

# Design 2000<sub>plus</sub>

## VFDs – Variable Frequency Drives

### 2009 Project Information Form for Rhode Island

This Project Information Form provides a template to collect project systems and equipment information and specifications. In addition, this form serves as a guide to terms for Variable Frequency Drives (VFDs) and identifies energy efficiency improvement products and incentives. Contact your **Energy Solutions representative** to complete an application and to determine the incentive for this VFD project.

#### Customer Facility Information

Customer Facility Name: \_\_\_\_\_ Date of Application: \_\_\_\_\_  
 \_\_\_\_\_ Sq. Ft. Covered by Application: \_\_\_\_\_  
 Contact Person: \_\_\_\_\_ Design 2000<sub>plus</sub> Project Type:\* (see below for details)  
 Street Address: \_\_\_\_\_ Federal ID Number: \_\_\_\_\_  
 City: \_\_\_\_\_ State: \_\_\_\_\_ Zip: \_\_\_\_\_ Company Type:  
 E-mail Address: \_\_\_\_\_  Incorporated  Exempt  Not Incorporated  
 Facility Description: \_\_\_\_\_ Phone Number: \_\_\_\_\_  
 \_\_\_\_\_ Fax Number: \_\_\_\_\_

#### Customer of Record Information: Billing Account Number: \_\_\_\_\_ Internal Use only

**\*Design 2000<sub>plus</sub> Project Type (select one)**

- Change in the use or Function of the Building Space
- New Building
- New Equipment for New Process or Expanded Operation
- Renovation of Existing Equipment
- Expansion of an Existing Building
- New Controls for Improved Operations
- Planned Replacement of Equipment
- Replacement of Failed Equipment

#### Installation Contractor Information

Installation Performed By:\*\*  Customer  Installation Contractor  Project Expediter  Other (Vendor)

**Complete this section if installation is not by the customer**

Installation Company: \_\_\_\_\_ Street Address: \_\_\_\_\_  
 Contact Person: \_\_\_\_\_ City: \_\_\_\_\_  
 E-mail Address: \_\_\_\_\_ State: \_\_\_\_\_ Zip: \_\_\_\_\_  
 Phone Number: \_\_\_\_\_

\*\* If contractor has not been selected, select **Customer**

#### Application Information

Application Funding Type  AAP  Other *Internal Use only*  
 Expected Completion Date \_\_\_\_\_  
 Proposed Incentive Recipient  Customer (Account Credit or Check)  Installation Contractor\*\*\*  Other (Vendor)\*\*\*

**\*\*\* Complete this section if Installation Contractor or Other has been selected**

Federal ID Number: \_\_\_\_\_ Company Type:  Incorporated  Exempt  Not Incorporated

#### This Form Was Completed By:

Name: \_\_\_\_\_  
 Phone Number: \_\_\_\_\_ E-mail Address: \_\_\_\_\_

#### For More information

Phone: 1-800-787-1706 Internet: www.nationalgridus.com

**Project Information Form Index:**

- Page 1: Customer information datasheet
- Page 2: Proposed Equipment Specification Table and Application Types reference guide
- Page 3: Variable Frequency Drive Eligibility Requirements and Incentive Details
- Page 4: Variable Frequency Drive Installation Form – equipment survey

**Instructions:**

Use this form to apply for incentives through the prescriptive incentive program. VFDs installed in process applications, wastewater or municipal water supply applications may alternately use the Custom Application process, which requires detailed energy savings calculations.

- 1) Fill in the Customer information datasheet on page 1.
- 2) Fill in the Proposed Variable Frequency Drive information in the Equipment Specification Table below.  
**For multiple VFDs:** submit multiple copies of this page when applying for incentives for more than one piece of equipment with dissimilar size or specifications.
- 3) Fill in the equipment survey on the Variable Frequency Drive Installation Form on page 4.
- 4) Contact your Energy Solutions representative to complete an application and to determine the incentive for this VFD project.

Proposed Equipment Specification <i>(Facility Detail)</i>
<p><b><u>Building, Room and Equipment Identification</u></b> <i>(Installation Site):</i> _____</p> <p><b>Measure Category: Variable Frequency Drives (VFDs)</b></p> <p>Device Code: _____ <i>*see below for list of application types</i></p> <p>Fan or Pump ID: _____ <i>(Example: Feed Water Pump #1; Condenser Water Pump #1)</i></p> <p>Quantity: _____</p> <p>Motor Horsepower Controlled By Each VFD: _____</p> <p>Annual Hours of Operation: _____ <i>(minimum of 2000 annual hours of operation is required)</i></p>
<p><b>Harmonics Test Eligibility Information:</b></p> <ul style="list-style-type: none"> <li>Total VFD Load Supplied by Transformer (HP)** _____</li> <li>KVA Rating of Building Transformer _____</li> </ul> <p><small>** The value for the "Total VFD Load Supplied by Transformer" is the sum of the rated horse power for all motors, existing as well as all proposed at this time, in the facility that are under control of Variable Frequency Drives. For Utility Owned Transformers, contact your Energy Solutions representative.</small></p>

**\* Application Types**

Device Code	Application
BDF	Boiler draft fan
FWP	Boiler feed water pump
HPP	WSHP circulation pump
PCP	Process cooling pump
PE	Process exhaust and make-up air fan
REF	Return fan on return air handler or on VAV packaged HVAC unit
SF	Supply fan on supply air handler or on VAV packaged HVAC unit

# **I. Variable Frequency Drive Eligibility Requirements and Incentive Details**

## **VFD Requirements:**

1. Provide a manufacturers cut-sheet or engineer's design specifications for the VFD.
2. Fill out the VFD Installation Information Form on page four.
3. VFDs offer a method of significantly reducing the energy consumed by fans, centrifugal pumps, and other motor-driven machinery operated under varying loads. This form addresses most popular applications. For other VFD applications, use the Custom Approach.
4. Systems must have varying load operations such as variable flow or pressure regulation. Pump operations that would otherwise be regulated by on/off cycling are not eligible for VFD incentives. Systems with constant speed and variable load operations (such as conveyors) are not eligible for VFD incentives.
5. VFDs must be equipped with a minimum of 3% impedance series reactor in its AC power input connection.
6. VFDs must comply with Rhode Island Harmonics requirements. Contact your Energy Solutions representative for details.
7. Invoices will be required for payment of incentives.

## **Important Information on Variable Frequency Drives**

VFDs can be sensitive to overvoltages that occur when power factor correcting capacitor banks on the utility power system are switched on. To qualify for an incentive payment, each VFD must include a series reactor (*inductor, choke*) in its AC input connections. Your VFD supplier should assist in the sizing of the reactor. Minimum requirement is a 3% impedance reactor, based on the horsepower of the VFD to be installed.

As a general rule, a 3% reactor is sufficient to avoid misoperation of VFDs during utility capacitor switching and will also help reduce the magnitude of harmonic currents generated by the drive. In some instances your supplier may find it necessary to install 5% reactors and, rarely, additional filtering devices to meet acceptable current and voltage harmonic distortion requirements.

If your power factor is less than 0.8 (80%), we recommend that you consider power factor correction concurrent with the installation of drives, because the presence of power factor correction equipment can influence proper reactor sizing, and because the presence of VFDs can influence the design of power factor correction equipment. In situations where the load due to VFDs is a substantial part of the facility load, we recommend that filters, rather than capacitors, be used for power factor correction.

The use of VFDs which incorporate pulse width modulation (PWM) may produce overvoltages which may cause premature failure of AC induction motors not rated for use with an inverter. We recommend that when installing PWM drives, you consider utilizing inverter rated motors or suitable overvoltages mitigation devices that may include additional line reactors between the drive and the motor. Consider shaft grounding, insulated bearings, load filters or conductive lubricants to prevent possible bearing frosting or fluting. This is particularly important for installations where the motor will operate in a narrow speed band for long periods of time.

## **Eligibility Requirements:**

1. This form may be used for VFD's installed on the following types of applications.
  - a. Supply fan on constant volume supply air handler and VAV packaged HVAC unit [SF] (*forward curved fans are not eligible*)
  - b. Return fan on constant volume return air handler and VAV packaged HVAC unit [REF] (*forward curved fans are not eligible*)
  - c. Boiler draft fan [BDF]
  - d. Boiler feed water pump [FWP]
  - e. WSHP circulation pump [HPP]
  - f. Process exhaust and cooling pump [PCP] (*non VAV system*)
  - g. Process exhaust and make-up fan [PE]
2. Only water source heat pump circulation pumps with 2 way control valves on each heat pump are eligible.
3. Applicants must demonstrate significant load diversity that will result in savings through motor speed variation.
4. The VFD speed must be automatically controlled by differential pressure, flow or temperature.
5. A minimum of 2000 hours annual hours of operation is required for a VFD incentive.

**Table 1: Incentives for VFDs**

<b>Motor Horsepower (Hp) Controlled By Each VFD</b>	<b>5 Hp</b>	<b>7.5 Hp</b>	<b>10 Hp</b>	<b>15 Hp</b>	<b>20 Hp</b>
Maximum Incentive	\$900	\$1,000	\$1,300	\$1,500	\$1,800

# VFD Installation Information Form

## Equipment Information

Fan or Pump ID(s) \_\_\_\_\_ (Example: Feedwater Pump #1; Condenser Water Pump #1)  
 Device Code: \_\_\_\_\_ (Use list of applications types from page two, or describe other)  
 Building Type: \_\_\_\_\_ (Office, Hotel/Motel, Healthcare, Elementary/High School, College/University, Warehouse, Restaurant, Manufacturing, Other?)  
 Type of area(s) served by fan(s) or pump(s): \_\_\_\_\_  
 Equipment served by the fan (s) or pump (s): \_\_\_\_\_  
 If fan, note type: \_\_\_\_\_ (centrifugal, forward curve, backward curve, axial, etc)  
 Fan or Pump Nominal HP \_\_\_\_\_, (if multiple motors, list individual HP's) Nameplate motor efficiency(s) \_\_\_\_\_  
 Fan or Pump Manufacturer: \_\_\_\_\_ Model: \_\_\_\_\_  
 Full Load Design Conditions: Flow \_\_\_\_\_ (CFM, GPM) Pressure \_\_\_\_\_ (inches static, feet of water, PSI, other?)  
 Existing Controls: \_\_\_\_\_ (discharge damper, inlet guide vanes, outlet control valve, bypass valve, etc.)  
 Existing setpoint: \_\_\_\_\_ (inches static, feet of water, PSI, other?)

## Operating Hours

The fan or pump operates the following hours: (Example: 0600 to 1800)

### Summer

Weekdays \_\_\_\_\_ to \_\_\_\_\_  
 Saturdays \_\_\_\_\_ to \_\_\_\_\_  
 Sundays \_\_\_\_\_ to \_\_\_\_\_

### Winter

Weekdays \_\_\_\_\_ to \_\_\_\_\_  
 Saturdays \_\_\_\_\_ to \_\_\_\_\_  
 Sundays \_\_\_\_\_ to \_\_\_\_\_

Number of shifts per weekday: \_\_\_\_\_ Number of shifts per weekend day: \_\_\_\_\_

**Option 1:** (retrofit): Measured input power under full load: \_\_\_\_\_ kW, (true RMS power) \_\_\_\_\_ Power Factor

**Option 2:** (retrofit): Measured current and voltage under full load: \_\_\_\_\_ Amps \_\_\_\_\_ Volts

Load calculation = \_\_\_\_\_ volts X \_\_\_\_\_ amps X \_\_\_\_\_ PF = \_\_\_\_\_ kW

**Option 3:** (retrofit or new): Estimated Fan or Pump Load: \_\_\_\_\_%, Estimated Power \_\_\_\_\_ kW

If estimating load, provide description, assumptions and formula used to calculate power: \_\_\_\_\_

## Proposed Operations

The proposed VFD will be automatically controlled to maintain the following setpoints:

Flow \_\_\_\_\_ (CFM, GPM, other?) Pressure \_\_\_\_\_ (inches static, feet of water, PSI, other?)

Other? (describe): \_\_\_\_\_

**Table 2: Estimated VSD speed in future operations**

% Load	Summer		Winter	
	Week-day	Week-end	Week-day	Week-end
90 to 100%				
80 to 90%				
60 to 80%				
20 to 60%				
Off				
<b>Totals</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>