-1ed3)
Design Lifetime	20 years

3 Power Curve and Energy Production

The following power curve is intended for use in estimating annual energy production. Power performance is based on standard conditions (air density of 1.225 kg/m^3). Annual energy calculations are based on Rayleigh wind speed distribution and 100% turbine availability.

Power curve is subject to change based on field testing.



Power Curve Data	
Wind Speed (m/s)	Power (kW)
1	-0.5
2	-0.5
3	1.2
4	7.2
5	14.5
6	24.7
7	37.9
8	58.7
9	74.8
10	85.1
11	90.2
12	94.7
13	95.3
14	95.1
15	94.2
16	92.9
17	91.2
18	88.9
19	87.1
20	84.1
21	81.3
22	78.6
23	76.1
24	74.3
25	71.7

Annual Energy Production (AEP)	
Average Annual Wind Speed (m/s)	Annual Output (MWh)
5.0	196
5.5	240
6.0	284
6.5	325
7.0	364
7.5	400

AEP and Performance estimates based on Rayleigh distribution at standard conditions, 0.12 turbulence intensity at 15 m/s, and 100% availability.

4 Electrical Specifications

4.1 Section Overview

This section defines the nominal electrical specifications for the NPS 100C-24 wind turbine system. Wind turbine scope of supply includes turbine equipment up to and including the tower mounted isolation transformer with necessary over current protective devices, the grid interface cabinet (GIC) with utility protective relay, and the RTU with multiple remote communication options. Specifications herein refer to turbine output at the base of the tower at nominal 400 VAC output. Refer to the Application Requirements (A08136) for more details during the electrical distribution design process.

4.2 Turbine Output Specifications

Utility-specific protective relay settings or interconnect rules may require the equipment to operate within a tighter band than the full capability of the turbine.

Table 4 NPS 100C-24 Output Specifications

3-Phase Output Voltage	400 VAC (+/-15%)
Nominal Output Current	159 Arms
Transformer Output Configuration	Delta Winding (No Neutral Conductor)
Nominal Frequency	50 Hz
Nominal Active Power Output	95 kW
Reactive Power Range	+/- 45 kVAR
Power Factor Range	At rated power, adjustable between 0.9 leading and 0.9 lagging

5 Turbine Options

5.1 CEI 0-21 Compliance for Italy

The turbine is fully certified to CEI 0-21 (the Italian interconnection standard), when installed with the required Italian Grid Interface Cabinet (GIC) package. This region-specific package includes the 400 volt output transformer with overcurrent protection, utility protective relay device (SPI), tower mounted RTU and cellular capable communications interface. As the ENEL grid interface requirements evolve, various reactive power “operational modes” may need to be activated within the turbine system controller. ENEL is presently developing the functional requirements of the grid interface which may allow or enable various reactive power modes.

Any additional hardware and integration costs associated with this requirement and/or periodical operational tests and protective relay verification required by the local utility are the end user’s responsibility. Additional information regarding the Italian GIC package can be found in NPS document A08136.

5.2 G59 Protective Relay for United Kingdom

For the UK the GIC, located in the base of the turbine, is equipped with a G59/2 Protective Relay. This region-specific package includes the 400 volt output transformer with overcurrent protection, utility protective relay device (G59), tower-mounted RTU and cellular capable communications interface. Additional information regarding the UK GIC package can be found in NPS document A08136.

5.3 Cellular Modem Communications Interface

If the turbine site does not have a hardwired ISP available or the end user is not interested in a wired data connection for the mandatory remote monitoring aspect of the product warranty, a nacelle mounted GSM cell modem is available. It is the responsibility of the end user to provide the cellular phone/data account of the appropriate configuration and format as detailed in NPS document A01131, SmartView RTU Application Requirements.

5.4 L810 Obstruction Marker Light

For installations located in the approach of an airport, or when local zoning regulations require obstruction lighting, a dual fixture L810 light can be added to the standard machine configuration. This light assembly provides automatic photo cell controlled operation, but is not required to include a remote monitoring system for bulb/lamp failure. Additional information regarding FAA compliance can be found in NPS document A00454.

5.5 Low Noise Operating Mode

For sites with permitting or other local operating constraints the turbine may be configured to operate in a noise-restricted mode where the rotor speed will be reduced to lower the tip speed and the associated blade noise. This mode may be enabled either as a permanent operating condition or based on time of day, time of year, or as needed based on local site conditions. This mode may be required to meet local permitting constraints for some sites such as the ETSU Noise Guidelines which are applied in most of the United Kingdom. While in Low Noise Mode the energy production will be lower than when in Standard Operating Mode.

6 Disclaimers and Reservations

Turbine controls may stop or temporarily disable operation or delay startup even though ambient conditions appear to be within normal operating ranges. Turbine controls may impose these behaviors to allow for sub-system temperature stabilization, yaw system stabilization, or similar reasons.

A variety of conditions will affect turbine performance, including but not limited to: maintenance, site conditions, topography, altitude, climatic conditions and electrical grid conditions. This general specification does not guarantee performance or operability at a particular site.

Turbines may be installed in coastal environments, but Northern Power recommends the Special Paint option for installations within 1 km of the coast, and in no cases shall the turbine be subjected to sea spray. The lifetime maintenance costs of a turbine will vary based on site conditions, including wind, precipitation, temperature, and corrosivity of the air. Corrosivity of the air varies based on the local atmospheric conditions at the site including time of wetness, acidity, and salinity.

The values stated in metric (SI) units shall be regarded as the standard. The inch-pound (IP) units shown in parenthesis shall be for reference only. Northern Power Systems is continually developing product upgrades, modifications and improvements, and as a result reserves the right to change or alter these specifications at any time.