

Design 2000_{plus}

VFDs – Variable Frequency Drives

2007 Project Information Form for Massachusetts and Nantucket

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 Business Services 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_{plus} 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: LOC ID: _____ Account Number: _____ Internal Use only

***Design 2000_{plus} 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/masselectric

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 Business Services representative to complete an application and to determine the incentive for this VFD project.

| Proposed Equipment Specification (<i>Facility Detail</i>) | |
|---|--|
| Building, Room and Equipment Identification (<i>Installation Site</i>): _____ | |
| Measure Category: Variable Frequency Drives (VFDs) | |
| Device Code: _____ | <i>*see below for list of application types</i> |
| Fan or Pump ID: _____ | <i>(Example: Feed Water Pump #1; Condenser Water Pump #1)</i> |
| Quantity: _____ | |
| Motor Horsepower Controlled By Each VFD: _____ | |
| Annual Hours of Operation: _____ | <i>(minimum of 2000 annual hours of operation is required)</i> |
| Harmonics Test Eligibility Information: | |
| <ul style="list-style-type: none"> • Total VFD Load Supplied by Transformer (HP)** _____ • KVA Rating of Building Transformer _____ | |
| <p>** 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 Business Services representative.</p> | |

*** Application Types**

| Device Code | Application |
|-------------|---|
| BDF | Boiler draft fan |
| CWP | Chilled water distribution pump |
| FWP | Boiler feed water pump |
| HPP | WSHP circulation pump |
| HWP | Heating hot water 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. Fan and 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 Massachusetts Harmonics requirements. Contact your Business Services 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. Chilled water distribution pump [CWP]
 - e. Boiler feed water pump [FWP]
 - f. WSHP circulation pump [HPP]
 - g. Heating hot water pump [HWP]
 - h. Process exhaust and cooling pump [PCP] (*non VAV system*)
 - i. 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

| Motor Horsepower (Hp) Controlled By Each VFD | 5 Hp | 7.5 Hp | 10 Hp | 15 Hp | 20 Hp |
|---|-------------|---------------|--------------|--------------|--------------|
| 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: _____

Motor Load

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 | | | | |
| Totals | 100% | 100% | 100% | 100% |