Duke Energy®
Ohio

DUKE ENERGY OHIO, INC.
155 E. Broad St., 21st Floor
Columbus, OH 43215

614-222-1330
614-222-1337 fax

March 21, 2013

Docketing Division
Public Utilities Commission of Ohio
180 East Broad Street, 11th Floor
Columbus, OH 43215-3716

Re: PUCO Case No. 13-0695-EL-EEC, Application to Commit Energy Efficiency/Peak Demand Reduction Programs (Mercantile Customers Only), TriHealth Good Samaritan Hospital

Dear Docketing,

On March 15, 2013, Duke Energy Ohio filed an application in the above referenced case. The application has since been amended to include the following changes:

- Section 6, Page 7 - Utility Cost Test value was 11.7 and has been changed to 6.33
- Section 6, Page 8, Subsection 2: UCT Used - "Our avoided supply costs were" (was) $143,629 and has been changed to $77,744
- Appendix D UCT Value, Page 16 – Total Avoided Cost revised to $77,744 and Measure UCT revised to 6.33

Please find enclosed a copy of the revised version of the application to replace the original filing.

Should you have any questions, please contact me.

Respectfully submitted,

Carys Cochern

Ohio | Public Utilities Commission

Application to Commit Energy Efficiency/Peak Demand Reduction Programs (Mercantile Customers Only)

Case No.: 13-0695-EL-EEC

Mercantile Customer: **TriHealth Good Samaritan Hospital (REVISED)**

Electric Utility: **Duke Energy**

Program Title or Description: **VFD**

Rule 4901:1-39-05(F), Ohio Administrative Code (O.A.C.), permits a mercantile customer to file, either individually or jointly with an electric utility, an application to commit the customer's existing demand reduction, demand response, and energy efficiency programs for integration with the electric utility's programs. The following application form is to be used by mercantile customers, either individually or jointly with their electric utility, to apply for commitment of such programs in accordance with the Commission's pilot program established in Case No. 10-834-EL-POR

Completed applications requesting the cash rebate reasonable arrangement option (Option 1) in lieu of an exemption from the electric utility's energy efficiency and demand reduction (EEDR) rider will be automatically approved on the sixty-first calendar day after filing, unless the Commission, or an attorney examiner, suspends or denies the application prior to that time. Completed applications requesting the exemption from the EEDR rider (Option 2) will also qualify for the 60-day automatic approval so long as the exemption period does not exceed 24 months. Rider exemptions for periods of more than 24 months will be reviewed by the Commission Staff and are only approved up the issuance of a Commission order.

Complete a separate application for each customer program. Projects undertaken by a customer as a single program at a single location or at various locations within the same service territory should be submitted together as a single program filing, when possible. Check all boxes that are applicable to your program. For each box checked, be sure to complete all subparts of the question, and provide all requested additional information. Submittal of incomplete applications may result in a suspension of the automatic approval process or denial of the application.

Any confidential or trade secret information may be submitted to Staff on disc or via email at ee-pdr@puc.state.oh.us.

Section 1: Mercantile Customer Information

Name: **TriHealth – Bethesda Oak Hospital**

Principal address: **375 Dixmyth Avenue Cincinnati, Ohio 45220**

Address of facility for which this energy efficiency program applies:

375 Dixmyth Avenue Cincinnati, Ohio 45220

Name and telephone number for responses to questions:

Grady Reid Jr 513-287-1038

Electricity use by the customer (check the box(es) that apply):

- ✓ The customer uses more than seven hundred thousand kilowatt hours per year at the above facility. (**Refer to Appendix A for documentation**.)
- □ The customer is part of a national account involving multiple facilities in one or more states. (Please attach documentation.)

Section 2: Application Information

A) The customer is filing this application (choose which applies):

- □ Individually, without electric utility participation.
- ✓ **Jointly with the electric utility.**

B) The electric utility is: **Duke Energy**

C) The customer is offering to commit (check any that apply):

- □ Energy savings from the customer's energy efficiency program. (Complete Sections 3, 5, 6, and 7.)
- □ Capacity savings from the customer's demand response/demand reduction program. (Complete Sections 4, 5, 6, and 7.)
- ✓ **Both the energy savings and the capacity savings from the customer's energy efficiency program. (Complete all sections of the Application.)**

Section 3: Energy Efficiency Programs

A) The customer's energy efficiency program involves (check those that apply):

✓ Early replacement of fully functioning equipment with new equipment. (Provide the date on which the customer replaced fully functioning equipment, and the date on which the customer would have replaced such equipment if it had not been replaced early. Please include a brief explanation for how the customer determined this future replacement date (or, if not known, please explain why this is not known)).
The following new equipment was installed starting June 2012 and was finished August 2012.

1 VFD on 100HP Supply Fan Motor

□ Installation of new equipment to replace equipment that needed to be replaced The customer installed new equipment on the following date(s): _____.

□ Installation of new equipment for new construction or facility expansion. The customer installed new equipment on the following date(s): _____.

□ Behavioral or operational improvement.

B) Energy savings achieved/to be achieved by the energy efficiency program:

1) If you checked the box indicating that the project involves the early replacement of fully functioning equipment replaced with new equipment, then calculate the annual savings [(kWh used by the original equipment) – (kWh used by new equipment) = (kWh per year saved)]. Please attach your calculations and record the results below:

Annual savings: 231,799 kWh
Refer to Appendix B for calculations and supporting document

2) If you checked the box indicating that the customer installed new equipment to replace equipment that needed to be replaced, then calculate the annual savings [(kWh used by less efficient new equipment) – (kWh used by the higher efficiency new equipment) = (kWh per year saved)]. Please attach your calculations and record the results below:

Annual savings: _____kWh

Please describe any less efficient new equipment that was rejected in favor of the more efficient new equipment.

3) If you checked the box indicating that the project involves equipment for new construction or facility expansion, then calculate the annual savings [(kWh used by less efficient new equipment) – (kWh used by higher efficiency new equipment) = (kWh per year saved)]. Please attach your calculations and record the results below:

Annual savings: _____kWh

Please describe the less efficient new equipment that was rejected in favor of the more efficient new equipment.

4) If you checked the box indicating that the project involves behavioral or operational improvements, provide a description of how the annual savings were determined.

_____

Section 4: Demand Reduction/Demand Response Programs

A) The customer's program involves (check the one that applies):

- ✓ **Coincident peak-demand savings from the customer's energy efficiency program.**
- □ Actual peak-demand reduction. (Attach a description and documentation of the peak-demand reduction.)
- □ Potential peak-demand reduction (check the one that applies):
  - □ The customer's peak-demand reduction program meets the requirements to be counted as a capacity resource under a tariff of a regional transmission organization (RTO) approved by the Federal Energy Regulatory Commission.
  - □ The customer's peak-demand reduction program meets the requirements to be counted as a capacity resource under a program that is equivalent to an RTO program, which has been approved by the Public Utilities Commission of Ohio.

B) On what date did the customer initiate its demand reduction program?

New VFD equipment was installed between June 2012 and August 2012

C) What is the peak demand reduction achieved or capable of being achieved (show calculations through which this was determined):

-2.64 kW
Refer to Appendix B for calculations and supporting documentation.

Section 5: Request for Cash Rebate Reasonable Arrangement (Option 1) or Exemption from Rider (Option 2)

Under this section, check the box that applies and fill in all blanks relating to that choice.

Note: If Option 2 is selected, the application will not qualify for the 60-day automatic approval. All applications, however, will be considered on a timely basis by the Commission.

A) The customer is applying for:

✓ **Option 1: A cash rebate reasonable arrangement.**

OR

□ Option 2: An exemption from the energy efficiency cost recovery mechanism implemented by the electric utility.

OR

□ Commitment payment

B) The value of the option that the customer is seeking is:

Option 1: A cash rebate reasonable arrangement, which is the lesser of (show both amounts):

✓ A cash rebate of **$6250. Refer to Appendix C for documentation.** (Rebate shall not exceed 50% project cost.

Option 2: An exemption from payment of the electric utility's energy efficiency/peak demand reduction rider.

□ An exemption from payment of the electric utility's energy efficiency/peak demand reduction rider for ____ months (not to exceed 24 months). (Attach calculations showing how this time period was determined.)

OR

□ A commitment payment valued at no more than $_____. (Attach documentation and

calculations showing how this payment amount was determined.)

OR

□ Ongoing exemption from payment of the electric utility's energy efficiency/peak demand reduction rider for an initial period of 24 months because this program is part of the customer's ongoing efficiency program. (Attach documentation that establishes the ongoing nature of the program.) In order to continue the exemption beyond the initial 24 month period, the customer will need to provide a future application establishing additional energy savings and the continuance of the organization's energy efficiency program.)

Section 6: Cost Effectiveness

The program is cost effective because it has a benefit/cost ratio greater than 1 using the (choose which applies):

□ Total Resource Cost (TRC) Test. The calculated TRC value is: _____ (Continue to Subsection 1, then skip Subsection 2)

✓ Utility Cost Test (UCT) . The calculated UCT value is **6.33** (Skip to Subsection 2.) **Refer to Appendix D for calculations and supporting documents.**

Subsection 1: TRC Test Used (please fill in all blanks).

The TRC value of the program is calculated by dividing the value of our avoided supply costs (generation capacity, energy, and any transmission or distribution) by the sum of our program overhead and installation costs and any incremental measure costs paid by either the customer or the electric utility.

The electric utility's avoided supply costs were _____.

Our program costs were _____.

The incremental measure costs were _____.

Subsection 2: UCT Used (please fill in all blanks).

We calculated the UCT value of our program by dividing the value of our avoided supply costs (capacity and energy) by the costs to our electric utility (including administrative costs and incentives paid or rider exemption costs) to obtain our commitment.

Our avoided supply costs were **$77,744.**

The utility's program costs were **$6,030.**

The utility's incentive costs/rebate costs were **$6250.**

Refer to Appendix D for calculations and supporting documents.

Section 7: Additional Information

Please attach the following supporting documentation to this application:

Narrative description of the program including, but not limited to, make, model, and year of any installed and replaced equipment.

A copy of the formal declaration or agreement that commits the program or measure to the electric utility, including:

1) any confidentiality requirements associated with the agreement;
2) a description of any consequences of noncompliance with the terms of the commitment;
3) a description of coordination requirements between the customer and the electric utility with regard to peak demand reduction;
4) permission by the customer to the electric utility and Commission staff and consultants to measure and verify energy savings and/or peak-demand reductions resulting from your program; and,
5) a commitment by the customer to provide an annual report on your energy savings and electric utility peak-demand reductions achieved.

Refer to Offer Letter following this application

A description of all methodologies, protocols, and practices used or proposed to be used in measuring and verifying program results. Additionally, identify and explain all deviations from any program measurement and verification guidelines that may be published by the Commission.

DUKE ENERGY
Mercantile Self Direct Program
139 East Fourth Street
Cincinnati, OH 45202
513 629 5572 fax

February 5, 2013

Mr. Gene Gesell
TriHealth – Good Samaritan Hospital
375 Dixmyth Avenue
Cincinnati, Ohio 45220

Subject: Your Application for a Duke Energy Mercantile Self-Direct Rebate

Dear Mr. Gesell:

Thank you for your Duke Energy Mercantile Self Direct rebate application. As noted in the Energy Conservation Measure (ECM) chart on page two, a total rebate of $6250.00 has been proposed for your variable frequency drive project completed in the 2012 calendar year. **All Self Direct Rebates are contingent upon approval by the Public Utilities Commission of Ohio (PUCO).**

At your earliest convenience, please indicate if you accept this rebate by

- providing your signature on page two
- completing the PUCO-required affidavit on page three.

Please return the documents to my attention via fax at 513-629-5572 or e-mail to SelfDirect@Duke-Energy.com. Upon receipt, Duke Energy will submit the necessary documentation to PUCO. Following PUCO's approval, Duke Energy will remit payment.

At Duke Energy, we value your business and look forward to working with you on this and future energy efficiency projects. We hope you will consider our Smart $aver® incentives, when applicable. Please contact me if you have any questions.

Sincerely,

Grady Reid, Jr
Product Manager
Mercantile Self Direct Rebates

cc: Mike Heath – Duke Energy
Rob Jung - Ecova
Steve Rohrs - Pathian

03/06/13 WED 15:54 FAX 5138624994 001

Please indicate your response to this rebate offer within 30 days of receipt.

☑ Rebate is accepted. ☐ Rebate is declined.

By accepting this rebate, TriHealth affirms its intention to commit and integrate the energy efficiency projects listed on the following pages into Duke Energy's peak demand reduction, demand response and/or energy efficiency programs.

Additionally, TriHealth also agrees to serve as joint applicant in any future filings necessary to secure approval of this arrangement as required by PUCO and to comply with any information and reporting requirements imposed by rule or as part of that approval.

Finally, TriHealth affirms that all application information submitted to Duke Energy pursuant to this rebate offer is true and accurate. Information in question would include, but not be limited to, project scope, equipment specifications, equipment operational details, project costs, project completion dates, and the quantity of energy conservation measures installed.

If rebate is accepted, will you use the monies to fund future energy efficiency and/or demand reduction projects?

☑ YES ☐ NO

If rebate is declined, please indicate reason (optional):

Gene Gesell 3/6/13

Customer Signature Printed Name Date

Proposed Rebate Amounts

Measure ID	Energy Conservation Measure (ECM)	Proposed Rebate Amount
ECM-1	Installed 100 HP VFD (Qty – 1)	$6250.00
Total		$6250.00

002 03/06/13 WED 15:55 FAX 5138624994

Ohio | Public Utilities Commission

Application to Commit Energy Efficiency/Peak Demand Reduction Programs (Mercantile Customers Only)

Case No.: ____-____-EL-EEC

State of OHIO :

Gene Gesell, Affiant, being duly sworn according to law, deposes and says that:

1. I am the duly authorized representative of:

Tri-Health Good Samaritan Hospital
[insert customer or EDU company name and any applicable name(s) doing business as]

2. I have personally examined all the information contained in the foregoing application, including any exhibits and attachments. Based upon my examination and inquiry of those persons immediately responsible for obtaining the information contained in the application, I believe that the information is true, accurate and complete.

3. I am aware of fines and penalties which may be imposed under Ohio Revised Code Sections 2921.11, 2921.31, 4903.02, 4903.03, and 4903.99 for submitting false information.

Signature of Affiant & Title

Sworn and subscribed before me this 6 day of March,
Month/Year 2013

Signature of official administering oath

Dahei Haile Notary
Print Name and Title

My commission expires on _____

NOTARIAL SEAL STATE OF OHIO

Dahei Haile
Notary Public, State of Ohio
My Commission Expires 06-18-2017

003 03/06/13 WED 15:56 FAX 5138624994

87200706 01				
TRIHEALTH				
3217 CLIFTON				
CINCINNATI, OH 45220				
Bulked Electric Meter# 106156634 & 106940057 -- Rate DP02				
Date	Days	Actual KWH		
12/3/2012	33	2,735,338		
10/31/2012	29	2,607,869		
10/2/2012	32	3,370,296		
8/31/2012	29	3,392,736		
8/2/2012	30	3,841,022		
7/3/2012	29	3,240,067		
6/4/2012	32	3,341,366		
5/3/2012	30	2,724,374		
4/3/2012	29	2,733,926		
3/5/2012	31	2,613,878		
2/3/2012	29	2,506,882		
1/5/2012	31	2,627,693		
Total		35,735,447		

Appendix B - TriHealth Good Samaritan Energy Savings Achieved

	Baseline Used			Post Project Actual				Savings	
	Description	Annual kWh	Summer Coincident kW	Description	Annual kWh	Summer Coincident kW	Hours of Operation	Annual kWh	Summer Coincident kW[1]
ECM - 1	AHU 7 with 100HP supply fan motor and volume control via Inlet Guide Vanes	571,462	79.0	Installed VFD on 100HP supply fan motor	354,292	82.0	8,760	217,170	-3.0

1 Summer coincident demand savings were calculated by DSMore software based on a representative loadshape and the modeled energy (kWh) savings.

After consideration of line losses, total energy savings are **231,799 kWh** and **XXXX summer coincident -2.64**. These values may also reflect minor DSMore modeling software rounding error.

DETAILED CALCULATIONS

Dec 2012 V1

Salesforce Opportunity Name	*0*	Application #	TRI02	Rev.	0
Project Name	*TriHealth - Mercantile Self Direct Custom - Samaritan Hospital - IGV to VFD*		*TRI02-TriHealthSmtn-Hptl-DN IGV to VFD*	State	OH

Measure Description

Replacing Inlet Guide Vanes (IGV) volume controls with VFDs on a 100-hp supply fan motors at TriHealth Samaritan Hospital. The customer also implemented supply air static pressure reset controls and the proposed duty cycle reflects the upgrade.

Baseline

The baseline usage of the fan motors appears to be 2% of total usage, which is within expectation. Baseline was calculated using the existing motor efficiency and duty cycle. The fan runs 8,760 hours annually.

Savings Calculation Methodology

Savings were submitted using the ABB ACH550 Energy Savings Estimator, which was verified reasonable using the in-house VFD calculator tool because the retrofit is from IGV to VFD (see attached reference). The change in duty cycle is due to programmed supply air static pressure reset controls also implemented at the site. Tool output details and efficiency used were verified with the tool and outlined in the Savings Calculations section below.

Incremental Measure Cost (IMC)

IMC = project cost for this retrofit. The total project cost of $28,900 was quoted for one 100-hp supply fan and one 40-hp return fan. $25,000 was listed for the measure cost in the application, which was deemed reasonable although it is slightly higher than the cost approximated from the size of fan.

IMC Calculation

IMC ($)	Baseline Cost ($)	Measure Cost ($)
$25,000.00	$0.00	$25,000.00

Attached Files

- ☑ Equipment Specs
- ☑ Calculations
- ☑ Cost Documentation

TRI02 Custom Spec.pdf | TRI02 Custom Quote.pdf | Z:\Duke Energy\ Duke Energy Custo | TRI02 AESC Tool Savings.xls

References to source documents/back up files as appropriate

TRI02 Custom Quote.pdf
TRI02 Custom Spec.pdf
TRI02 Custom AESC Tool Savings.xls
TRI02 Custom ABB Calculations.pdf

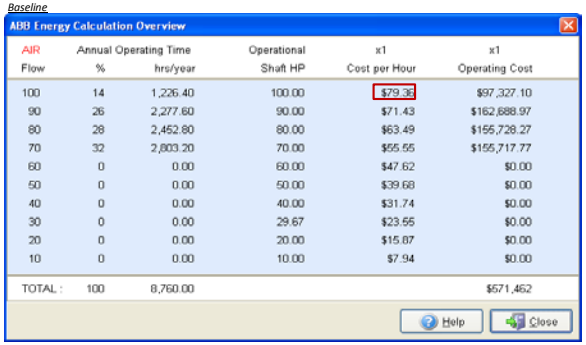
Savings Calculations

	Peak kW	kWh	AESC tool	
Baseline	79.36	571,462	518,000	1.62% Billed
Proposed	81.82	354,292	320,017	
Savings	**-2.46**	**217,170**	197,983	**8.84%** difference

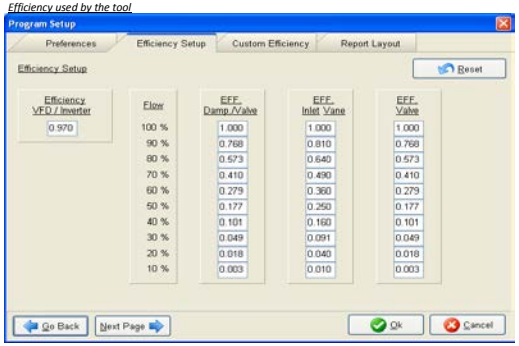
Tool Outputs:

1) Baseline efficiency of the motor was submitted as 94% while proposed motor efficiency was submitted as 95%. The review re-run the calculator with 94% motor efficiency for both baseline and proposed to be consistent.
2) Columns "Cost per Hour" and "Operating Cost" correspond to kW and kWh because 100 cents per kW was entered to the tool.

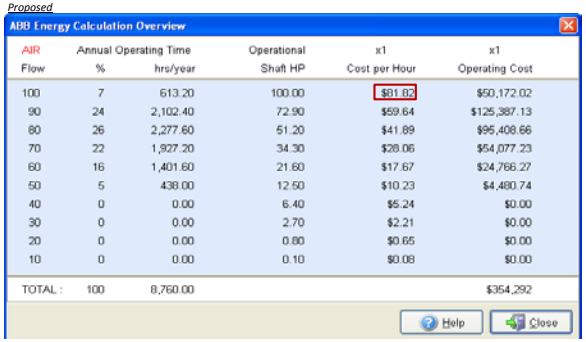
Baseline



Efficiency used by the tool



Proposed



Appendix C -Cash Rebate Calculation

TriHealth Good Samaritan - VFD

Measure	Quantity	Cash Rebate Rate	Rebate	Cash Rebate
Installed VFD on 100HP supply fan motor	1	50% of incentive that would be offered by the Smart $aver Custom program	$6,250	**$6,250**
			Total	**$6,250**

Appendix D (REVISED)-UCT Value

TriHealth Good Samaritan - VFD

Measure	Total Avoided Cost	Program Cost	Incentive	Quantity	Measure UCT
Installed VFD on 100HP supply fan motor	$77,744	$6,030	$6,250	1	**6.33**
Totals	**$77,744**	**$6,030**	**$6,250**	**1**	

Total Avoided Supply Costs	$77,744	***Aggregate Application UCT***	***6.33***
Total Program Costs	$6,030.00		
Total Incentive	$6,250		

GSH CUSTOM VFD.

Ohio Mercantile Self Direct Program

Application Guide & Cover Sheet

Questions? Call 1-866-380-9580 or visit www.duke-energy.com.

Email this form along with completed Mercantile Self Direct Prescriptive or Custom applications, proof of payment, energy savings calculations and spec sheets to SelfDirect@Duke-Energy.com. You may also fax to 1-513-629-5572.

Mercantile customers, defined as using at least 700,000 kWh annually are eligible for the Mercantile Self Direct program. Please indicate mercantile qualification:

- ☒ a single Duke Energy Ohio account
- ☐ multiple accounts in Ohio (energy usage with other utilities may be counted toward the total)

Please list Duke Energy account numbers below (attach listing of multiple accounts and/or billing history for other utilities as required):

Account Number	Annual Usage	Account Number	Annual Usage
8720070601	35,673,576 kWh		

Self Direct rebates are available for completed Custom projects that have not previously received a Duke Energy Smart $aver® Custom Incentive. Self Direct incentives are applicable to Prescriptive measures that were installed more than 90 days prior to submission to Duke Energy and have not previously received a Duke Energy Prescriptive rebate.

Self Direct Program requirements dictate that certain projects that may be Prescriptive in nature under the Smart $aver program must be evaluated using the Custom process. Use the table on page two as a guide to determine which Self Direct program fits your project(s). Apply for Self Direct projects using the appropriate application forms in conjunction with this cover sheet. Where Mercantile Self Direct Prescriptive applications are listed, please refer to the measure list on that application. If your measure is not listed, you may be eligible for a Self Direct Custom rebate. Self Direct Custom applications, like Smart $aver Custom applications, should include detailed analysis of pre-project and post-project energy usage and project costs. Please indicate which type of rebate applications are included in the table provided on page two.

Please check each box to indicate completion of the following program requirements:

☑ All sections of appropriate application(s) are completed	☑ Proof of payment.*	☑ Manufacturer's Spec sheets	☑ Energy model/calculations and detailed inputs for Custom applications

* If a single payment record is intended to demonstrate the costs of both Prescriptive & Custom projects, please include an additional document with an estimated breakout of costs for each Prescriptive and Custom energy conservation measure.

Application Type	Replaced equipment at end of lifetime or because equipment failed**	Replaced fully operational equipment to improve efficiency***	New Construction
Lighting	MSD Custom Part 1 ☐ Custom Lighting Worksheet ☐	MSD Prescriptive Lighting ☐	MSD Prescriptive Lighting ☐
		MSD Custom Part 1 ☐ Custom Lighting Worksheet ☐	MSD Custom Part 1 ☐ Custom Lighting Worksheet ☐
Heating & Cooling	MSD Custom Part 1 ☐ MSD Custom General Worksheet ☐	MSD Custom Part 1 ☐ MSD Custom General Worksheet ☐	MSD Prescriptive Heating & Cooling ☐
			MSD Custom Part 1 ☐ MSD Custom General Worksheet ☐
Window Films, Programmable Thermostats, & Guest Room Energy Management Systems	MSD Custom Part 1 ☐ MSD Custom General and/or EMS Worksheet(s) ☐	MSD Prescriptive Heating & Cooling ☐	MSD Custom Part 1 ☐ MSD Custom General and/or EMS Worksheet(s) ☐
Chillers & Thermal Storage	MSD Custom Part 1 ☐ MSD Custom General Worksheet ☐	MSD Custom Part 1 ☐ MSD Custom General Worksheet ☐	MSD Prescriptive Chillers & Thermal Storage ☐
			MSD Custom Part 1 ☐ MSD Custom General Worksheet ☐
Motors & Pumps	MSD Custom Part 1 ☐ MSD Custom General Worksheet ☐	MSD Custom Part 1 ☐ MSD Custom General Worksheet ☐	MSD Prescriptive Motors, Pumps & Drives ☐
			MSD Custom Part 1 ☐ MSD Custom General Worksheet ☐
VFDs	Not Applicable	MSD Prescriptive Motors, Pumps & Drives ☒	MSD Custom Part 1 ☐ MSD Custom VFD Worksheet ☒
		MSD Custom Part 1 ☐ MSD Custom VFD Worksheet ☐	
Food Service	MSD Custom Part 1 ☐ MSD Custom General Worksheet ☐	MSD Custom Part 1 ☐ MSD Custom General Worksheet ☐	MSD Prescriptive Food Service ☐
			MSD Custom Part 1 ☐ MSD Custom General Worksheet ☐
Air Compressors	MSD Custom Part 1 ☐ MSD Custom Compressed Air Worksheet ☐	MSD Custom Part 1 ☐ MSD Custom Compressed Air Worksheet ☐	MSD Prescriptive Process ☐
			MSD Custom Part 1 ☐ MSD Custom Compressed Air Worksheet ☐
Process	MSD Custom Part 1 ☐ MSD Custom General Worksheet ☐	MSD Prescriptive Process ☐	MSD Custom Part 1 ☐ MSD Custom General Worksheet ☐
		MSD Custom Part 1 ☐ MSD Custom General Worksheet ☐	
Energy Management Systems	MSD Custom Part 1 ☐ MSD Custom EMS Worksheet ☐	MSD Custom Part 1 ☐ MSD Custom EMS Worksheet ☐	MSD Custom Part 1 ☐ MSD Custom EMS Worksheet ☐
Chiller Tune-ups	MSD Prescriptive Chiller Tune-ups ☐		
Behavioral* & No/Low Cost**	MSD Custom Part 1 ☐ MSD Custom General Worksheet ☐		

** Under the Self Direct program, failed equipment and equipment at the end of its useful life are evaluated differently than early replacement of fully functioning equipment. **All equipment replacements due to failure or old age will be evaluated via the Custom program.**

*** Please ensure that you include the age of the replaced equipment for measures classified as "Early Replacement" in your application as well as the estimated date that you would have otherwise replaced the existing equipment if you had not chosen a more energy efficient option.

**** Behavioral energy efficiency and demand reduction projects must be both measurable and verifiable. Provide justification with your application.

Mercantile Self Direct
Nonresidential Custom Rebate Application
PART 1

Proposed energy efficiency measures may be eligible for Self-Direct Custom rebates if they clearly reduce electrical consumption and/or demand as compared to the appropriate baseline.

Before you complete this application, please note the following important criteria:

- Submitting this application does not guarantee a rebate will be approved.
- Rebates are based on electricity conservation only.
- Electric demand and/or energy reductions must be well documented with auditable calculations.
- Incomplete applications cannot be reviewed; all fields are required.

Refer to the complete list of Instructions and Disclaimers, beginning on page 6.

Notes on the Application Process

If you have any questions concerning how to complete any portion of the application or what supplementary information is required, please contact your Duke Energy Ohio, Inc account manager or the Duke Energy Smart $aver® team at 1-866-380-9580.

Every application must include calculations of the baseline electrical usage and the electrical usage of the proposed high-efficiency equipment/system. Monthly calculations are best. You, the Duke Energy Ohio customer, or your equipment vendor / engineer should perform these calculations and submit them to Duke Energy for review. *We strongly encourage the use of modeling software (such as eQuest or comparable) for complex projects.*

Upon receipt of your application, an acknowledgement email will be sent to you with an estimated response time based on an initial assessment of your application. The application review may include some communication to resolve any questions about the project or to request additional information. Applications that are received complete without missing information have a faster review time.

There are two ways to submit your completed application.

Email your scanned form to: SelfDirect@duke-energy.com

Or, fax your form to 513-629-5572

Mercantile Self Direct
Nonresidential Custom Rebate Application
PART 1

1. Contact Information (Required)

Duke Energy Customer Contact Information						
Company Name	TriHealth-Good Samaritan Hospital					
Address	375 Dixmyth Avenue					
Project Contact	Gene Gesell					
City	Cincinnati	State	Ohio	Zip Code	45220	
Title	Maintenance Supervisor					
Office Phone	513-872-2809	Mobile Phone		Fax		
E-mail Address	gene_gesell@trihealth.com					

Equipment Vendor / Contractor / Architect / Engineer Contact Information					
Company Name	Pathian				
Address	11260 Chester Road, Suite 545				
City	Cincinnati	State	Ohio	Zip Code	45246
Project Contact	Steve Rohrs				
Title	Mechanical Engineer				
Office Phone	513-737-7430	Mobile Phone	513-325-9055	Fax	513-737-1549
E-mail Address	srohrs@pathian.com				
Describe Role	Energy Engineer				

Payment Information					
Payee Legal Company Name (as shown on Federal income tax return):	TriHealth Hospitals				
Mailing Address	375 Dixmyth Avenue				
City	Cincinnati	State	Ohio	Zip Code	45220
Type of organization (check one) ☐ Individual/Sole Proprietor ☒ Corporation ☐ Partnership ☐ Unit of Government ☐ Non-Profit (non-corporation)					
Payee Federal Tax ID # of Legal Company Name Above:	31-127019				
Who should receive incentive payment? (select one) ☒ Customer ☐ Vendor (Customer must sign below)					
If the vendor is to receive payment, please sign below: I hereby authorize payment of incentive directly to vendor: Customer Signature _____ Date 12/21/12 (mm/dd/yyyy)					

2. Project Information (Required)

A. Please indicate project type:
- ☐ New Construction
- ☐ Expansion at an existing facility
- ☐ Replacing equipment due to equipment failure
- ☐ Replacing equipment that is estimated to have remaining useful life of 2 years or less
- ☒ Replacing equipment that is estimated to have remaining useful life of more than 2 years
- ☐ Behavioral, operational and/or procedural programs/projects

B. Please describe your project, or attach a detailed project description that describes the project.

Currently AHU 7 has a 100 HP supply fan motor that has volume control via Inlet Guide Vanes. The IGV's will be removed and a VFD will be installed. In adddition to the VFD, the unit will be resequenced to reset the supply air static pressure in the duct, by looking at time of day, OA enthalpy, and night setback based on a photocell contact closure.

C. When did you start and complete implementation?
Start date 06/ 2012 (mm/yyyy) End date 08/ 2012 (mm/yyyy)

D. Are you also applying for Self-Direct Prescriptive incentives and, if so, which one(s)[1]?
Yes, the return fan for this unit has a 40 HP motor that falls under the prescriptive incentive.

E. Please indicate which worksheet(s) you are submitting for this application (check all that apply):
- ☐ Lighting
- ☒ Variable Frequency Drive (VFD)
- ☐ Compressed Air
- ☐ Energy Management System (EMS)
- ☐ General (for projects not easily submitted using one of the above worksheets)

F. Please tell us if there is anything about your electrical energy projections (either for the baseline or the proposed project) that you are either unsure about or for which you have made significant assumptions. Attach additional sheets as needed.

[1] If your project involves some equipment that is eligible for prescriptive incentives and some equipment that is likely eligible for custom incentives, and if it is feasible to separate the equipment for the energy analysis, then the equipment will be evaluated separately. If it is not feasible to separate the equipment for analysis, then the equipment will be evaluated together in the custom application.

Required: Attach a supplier or contractor invoice or other equivalent information documenting the Implementation Cost for each project listed in your application. (Note: self-install costs cannot be included in the Implementation Cost)

3. Signature (Required – must be signed by Duke Energy customer)

Customer Consent to Release of Personal Information

I, (insert name) GENE GESELL [redacted], do hereby consent to Duke Energy disclosing my Duke Energy Ohio, Inc Account Number and Federal Tax ID Number to its subcontractors solely for the purpose of administering Duke Energy Ohio's Mercantile Self-Direct Program. I understand that such subcontractors are contractually bound to otherwise maintain my Duke Energy Ohio, Inc Account Number and Federal Tax ID Number in the strictest of confidence.

I realize that under the rules and regulations of the public utilities commission, I may refuse to allow Duke Energy Ohio, Inc to release the information set forth above. By my signature, I freely give Duke Energy Ohio, Inc permission to release the information designated above.

Application Signature

I certify that I meet the eligibility requirements of the Duke Energy Ohio, Inc Mercantile Self Direct Custom Incentives Program and that all information provided within this application is correct to the best of my knowledge. I agree to the terms and conditions set forth for this program. I certify that the numbers, energy savings, and responses shown on this form are correct. Further, I certify that the taxpayer identification number is current and correct. I am not subject to backup withholding because: (a) I am exempt from backup withholding; or (b) I have not been notified by the IRS that I am subject to backup withholding as a result of a failure to report all interest or dividends; or (c) the IRS has notified me that I am no longer subject to backup withholding. I am a U.S. citizen (includes a U.S. resident alien).

Gene Gesell
Duke Energy Ohio, Inc Customer Signature

Print Name ~~William Martin~~ Gene Gesell

Date 12/21/12

Mercantile Self Direct
Nonresidential Custom Rebate Application
PART 1

Duke Energy®

Checklist for completing the Application

INCOMPLETE APPLICATIONS WILL RESULT IN DELAYS IN DUKE ENERGY PROCESSING YOUR APPLICATION AND NOTIFYING YOU CONCERNING AY REBATES. Before submitting the application and the required supplementary information, use the following checklist to ensure that your application is complete and the information in the application is accurate. (Note: this checklist is for your use only – do not submit this checklist with your application)

Section No. & Title	Have You:
1. Contact Information	☑ Completed the contact information for the Duke Energy customer? ☑ Completed the contact information for the equipment vendor / project engineer that can answer questions about the technical aspects of the project, if that is a different person than above?
2. Project Information	☑ Answered the questions A-E, including providing a description of your project. ☑ Completed and attached the lighting, compressed air, VFD, EMS and/or General worksheet(s)?
3. Signature	☑ Signed your name? ☑ Printed your name? ☑ Entered the date?
Supplementary information (Required)	☑ Attached a supplier or contractor's invoice or other equivalent information documenting the Implementation Cost for projects listed in your application? (Note: self-install costs cannot be included in the Implementation Cost) ☑ (If submitting the General Worksheet) attached calculations documenting the energy usage and energy savings for **each** project listed in your application?

If you have any questions concerning how to complete any portion of the application or what supplementary information is required, please contact:

- your Duke Energy account manager
  or,
- the Duke Energy Smart $aver® team at 1-866-380-9580.

Mercantile Self Direct
Nonresidential Custom Rebate Application
PART 1

Instructions/Terms/Conditions

Note: Please keep for your records- do not submit with the application

1. Energy service companies or contractors may assist in preparing the application, but an authorized representative of the customer must sign this application to be eligible to participate in the Mercantile Self Direct Program. Completion of this application does not guarantee the approval of a Self Direct Custom Rebate.

2. Once all documentation requested in this application is received by *Duke Energy Ohio, Inc,* and any follow-up information requested by *Duke Energy* is received, the rebate amount for each Energy Conservation Measure (ECM) will be communicated to the customer. The rebate amount will be based on ECM energy savings and ECM incremental installation cost.

3. All rebates require approval by the Public Utilities Commission of Ohio. *Duke Energy Ohio, Inc* will submit an application for rebate on the customer's behalf upon customer attestation to program terms, conditions and requirements as outlined in the rebate offer letter and upon customer completion of attestation documents required by the Public Utilities Commission of Ohio.

4. *Duke Energy Ohio, Inc* will issue a Self Direct Custom Rebate check, based on the approved rebate amount for each ECM, upon receiving approval from the Public Utilities Commission of Ohio. *Duke Energy* Ohio, Inc does not guarantee PUCO approval.

5. With the application, the customer must provide a list of all sites where the ECMs were installed. *Duke Energy Ohio, Inc* requests that sites of similar size, hours of operation and energy consuming characteristics be grouped together in one application for the determination of the rebate amount. The application should identify the site where each unique ECM was installed.

6. Based on the information submitted with the application and the information gathered both before and after the initial installation of the ECM, *Duke Energy Ohio, Inc* will calculate the rebate amount for each ECM.

7. *Duke Energy Ohio, Inc* may conduct random site inspections of a sample of the locations where the ECMs are installed to verify installation and operability of the ECMs and to obtain information needed to calculate the Approved Incentive Amount.

8. Customers are encouraged to retain copies of all forms, invoices and supporting documentation for their records.

9. Approved rebates are valid for 6 months from the date communicated to the customer by *Duke Energy Ohio, Inc,* subject to the expiration of measure eligibility based on project completion dates and application submission deadlines as defined by PUCO. Customers are encouraged to execute their rebate offer contracts and PUCO-required affidavits promptly to ensure eligibility is not forfeited.

10. *Duke Energy Ohio, Inc* reserves the right to recover all unrecoverable costs associated with the project approval if the customer decides not to execute the rebate contract, after the project is approved by *Duke Energy Ohio, Inc.*

11. Projects financially supported by other funding sources will be evaluated on a case-by-case basis for potential partial funding from *Duke Energy Ohio, Inc.*

12. Participants must be *Duke Energy Ohio, Inc* nonresidential, mercantile customers with the project sites in the *Duke Energy Ohio, Inc* service territory.

13. Customers or trade allies may not use any *Duke Energy* logo without prior written permission.

14. Only trade allies registered with *Duke Energy* are eligible to participate.

15. All equipment must be new. Used or rebuilt equipment is not eligible for incentives. All old existing equipment must be removed on retrofit projects.

16. Disclaimers: *Duke Energy Ohio, Inc*
    a. does not endorse any particular manufacturer, product or system design within the program;
    b. will not be responsible for any tax liability imposed on the customer as a result of the payment of incentives;
    c. does not expressly or implicitly warrant the performance of installed equipment. (Contact your contractor for details regarding equipment warranties.);
    d. is not responsible for the proper disposal/recycling of any waste generated or obsolete or old equipment as a result of this project;
    e. is not liable for any damage caused by the installation of the equipment nor for any damage caused by the malfunction of the installed equipment; and
    f. reserves the right to change or discontinue this program at any time. The acceptance of program applications is determined solely by *Duke Energy Ohio, Inc.*

ACH550 Energy Savings Estimator

To: Pathian
Mechanical Engineer Steve Rohrs

Prepared by:

Fan Application

Project Name: Good Sam hoapital AHU 7 SF

Total Annual Hours of Operation: 8,736 Hours

Operation / Motor / VFD Data

Cost per kWh:	7.00 ct.
Motor Horse Power:	100.0 HP
Motor Efficiency:	95.0 %
Drive Efficiency:	97.0 %
Power Company Incentive:	0.0 $/HP
ABB ACH550 Drive Cost:	$0

New Operation

Annual Energy Cost per Control Method

No Speed Control	$48,152
ABB ACH550 Drive:	$24,524
Outlet Damper Control	$42,066
Inlet Vane Control	$37,050

Annual Energy Savings per Control

No Speed Control	$23,628
Outlet Damper Control	$17,541
Inlet Vane Control	$12,526

Duty Cycle

% Flow	Time (Hrs)	Time (%)
100%	611.5 Hrs	7 %
90%	2,096.6 Hrs	24 %
80%	2,271.4 Hrs	26 %
70%	1,921.9 Hrs	22 %
60%	1,397.8 Hrs	16 %
50%	436.8 Hrs	5 %
40%	0.0 Hrs	0 %
30%	0.0 Hrs	0 %
20%	0.0 Hrs	0 %
10%	0.0 Hrs	0 %

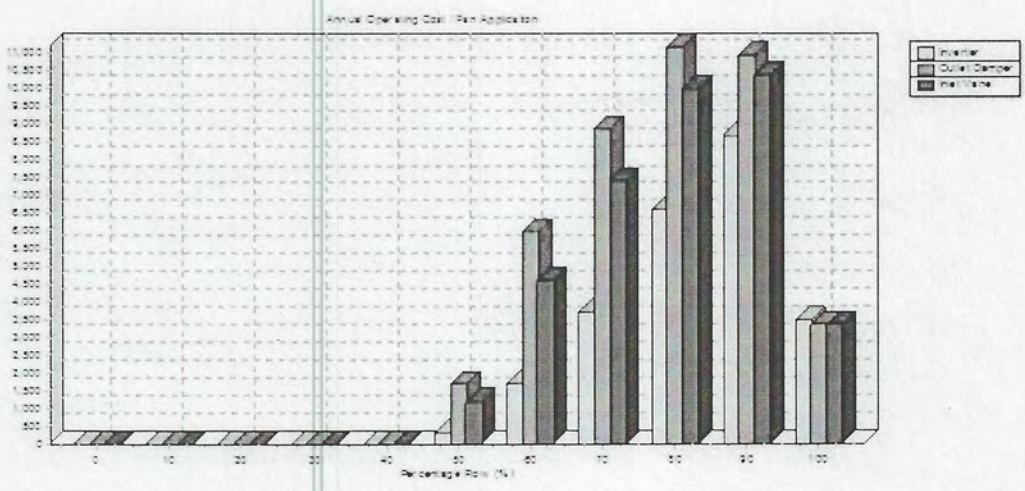
Payback Period ABB ACH550 Drive

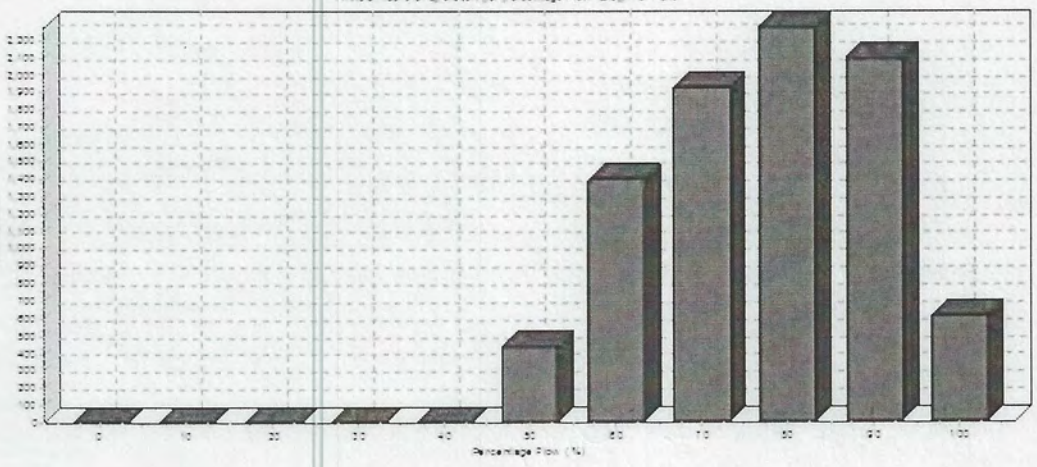
No Control	Immediate
Outlet Damper	Immediate
Inlet Vane	Immediate

Includes Company Incentive

ABB ACH550 Energy Savings Estimator

This Energy Estimation is based on available data, ABB Inc. assumes no responsibility for the accuracy of the supplied data on this report.





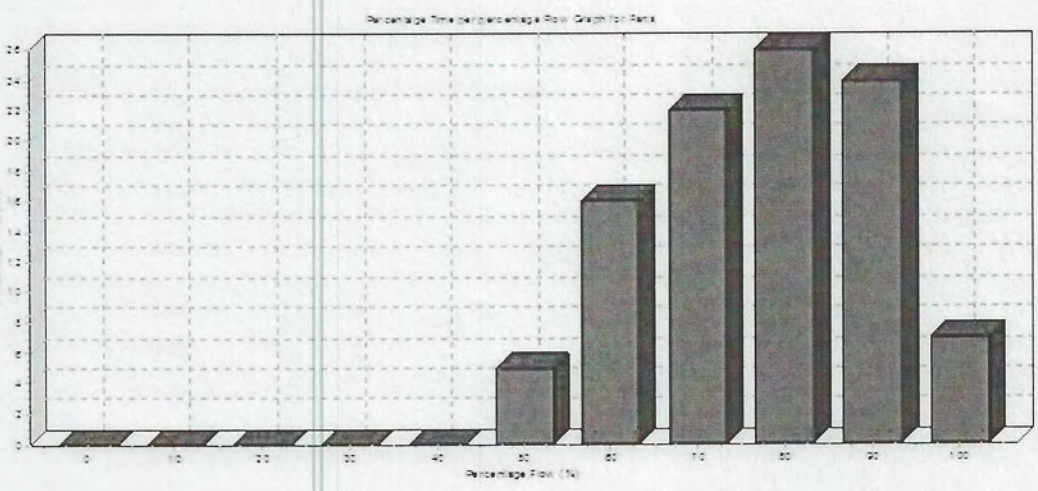


ABB ACH550 Energy Savings Estimator

This Energy Estimation is based on available data, ABB Inc. assumes no responsibility for the accuracy of the supplied data on this report.

ACH550 Energy Savings Estimator

To: Pathian
Mechanical Engineer Steve Rohrs

Prepared by:

Fan Application

Project Name: Good Samaritan Hospital AHU 7 SF

Total Annual Hours of Operation: 8,736 Hours

Operation / Motor / VFD Data

Cost per kWh:	7.00 ct.
Motor Horse Power:	100.0 HP
Motor Efficiency:	94.0 %
Drive Efficiency:	97.0 %
Power Company Incentive:	0.0 $/HP
ABB ACH550 Drive Cost:	$0

Annual Energy Cost per Control Method

No Speed Control	$48,665
ABB ACH550 Drive:	$29,229
Outlet Damper Control	$44,023
Inlet Vane Control	$40,002

Annual Energy Savings per Control

No Speed Control	$19,436
Outlet Damper Control	$14,794
Inlet Vane Control	$10,773

Duty Cycle

% Flow	Time (Hrs)	Time (%)
100%	1,223.0 Hrs	14 %
90%	2,271.4 Hrs	26 %
80%	2,446.1 Hrs	28 %
70%	2,795.5 Hrs	32 %
60%	0.0 Hrs	0 %
50%	0.0 Hrs	0 %
40%	0.0 Hrs	0 %
30%	0.0 Hrs	0 %
20%	0.0 Hrs	0 %
10%	0.0 Hrs	0 %

Original programming operation

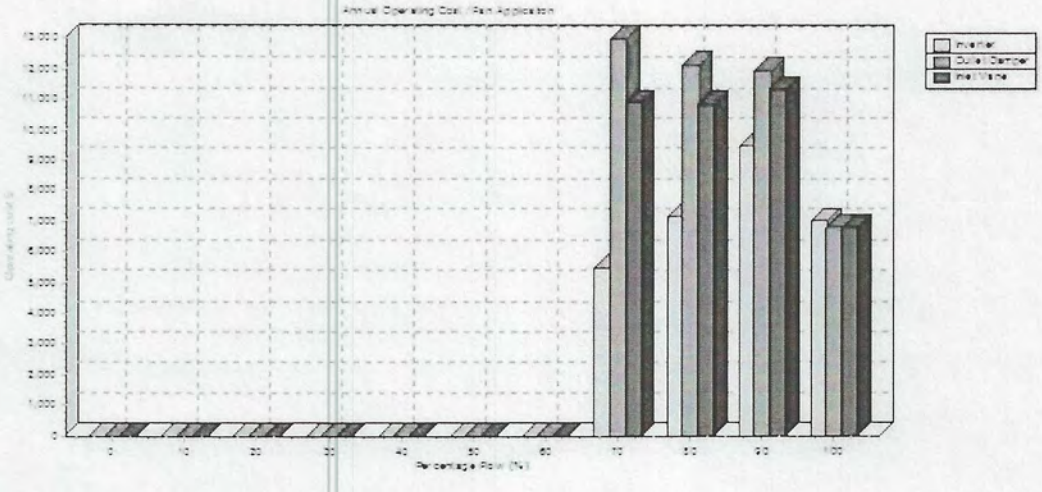
Payback Period ABB ACH550 Drive

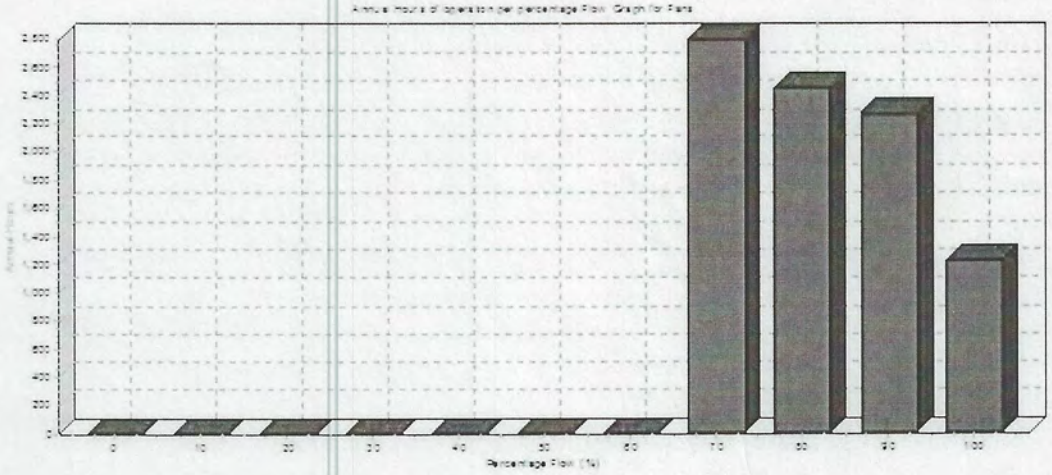
No Control	Immediate
Outlet Damper	Immediate
Inlet Vane	Immediate

Includes Company Incentive

ABB ACH550 Energy Savings Estimator

This Energy Estimation is based on available data, ABB Inc. assumes no responsibility for the accuracy of the supplied data on this report.





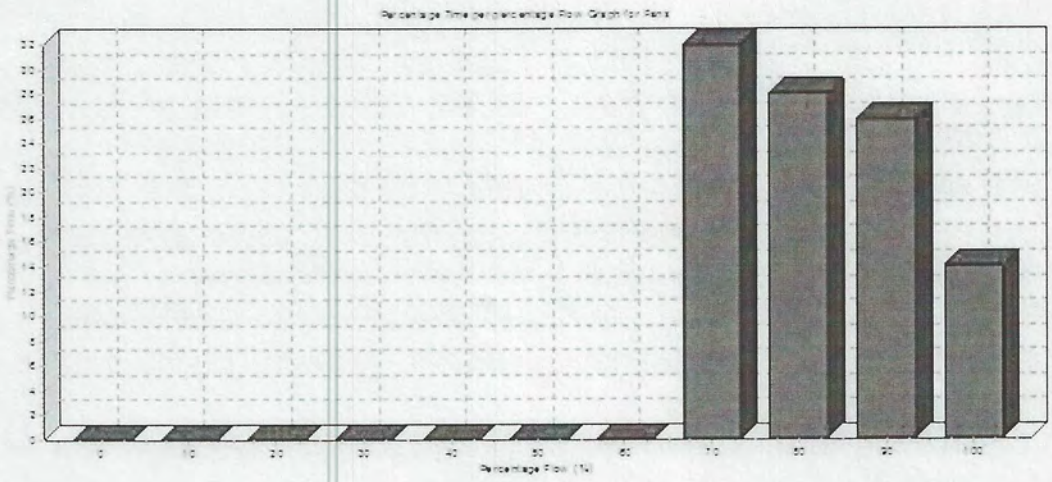


ABB ACH550 Energy Savings Estimator

This Energy Estimation is based on available data, ABB Inc. assumes no responsibility for the accuracy of the supplied data on this report.

The General Worksheet is part 2 of the application. Do not submit this file without submitting a completed Part1 Custom Application document file, which can be found at www.duke-energy.com. This worksheet is for all projects that are not easily submitted through one of the other worksheets

Before you complete this application, please note the following important criteria:

- Incentive approval is required PRIOR to equipment purchase, or any other activity which would indicate that the Duke Energy customer has already decided to proceed.
- Submitting this application does not guarantee an incentive will be approved.
- Incentives are based on electricity conservation only.
- Electric demand and/or energy reductions must be well documented with auditable calculations.
- Simple payback without incentive must be greater than 1 year.
- Incomplete applications will not be reviewed; all fields are required.

Refer to the complete list of Instructions and Disclaimers, found in the Custom Application Part 1 document.

Please enter your information and data into the cells that are shaded.
Cells in white are locked and cannot be written over.

Duke Energy Customer Contact Information (Match the information in Application Part 1):

Name	TriHealth Hospitals - Good Samaritan Hospital
Company	TriHealth

Equipment Vendor / Project Engineer Contact Information

Name	Pathian - Steve Rohrs
Company	Pathian

Before proceeding with the custom application, please verify that your project is not on the prescriptive incentive application.
The prescriptive incentive applications can be found at:

KY http://www.duke-energy.com/kentucky-business/energy-management/energy-efficiency-incentives.asp
Kentucky only: custom incentives only available to K-12 school facilities; prescriptive incentives available for those not on rate TT.
OH http://www.duke-energy.com/ohio-business/energy-management/energy-efficiency-incentives.asp
NC http://www.duke-energy.com/north-carolina-business/energy-management/energy-efficiency-incentives.asp
SC http://www.duke-energy.com/south-carolina-business/energy-management/energy-efficiency-incentives.asp

Prescriptive incentives are already pre-approved and the application is submitted after project implementation.
Take note of the equipment eligibility on the prescriptive application before planning to utilize the prescriptive application.

List of Sites (Required)

App No.
Rev.

Provide a list of sites addressed by this custom incentive application

Site ID (see note 1)	Duke Energy Electric Account Number(s) (see note 2)	Facility Address	List of Proposed Projects at each site	Annual Hours of Operation	Gross Square Footage
225	*12345678 01*	*Example: 123 Main Street, Anywhere USA 12345*	*Project Name(s)*	*5,840*	*42,000*
	8720070601	*375 Dixmyth Ave, Cincinnati OH, 45220*	*AHU 7 Supply fan upgrade*	*8,760*	*1,259,501*

1 Site ID
Can be a store number, building name or other way to identify the location. If there is only one site involved in this application, then a Site ID is not necessary.

2 Account Numbers
Must match the facility of the proposed project(s). If there are multiple meters at a site, only include the meters that pertain to the project(s).

Duke Energy

Conditioned Square Footage	Facility Age (years)
38,000	12
1,259,501	97

Duke Energy

For each project, answer the following questions (use one worksheet per project)

App No.	0
Rev.	0

Project Name: AHU 7 Supply fan upgrade

How would you classify this project? (Place an x in all boxes that apply.)

Lighting		Heating/Cooling		Air Compressor		Energy Management	x
VFD	x	Motors/Pumps		Process		Other, describe below:	

Brief Project Description

Describe the Baseline (see note 3) Equipment/System	Describe the Proposed High Efficiency Project
Currently AHU 7 has a 100 HP Supply fan motor that has volume control via Inlet Guide Vanes.	The IGV's will be removed and a VFD will be installed. In addition to the VFD, the unit will be resequenced to reset the supply air static pressure in the duct, by looking at time of day, OA enthalpy, and night setback based on a photocell contact closure.

If Existing Equipment is the Baseline, how many years of useful life remain or how many years until replacement? 20

Detailed Project Description Attached? Yes (Required)

Operating Hours (see note 4)

	Weekday		Saturday		Sunday		Weeks of Use in Year	Total Annual Hours of Use
24 x 7	Start Hour	End Hour	Start Hour	End Hour	Start Hour	End Hour	(see note 5)	
Yes							*52*	*8,760*

Energy Savings

	Baseline (see Note 3)	Proposed	Savings	Describe how energy numbers were calculated
Annual Electric Energy	571,457 kWh	350,342 kWh	221,115 kWh	
Electric Demand	10 kW	1 kW	9 kW	
Calculations attached	Yes	Yes	(Required)	Current control method vs new control method. See project description

Simple Payback

Average electric rate ($/kWh) on the applicable accounts (see note 6)			$0.07
Estimated annual electric savings			$15,478
Other annual savings in addition to electric savings, such as operations, maintenance, other fuels			
Incremental cost to implement the project (equipment & installation) (see note 7)			$25,000.00
Copy of vendor proposal is attached (see note 8)			Yes
Simple Electric Payback in years (see note 9)	1.615190544	Total Payback in years	1.615190544

100 HP
$50/HP
$5000 Rebate Min

total
28900
25,000
3,900
RF only

3 Baseline
Retrofit projects: the existing equipment is the baseline unless that equipment must be replaced for some reason anyway.
New construction projects or where the existing equipment must be replaced anyway: the baseline is the standard option in today's market, taking into account any applicable organizational, local, state or federal codes or standards currently in effect.

4 Operating Hours
Describe when the equipment is typically used. If the project is proposed for more than one site, provide any variations in operating hours between the sites on a separate sheet.

5 Weeks of Use in Year
If the equipment is not in use 52 weeks during the year (for example, during holiday or summer break), provide an explanation of when usage is not expected and why: 24-7-365

6 Average electric rate ($/kWh)
If you do not know your average electric rate, use $0.10/kWh.

7 Incremental cost to implement the project
Costs exclude self installation costs. Retrofit projects, incremental cost is the total cost of the proposed project. New construction or where the existing equipment must be replaced anyway, then incremental cost is the premium of the proposed high efficiency project over baseline.

8 Copy of vendor proposal is attached
Vendor proposal of proposed system is always required.
New construction projects or where the existing equipment must be replaced anyway, vendor proposal of baseline must also be attached.

9 Simple Electric Payback
If the simple electric payback is less than 1 year, then no incentive can be approved. Double check average electric rate for correct payback.

This unit has a 100 HP supply fan Custom app and a 40 HP return fan prescriptive app.

Pathian
INCORPORATED
Revolutionizing an Industry

INVOICE

Date:2/24/2012
INVOICE # 1-207

TO

Gene Gesell
Good Samaritan Hospital
375 Dixmyth Ave
Cincinnati, OH 45220-2489

Salesperson	Job	Payment Terms	Due Date
	AC-7 SAF & RAF VFD's: PO # 902459-0-150	Net 30	3/25/2012

Description	Qty.	Unit Price	Line Total
AC-7 SAF & RAF VFD's: PO # 902459-0-150	1	$28,900.00	$28,900.00

RF # 3,900.00
SF 25,000.00
Total → 28,900.00

Subtotal	$28,900.00
Sales Tax	$0.00
Total	$28,900.00
Payments	$0.00
Balance	$28,900.00

Thank you for your business!

Make all checks payable to Pathian Incorporated

2929 Audubon
Fairfield Township, OH 45011

Phone: (513) 746-8951
Fax: (513) 737-1549
dbuchanan@pathian.com

ABB HVAC packaged drive systems

ABB E-Clipse Bypass

Sales Bulletin

Eclipse *i-'klips, vt* ᵒsurpass, ᵒtop, ᵒoutshine, ᵒbeat, ᵒoutperform, ᵒovertake, ᵒovershadow, ᵒoutclass.

Introducing the ABB E-Clipse Bypass

In 1999, ABB introduced the world's first E-bypass design. Today, ABB has over 100,000 successful E-bypass installations world-wide. The initial focus in developing the E-bypass design concentrated on thoroughly understanding overall market, application and customer requirements where the E-bypass would be used. This focus was crucial to the resulting overall E-bypass design strategy and approach.

As a result of this effort, the determination was made that the only way to meet the demands of the current and future market and customer requirements was to implement a full digital microprocessor-based control in the E-bypass. The ABB E-Clipse Bypass has taken these developments to the next level. In addition to the benefits of the previous ABB design, ABB has added new capabilities focused upon the changing and evolving customer and market requirements. This brochure will give the user a brief overview of these features and benefits.

A Temperature Control Contractor Says...

- Having BACnet, FLN, ModBus, and N2 on board as standard means no additional cost or option modules for most communications projects.
- Serial communications directly to the bypass means no failed point on my network even if the VFD is out for maintenance or service.
- Onboard proof-of-flow indication and action means I no longer have to purchase expensive, prone to fail current transformers and relays.

Specifying Engineers State...

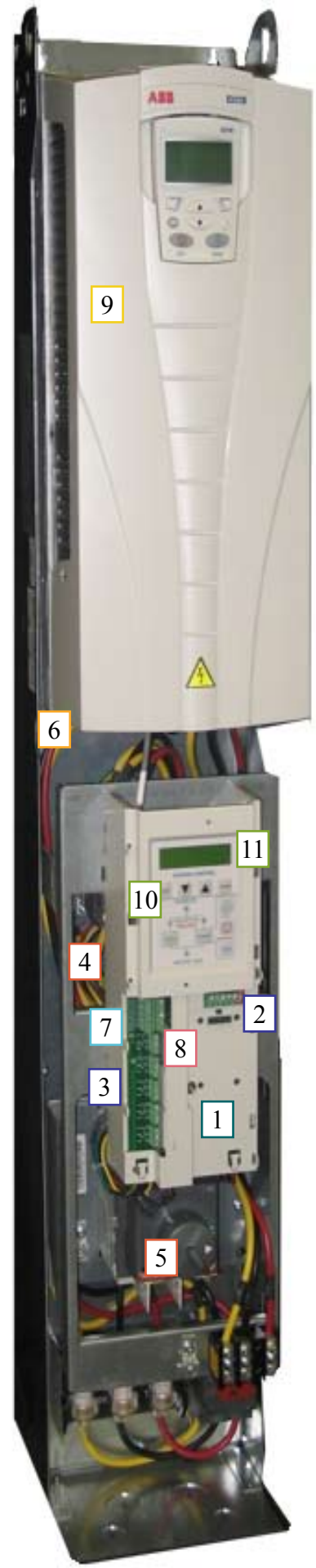
- The built-in communications suite means that I can have intelligent drive and bypass applications regardless of which temperature control contractor is successful on the project.
- ABB has thoroughly researched smoke control applications and embedded the correct response to all smoke emergency situations into this unit. UL type enclosures and seismic certification means I can apply the ABB E-Clipse Bypass in almost any application.
- With the VFD's 5% swinging choke and the VFD and bypass' RFI / EMI immunity, plus the regulated power supply (which means no issues during my monthly generator tests), the ABB E-Clipse Bypass is the only bypass I consider specifying in sensitive applications such as hospitals, airports, and laboratories.

Feedback from Facility Managers...

- Seismic certification is important to me. I wish all of my electrical equipment was seismic tested and certified.
- Individual safety annunciation means no more chasing down which interlock has opened.
- The supervisory controller means my cooling tower or pumping application is still functioning even if the VFD isn't.

A Contractors Point of View...

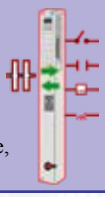
- The ABB E-Clipse Bypass is bullet proof. It even tells me in plain English if I have mis-wired the application and the fan is going to spin in reverse.
- The intelligent bypass and keypad diagnostics makes start up a snap. The bypass status LEDs and keypad messages let me know instantly if I have a VFD, a bypass, or an external issue.
- Individual safety annunciations makes troubleshooting start up issues a breeze.



2 Bypass Serial Communications

+ BACnet, FLN, ModBus, and N2 protocols on board
+ First in Industry
+ Over 45 points of bypass data/control
+ Go to bypass mode with no failed point on the communication network
+ Serially monitor amps, kWHrs, operating mode, and more – even in bypass mode

3 Pass Through I / O



+ Command 5 bypass relay outputs
+ Monitor and display which safety interlock is open
+ Control external devices (such as dampers and valves) via serial communications
+ 24 free I/O points - counting VFD

4 Regulated Power Supply

- No contactor chatter
- Tolerates +30, -35% voltage fluctuations

+ Welded contactor indication and action
+ Open contactor protection with diagnostics
+ Uses 115Vac contactor coils

5 Single Phase Protection

- Single phase motor protection - VFD and bypass
- No need for expensive add-on voltage monitors, circuits and relays

+ Included in every ABB E-Clipse Bypass

1 Intelligent - Microprocessor Based Advanced Features

- Microprocessor receives and processes all inputs for advanced features such as damper control/proof and smoke control

+ Supervisory control of pumps and cooling towers

- UL Listed motor Overload protection
- Most of the other advanced features called out on this page

6 Seismic Qualification Certificate

+ Tested to ICC-ES AC156
+ Designated Seismic System
+ Works even after seismic event

7 Proof-of-Flow (Broken-belt) Annunciation and Action

- Programmable proof-of-flow trigger

+ Proof-of-Flow indication on keypad
  Proof-of-Flow in both VFD and bypass modes

- No need for expensive, failure prone programmable current transmitters/relays

8 Smoke Control

- Two available overrides

+ Non programmable Smoke Control override designed to comply with UL864/UUKL
+ Second override may be field programmed to meet local AHJ
+ Becomes an integral part of your smoke control system

9 Stand Alone Operation

+ Serial communications still active, even with VFD removed

- Full bypass control without VFD

+ Supervisory control of application in bypass mode
+ Monitor all digital inputs and monitor and command all relay outputs
+ Monitor Volts, Amps, kWHrs and much more - even in bypass mode

10 Advanced Plain-English Bypass Keypad

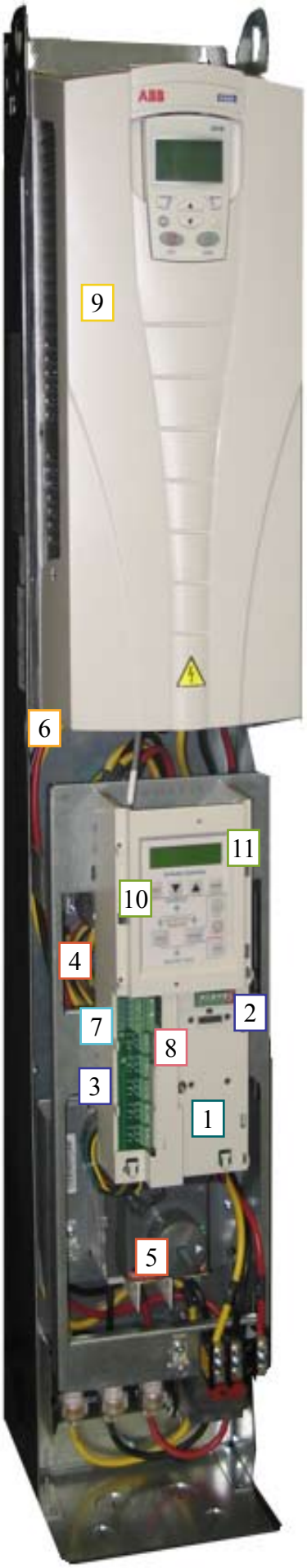
- System status LEDs

+ Superior system diagnostics
+ Advanced system programming
+ Sophisticated yet simple user interface

11 Individual Safety Annunciation

+ Up to 4 individual safeties
+ Unique name for each
+ Plain English display

- Safety annunciation over serial communicators

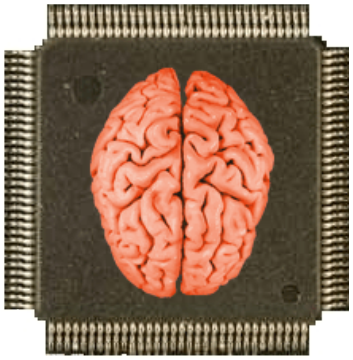


Applications

- Important
- • Critical

ABB E-Clipse Bypass Feature:	 Hospitals	 Universities K-12	 Airports & Labs
1 **Intelligent - Microprocessor Based Advanced Features** 	•	•	•
2 **Serial Communications** 	•	• •	•
3 **Run Permissive Damper Control & Proof** 	•	•	•
4 **Regulated Power Supply** 	• •	• •	• •
No Contactor Chatter	• •	•	•
5 **Single Phase Motor Protection** 	•	•	•
6 **Seismic Certification** 	• •		• •
7 **Proof-of-flow (Broken-belt)** 	•	•	• •
8 **Advanced Smoke Control** 	• •	• •	• •
9 **Stand Alone Operation** 	• •	•	• •
10 **Advanced Keypad Status & Diagnostics** 	•	• •	•
11 **Individual Safety Annunciations** 	•	•	• •

Intelligent Microprocessor Based Advanced Features



In 1999, ABB introduced the world's first E-bypass design. Today, ABB has over 100,000 successful E-bypass installations worldwide. The initial focus in developing the E-bypass design was to thoroughly understand the overall market, applications, and customer requirements where the E-bypass would be used. This focus was key to ABB's overall design strategy and approach.

As a result of this effort, the determination was made that the only way to meet the requirements of the current market, future market and customer demands was to implement a full microprocessor-based control in the E-bypass. The ABB E-Clipse Bypass has taken these developments to the next level. The ABB E-Clipse Bypass incorporates all of the features and functions you have come to know and love and added new capabilities focused on our changing and evolving market and application requirements.

The intelligence of the ABB E-Clipse Bypass is what differentiates this product from competitive offerings. The ABB E-Clipse Bypass microprocessor receives and processes all inputs into the system. These inputs may be digital inputs from customer supplied contact closures, serial communication inputs from the various Building Automation System (BAS) protocols, maintained contact closure inputs from devices such as safeties and damper proofs, or contacts from other sources such as the fire / smoke control panel (FSCP).

The ABB E-Clipse Bypass is structured around this intelligent microprocessor-based control. Microprocessor-based control is what allows ABB to provide the bullet proof contactor control and protection, serial communications, single phase control and protection, built-in broken-belt indication, and advanced smoke control action.

All of this intelligence is then linked to the advanced plain English bypass keypad for a superior human-machine interface. The ABB E-Clipse Bypass does not simply accept contact inputs from the customer and take the appropriate actions; the microprocessor-based intelligence in the ABB E-Clipse Bypass also allows for intelligent control of your application.

For example, by monitoring individual phase current, using built-in current transformers, ABB can obtain single phase protection of the A/C motor in the bypass mode without the need for additional current transformers, potential transformers, and external voltage monitoring circuit hardware. The microprocessor also provides the UL-listed motor overload protection, without the need for bimetallic overload heaters and relays.

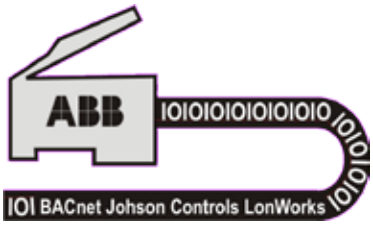
The microprocessor-based control has allowed ABB to implement a supervisory control mode into the ABB E-Clipse Bypass. In the supervisory control mode, the bypass monitors the 4-20 milliamp process feedback level coming to the variable frequency drive. The feedback level is then used to activate and deactivate the bypass contactor. This "bang-bang" control allows the user to maintain hysteresis control over applications such as cooling towers and booster pumps, even with the VFD out of service.

In addition, the microprocessor handles the brunt of the computational requirements for the run permissive circuit (damper actuator and proof receipt), the two different types of Fireman's override, and the multiple safeties and individual safety annunciation.

ABB chose to put a microprocessor into a new bypass controller in 1999. In 2008, the ABB E-Clipse Bypass takes the success of over 100,000 units installed to new heights.

Return to Brochure

Bypass Serial Communications



All ABB E-Clipse Bypass systems include the most common HVAC protocols as standard features. Included in every bypass shipped are ModBus, Johnson Controls N2, Siemens FLN, and BACnet communications protocols. Other protocols such as Lon Works, Profibus, Ethernet and DeviceNet are available as plug-in option cards.

In 1994, ABB pioneered serial communications for VFDs in the HVAC industry. Today ABB has installed over 150,000 units (in the U.S. alone) connected to building automations systems using the various HVAC communications protocols.

The ABB E-Clipse Bypass includes serial communications in the bypass mode. Now, going to bypass does not mean losing control!

In all previous designs, switching to bypass mode meant the VFD displayed as a failed point on the building automation system network. With the ABB E-Clipse Bypass, serial communications to the bypass controller means no loss of communication or control, and no failed point on the BAS network. The VFD may even be removed from the system (and sent back to the factory for repair, for example) with no loss of communications or control. The BAS system can still start and stop the application; monitor amps, volts, and kilowatts hours (and other objects); and monitor all warning and fault annunciations.

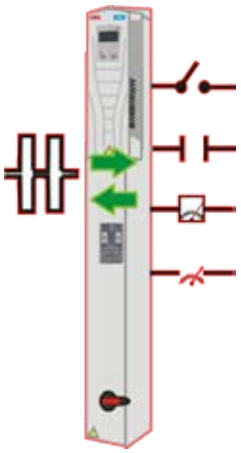
Over 45 individual points of data are communicated between the bypass and the BAS system master controller. For example, the operator can monitor all safeties, damper end-switch proofs, and any other digital inputs to the system. In addition, the operator can start and stop the bypass over serial communications or force the system into override mode.

Proof-of-flow, over temperature conditions, or other system warnings may also be displayed on the BAS master controller. Finally, all faults can be displayed at the master controller along with remote system fault reset capability via serial communications.

BACnet is a registered trademark of ASHRAE. ASHRAE does not endorse, approve or test products for compliance with ASHRAE standards. Compliance of listed products to requirements of ASHRAE Standard 135 is the responsibility of the BACnet Manufacturers Association (BMA). BTL is a registered trademark of the BMA.

Return to Brochure

Pass-through I/O



In 1997, ABB pioneered serial communications pass through I/O with the release of the ACH400 series drive. Pass-through I/O means the user can monitor all digital inputs on the variable frequency drive, and control all relay outputs and analog outputs on the variable frequency drive over the communications connection. This pass through I/O was quickly adopted by the more progressive temperature control contractors as a method of reducing system installed costs. For example, the BAS integrator could now use the VFD relay outputs to start a lag pump drive, open an isolation damper, or control any auxiliary device that requires a maintained contact closure for operation. In addition, all digital inputs such as damper receipt proof contacts, safeties, or supply fan run interlocks to the return fan can be monitored over the building automation system through the VFDs I/O.

However, using the VFD's I/O for control of the system inherently meant that, if the VFD was in a non-operational state, any ancillary devices that were being controlled through the VFD's I/O were also non-operational. The ABB E-Clipse Bypass addresses these concerns. With the ABB E-Clipse Bypass, I/O remains available to the BAS system even with the VFD removed. The BAS system integrator/end user now has complete confidence that, even if the drive were to fail, any ancillary devices being monitored and/or controlled using the system I/O available still is functional - even in the bypass mode.

The possibilities are limitless with this capability. If one counts the VFD and bypass I/O, the ABB E-Clipse Bypass and ACH550 drive gives the temperature control contractor a total of 24 free I/O points for their use, in addition to two free PID loops.

The ABB E-Clipse Bypass takes the serial communications functionality originally pioneered in 1997 to a whole new level!

Return to Brochure

Regulated Power Supply = Wide Voltage Tolerance

By far the most commonly reported problem with the classic (non-electronic) style of bypass was contactor coil failure caused by low-line or single phase input conditions.

Modern AC drives have a very wide voltage tolerance range. However, standard low voltage controls (contactors) typically are rated for approximately -15% nominal voltage maximum. A common problem with classic style bypasses was contactor chatter due to low line conditions followed quickly by contactor coil failure.

The typical scenario - a utility has a fault on one of their systems. This fault often is caused by a lightning storm, a downed power line due to a fallen tree, a car accident, an ice storm, or a rodent / bird problem.

While the utility is clearing their fault or re-routing power, a classic bypass may be subjected to a brownout condition. For example, a 480V drive/bypass now is receiving 350V or less. The 480:115V control power transformer in the classic bypass will have an output of about 85V instead of the nominal 115V. The drive output contactor drops out at about 100V. However, the building automation system is still sending the “run” contact to the drive/bypass system, so the contactor attempts to re-close.

However, the contactor is not being supplied enough voltage to pull in and seal in, so it bounces (chatters). The contactor coil also is pulling higher than normal amps because of the low voltage condition and the increased in-rush current caused by the pull-in effort. This cycle repeats until the contactor coil overheats and fails.

A stand-alone ABB VFD, without a classic bypass would have no issue with this brownout condition (unless the VFD was at full-load / full-speed during the brown-out event). The VFD is capable of input single phase operation and is generating a balanced three phase output to the motor. The fan or pump would continue operating without missing a beat if there were no bypass present!

Why did the customer pay the extra money for a bypass in the first place? Typically, this is because the customer felt that the driven fan or pump is on a critical application that cannot be without flow. In this situation, using as an example a 5 HP application, the customer had doubled the first cost of the drive (by adding a classic bypass) and inadvertently made the application less robust!

When ABB pioneered the electronic bypass in 1999, contactor chatter and failure was one of the problems with traditional bypass designs that ABB was determined to solve. The ABB E-Clipse Bypass has a regulated power supply circuit that keeps standard, ABB off-the-shelf 115V coil contactors seated and operating properly at guaranteed nominal voltage of +30% -35% (at minimum). This voltage tolerance range is maintained over all input voltage classes; 208, 240, 480, and 600V ABB E-Clipse Bypass units.

In addition, the micro processor based “brains” in the bypass protects the system from welded contacts and contactor failure to close. A coil monitoring circuit checks if the bypass or drive isolation contactor coil is not seated when the control system is commanding same closed. The system will trip off line and annunciate the “open contactor” condition if the contactor is not in the commanded state.

Finally, the bypass micro processor monitors if a contactor is closed when it should not be and will fault and display a “Bypass Contactor Stuck” or “Drive Contactor Stuck” annunciation on the keypad. This condition may be linked to a relay output. The relay output may then be used to trip an up-stream, shunt-trip circuit breaker to take the unit off-line. This feature allows one to protect the motor if the bypass contactor contacts become welded.

Motor protection, no contactor coil failure, drive operation in a single phase input situation, and contactor monitoring, all add up to a bullet proof, intelligent bypass system - the ABB E-Clipse Bypass.

Return to Brochure

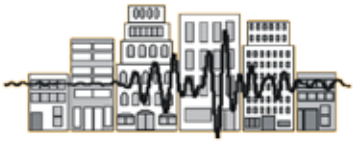
Single Phase Protection

The microprocessor-based design allows for many standard features in the ABB E-Clipse Bypass. For example, by monitoring output phase current using built-in current transducers, and feeding this information to the microprocessor-based controller - the ABB E-Clipse Bypass is capable of detecting and protecting the motor from input single phase conditions when in the bypass mode. Without a microprocessor-based design, this would require potential transformers and current transformers along with voltage monitoring hardware and relays to obtain single phase protection. The microprocessor-based design allows this single phase protection to be built-in as standard.

The ABB E-Clipse Bypass also monitors all three input phase voltages to the system. The ABB E-Clipse Bypass will allow the system to continue running if the system is in drive mode and a input single phase is present, but will trip off-line if the system is in the bypass mode when the single phase condition occurs, protecting the motor. In addition, the microprocessor uses the measured and calculated output current to provide the UL-listed motor overload protection.

Return to Brochure

Seismic Qualification Certificate



All ABB E-Clipse Bypass units comply to Section 1615 of the International Building Code, 2006 edition. Representative units were tested to test protocol AC156. These units were tested with an equipment importance factor of 1.5. An equipment importance factor of 1.5 indicates that the equipment functionality was verified before and after seismic simulation testing. This importance factor is indicative of critical facilities where maximizing the probability of post-event functionality is a priority. In other words, the ABB E-Clipse Bypass has been tested to function, even after an earthquake

ABB chose to test the ACH550 drive and E-Clipse Bypass to the importance factor of 1.5 because these drives and bypasses often are applied in critical applications such as hospitals, airports, and other facilities where lives are at stake.

The ABB ACH550 drive and ABB E-Clipse Bypass seismic withstand capacity was determined from seismic shake table test results defined in the International Code Counsel's (ICC) Acceptance Criteria for Seismic Qualification Testing of Non-structural Components (AC156). The Building Seismic Safety Council (BSSC) recognizes AC156 as an appropriate shake testing protocol. The National Institute of Building Sciences established the BSSC in 1979 to develop and promote regulatory provisions for earthquake risk management at the national level. The National Earthquake Hazard Reduction Program (NEHRP Provisions 6.4) also references AC156 as a national standard, and as a preferred shake-table testing protocol, which meets the force requirements of the Provisions and the American Society of Civil Engineers (ASCE 7-02).

ABB is pleased to certify that ABB ACH550 drives and the ABB E-Clipse Bypass series comply with National Seismic Qualification requirements.

Return to Brochure

Proof-of-Flow Annunciation

Proof-of-flow annunciation / broken-belt indication is now easier than ever. Since 1995 ABB has been able to provide drive proof-of-flow indication over your serial communications connection. The ABB E-Clipse Bypass technology extends this feature to units with both VFDs and bypasses.

The ABB E-Clipse Bypass system allows unprecedented diagnostics and fault annunciation through the onboard keypad and/or via serial communications. ABBs first E-bypass, released in 1999, included a programmable broken-belt fault only. The ABB E-Clipse Bypass includes programmable broken-belt indication levels, selectable warning or fault, and annunciation of both via the bypass keypad and over serial communications.

Also, the temperature control contractor or end user no longer needs to source and install expensive, PWM waveform compatible, current-sensing relays for proof-of flow. This hardware often was installed in the motor control center feeding the VFD / bypass and took up valuable real estate. These special current sensing relays often are less than robust in design and require an additional monitoring point on the BAS system.

With the ABB E-Clipse Bypass, all of the above expense and wasted real estate is avoided. In addition, the bypass is one node (address) on the BAS system with proof-of-flow indication as one of the 45 + objects included in the one bypass node.

As Simple as 1-2-3

Using the broken-belt feature on the ABB E-Clipse Bypass is a very simple process. First, select the type of response you would like the system to have under a loss-of-load condition. Next, program the percent of motor full load trigger level for proof-of-flow. Finally, determine whether you wish this information to simply display on the bypass keypad, or also to be annunciated over serial communications and / or via relay output.

The user can choose a common output for a system broken-belt indication, or broken-belt indication in drive mode with a separate indicator for broken-belt in the bypass mode. Other system (drive or bypass) level indicators are available such as system running, system overload, and system fault.

Return to Brochure

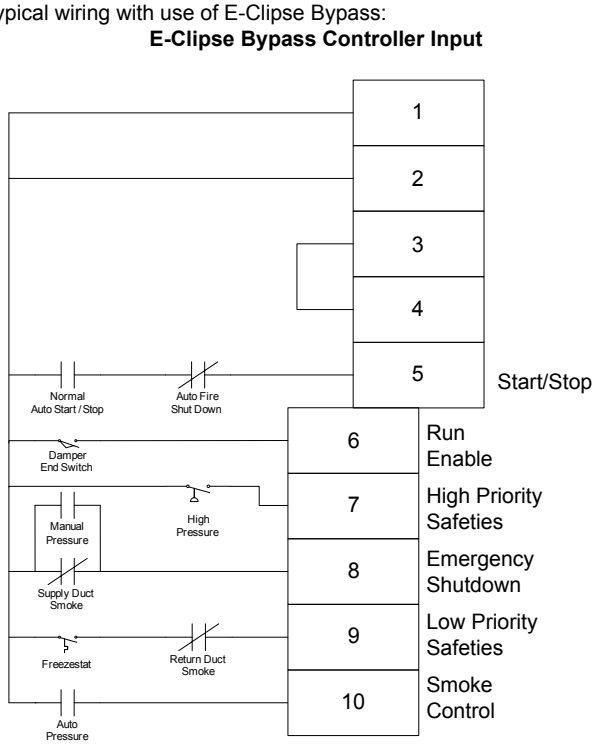
Smoke Control

Smoke Control operation for supply fans and return fans requires the system to ignore some external inputs, while acknowledging other system inputs. For example, for proper operation, a return/exhaust fan should ignore a return duct smoke detector input but should acknowledge a supply fan smoke detector input. The ABB E-Clipse Bypass is designed to meet the intent of the UL864/UUKL specifications.

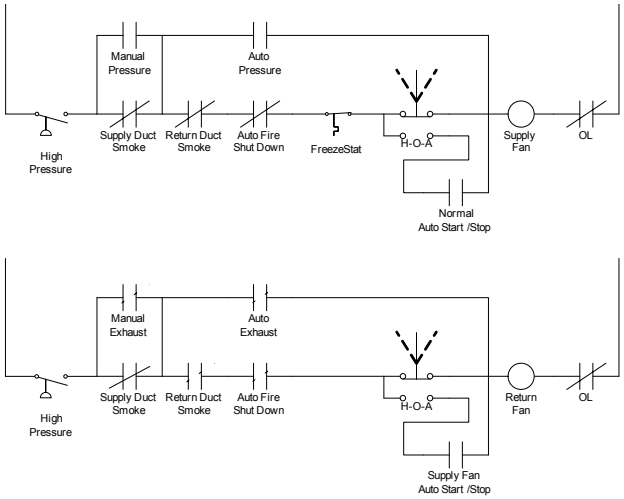
The Smoke Control override input in the ABB E-Clipse Bypass is always wired into Digital Input 6 on the bypass. The Smoke Control override always functions as shown on the wiring diagram below.

Typical Wiring Diagrams Showing a Conventional VFD/Bypass Wiring and Use of the E-Clipse Bypass

Typical wiring with use of E-Clipse Bypass:



Typical starter wiring for a UUKL listed System Today:



Notes:

- Pressure cutouts, duct smoke detectors and auto shutdown are 2-pole.
- Manual control also activates “auto control” relays.

Normal Operation:

- Close Start/Stop (DI-5)
- Fan starts assuming that DI-6, 7, 8, and 9 are all closed

Emergency Shutdown:

- Open fire shutdown, unit stops

Smoke Control Mode:

- Close contact on DI-10
- Fan starts regardless of position of internal HOA switch and inputs DI-5 and DI-9
- Inputs DI-6, 7 and 8 followed
- Internal overloads followed

The ABB E-Clipse Bypass also includes a second, programmable, override input. Override 2 is completely user programmable to allow the system integrator to configure the unit to acknowledge some digital inputs, all digital inputs, ignore digital inputs, or any combination of the above. This programmability allows the smoke control system integrator to program the ABB E-Clipse Bypass to react in whatever manner the local Authority Having Jurisdiction (AHJ) requests. Override 2 may be programmed to run until destruction or to acknowledge high-priority safeties and not acknowledge other, lower priority safeties.

The user may also force the unit into Override 2 mode via serial communications, while Smoke Control override only responds to an input on Digital Input 6.

Both Override modes are clearly annunciated on the bypass keypad, as well as acknowledged over serial communications. Both Override modes ignore any user input from either the VFD keypad or the bypass keypad. Both Override modes also respond to manual inputs from the Fireman’s Smoke Control Panel (FSCP). Finally, both Override modes are designed so that, when the override input is removed, the system returns to its previous operating state.

Return to Brochure

Stand-Alone Operation

The ABB E-Clipse Bypass allows for stand-alone operation of your system in several modes. First, most connections to the outside world are made into the bypass section of the system. These connections include start / stop command, safety interlocks, run permissive and serial communications. Therefore, removal of the VFD for service or replacement does not hinder the operation of your fan or pump system.

Even with the VFD removed, the same start / stop contact that was starting the system in drive mode can now start the system in bypass mode. In addition, because the ABB E-Clipse Bypass keypad has Hand and Off functions, local control of the system in bypass mode is as easy as the push of a button.

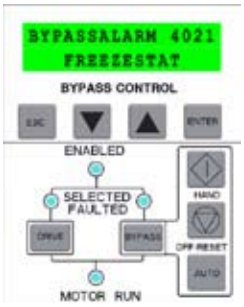
The bypass serial communications connection allows the user to monitor all of the bypass digital inputs and monitor and control all of the bypass digital (relay) outputs in a stand-alone mode.

If the VFD is taken out of service for any reason, the building management system is still communicating with the bypass controller system. Therefore, transfer to bypass no longer means loosing control! In the past, if the VFD power was removed, the application would show as a failed point on the serial communications network. With the ABB E-Clipse Bypass, the drive can be removed and sent back to the factory for service (for example) with no loss of communications to the building management system.

The user can also monitor motor volts, amps, kilowatt hours and much more information - even in the bypass mode. In all, over 45 points of bypass information is transmitted between the bypass controller and building management system. Bypass relay outputs can be controlled via the serial link to accomplish such tasks as starting exhaust fans, or opening interlock dampers. Finally, the bypass also includes a supervisory controller which allows one to maintain on/off control of your cooling tower or pump application - even with the VFD in a faulted state.

Return to Brochure

Advanced Plain-English Bypass Keypad



The new ABB E-Clipse Bypass keypad takes the typical operator interface to a new level. The ABB E-Clipse Bypass series keypads use full language, not cryptic codes. Using the intuitive interface, you can custom configure your bypass for a variety of applications and functions. This new keypad has pioneered several new-to-the-market features such as individual safety annunciation and the capability of allowing the user to choose the English to be displayed on the keypad. For example, the user can choose between eight different English phrases to display if a safety contact input to the bypass opens. The keypad can be programmed to display “FireStat”, “FreezeStat”, “Vibration Trip”, and five other choices. The user may also select from three pre-programmed English displays for the run-permissive proof. For example, the user can have the display read “Damper End Switch” if the run-permissive is not made.

This keypad also provides superior system diagnostics. If the bypass were to trip off line for any reason, the fault is displayed in plain English, telling the user what has occurred. In addition, the fault is time stamped to allow the user to coordinate the fault diagnostics with external history logs. Finally, the keypad also contains an event log which may be useful in developing causal connections between any faults and user/operator events.

Carried over from the current E-bypass operator panel design are the status LED indicators and the one-line power flow diagram. These features provide visual indication of the system status and operating mode. For example, if a safety is open, the enabled LED will display red in color and can easily be seen from across the room, annunciating the condition.

The new ABB E-Clipse Bypass has added a two-line, 16 character LCD display to the keypad LEDs and selectors. The keypad allows sophisticated yet simple user interface for programming advanced functionality such as serial communications, supervisory control, or individual safety annunciation into the system.

The ABB E-Clipse Bypass comes out of the box ready to run. The user does not need to use the advanced keypad functions if they do not require advanced operation. A standard VFD start-up is all that needs to be accomplished. The bypass controller reads the motor full load amp settings entered into the VFD during start up and uses those settings to set the UL-listed motor overload protection in the E-Clipse Bypass. Therefore, sophisticated, yet simple control is available at your fingertips.

Return to Brochure

Individual Safety Annunciation

The ABB E-Clipse Bypass allows for individual naming of safety inputs into the system. The user may choose from a predefined list of eight different safety names for display on the keypad. With programming by the BAS system vendor, the same names may be displayed on the BAS system master controller. For example, one digital input may be assigned the name FireStat. Another digital input may be programmed to display FreezeStat.

The list of programmable, predetermined annunciations for safety inputs is as follows:

- FireStat
- FreezeStat
- Smoke Alarm
- Vibration Trip
- Over Pressure
- Low Suction
- Vibration Switch
- Safety Open
- Factory default = Start Enable 1; Start Enable 2; Start Enable 3; or Start Enable 4

In addition, the run-permissive receipt proof has a predefined list of available names. The user may choose from the following list of annunciations to be displayed on the keypad for the Run Enable input:

- Damper End Switch
- Pre – Lube Cycle
- Valve Open
- Factory default = Run Enable

From the above, one can see that the ABB E-Clipse Bypass and its on-board microprocessor allow for previously unheard of diagnostics and information display. In addition to the above-listed keypad displays, the ABB E-Clipse Bypass will display all system warnings and system faults. The system also includes event and fault time-stamping information that will allow the end user to determine exactly when a fault condition occurred and if the fault condition was precipitated by a user input (event).

Return to Brochure

VSD Calculation

Inputs

Nominal HP	100	
Load	0.85	*at full flow
BHP	85	
Number	1	
Efficiency	94	
Hours	8760	
Measured kW	74.6	*at full flow

Retrofit: Fan with Inlet Guide Vanes to VSD

Calculated Fields

Electric HP	90.42553
FL kW	74.6
kWh Savings	197,984

Existing Curve	7
Proposed Curve	10

	Exisitng					Proposed				
% Flow	% Hours	%Power	kW	kWh	% Speed	% Hours	%Power	kW	kWh	Savings
20		47%			20		5%			
25		51%			25		6%			
30		55%			30		8%			
35		57%			35		11%			
40		58%			40		14%			
45		59%			45		17%			
50		60%			50	16	21%	15.666	21,957	
55		61%			55		26%			
60		63%			60	18	32%	23.872	37,641	
65		66%			65		38%			
70	32	69%	51.330	143,889	70	21	44%	32.824	60,383	83,506
75		72%			75		50%			
80	28	75%	56.121	137,654	80	24	57%	42.522	89,398	48,256
85		79%			85		64%			
90	26	85%	63.650	144,968	90	16	73%	54.458	76,328	68,640
95		92%			95		86%			
100	14	100%	74.600	91,489	100	5	105%	78.330	34,309	57,181
			Total kWh	518,000				Total kWh	320,017	197,984

		Baseline	Proposed
1	Direct Drive to VSD	2	9
2	Pos Disp Pump to VSD	3	9
3	Centrifugal Pump to VSD	4	8
4	Centrifugal Pump with Bypass to VSD	5	8
5	Fan with Bypass to VSD	5	10
6	Fan with Outlet Dampers to VSD	6	10
7	Fan with Inlet Guide Vanes to VSD	7	10

ID	Strategy	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100
1	2	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
2	3	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
3	4	0	0	0	0.632112	0.648488	0.665742	0.683876	0.71	0.72	0.74	0.76	0.79	0.81	0.83	0.86	0.89	0.93	0.94	0.96	1
4	5	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
5	6	0	0	0	0.576577	0.612613	0.648649	0.684685	0.720721	0.756757	0.783784	0.81982	0.846847	0.864865	0.891892	0.918919	0.936937	0.954955	0.963964	0.981982	1
6	7	0	0	0	0.46789	0.513761	0.550459	0.568807	0.577982	0.587156	0.59633	0.605505	0.633028	0.66055	0.688073	0.715596	0.752294	0.788991	0.853211	0.917431	1
7	8	0	0	0	0.05	0.06	0.08	0.11	0.14	0.17	0.21	0.25	0.3	0.35	0.41	0.48	0.57	0.66	0.78	0.9	1.05
8	9	0	0	0	0.21	0.26	0.31	0.36	0.41	0.46	0.51	0.56	0.61	0.66	0.71	0.76	0.82	0.87	0.93	0.98	1.05
9	10	0	0	0	0.05	0.06	0.08	0.11	0.14	0.17	0.21	0.26	0.32	0.38	0.44	0.5	0.57	0.64	0.73	0.86	1.05