Ohio | Public Utilities Commission

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

Case No.: ____-____-EL-EEC

Mercantile Customer: **Cincinnati Bell Telephone**

Electric Utility: **Duke Energy**

Program Title or Description: **Cooling Heat Exchanger and VFD's**

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: **Cincinnati Bell Telephone**

Principal address: **209 West 7th Street, Cincinnati, Ohio 45202**

Address of facility for which this energy efficiency program applies:

209 - 229 West 7th Street, Cincinnati, Ohio 45202

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. (See - Appendix A)**
- □ 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 January 2008 and was finished March 2011.

(2) 1000 Ton Free Cooling Heat Exchangers Added – March 2011
(1) VFD added to Cooling Water Pump 1 Motor – December 2008
(1) VFD added to Cooling Water Pump 4 Motor – December 2008
(3) Package of VFDs added to Domestic Water Pump– December 2088
(2) VFD's added to Cooling Tower 1 Fan Motor – December 2008
(2) VFD's added to Cooling Tower 2 Fan Motor – December 2008

This project involved a major renovation of an existing facility. As a result, the project takes on characteristics of both retrofit and new construction. Particularly, VFDs were added to new equipment that replaced existing, like equipment that was not driven by VFD. These measures are compared to the as-found condition which did not include VFDs, but a future replacement date is not known. The free cooling heat exchangers were an addition to the facility made solely for energy efficiency with no applicable future replacement date

□ 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: **3,671,231 kWh savings**
(**Refer to Appendix B for calculations and supporting documents).**

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 equipment was installed starting January 2008 and was finished March 2011.

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

6 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 **$66,150. Refer to Appendix C** (Rebate shall not exceed 50% project cost. Attach documentation showing the methodology used to determine the cash rebate value and calculations showing how this payment amount was determined.)

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: 19.06 (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 **$2,298,689**

The utility's program costs were **$54,451.22**

The utility's incentive costs/rebate costs were **$66,150**.

Refer to Appendix D for calculations

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 Rebate 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 CORPORATION
Mercantile Self Direct Program
139 East Fourth Street
Cincinnati, OH 45202

513 629 5572 fax

February 3, 2012

Mr. Kevin Daniel
Cincinnati Bell Telephone
229 West 7th Street
Cincinnati, Oh 45202

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

Dear Mr. Daniel:

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 $8750.00 has been proposed for your condenser water pump and cooling tower VFD projects completed in the 2008 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 Harp, Duke Energy
Rob Jung, WECC

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

☒ Rebate is accepted. ☐ Rebate is declined.

By accepting this rebate, Cincinnati Bell Telephone 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, Cincinnati Bell Telephone 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, Cincinnati Bell Telephone 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):

Customer Signature	Printed Name	Date
	Kevin Daniel	3/4/12

Proposed Rebate Amounts

Measure ID	Energy Conservation Measure (ECM)	Proposed Rebate Amount
ECM-1	Condenser Water Pump # 1 (added 1 VFD)	$2375.00
ECM-2	Condenser Water Pump # 4 (added 1 VFD)	$2375.00
ECM-2	Cooling Tower #1 (added 2 VFD's)	$2000.00
ECM-2	Cooling Tower #2 (added 2 VFD's)	$2000.00
Total		$8750.00

Ohio | Public Utilities Commission

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

Case No.: ____-____-EL-EEC

State of Ohio :

Kevin Daniel, Affiant, being duly sworn according to law, deposes and says that:

1. I am the duly authorized representative of:

Cincinnati Bell Telephone
[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 7th day of February, 2012
Month/Year

Signature of official administering oath

Cherie Ashworth
Print Name and Title

My commission expires on 7-31-2015

NOTARY PUBLIC STATE OF OHIO
CHERIE ASHWORTH
Notary Public, State of Ohio
My Commission Expires 07-31-15

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

February 10, 2012

C/O Mr. Kevin Daniel
Cincinnati Bell Telephone
229 West 7th Street
Mail Location 121-1200
Cincinnati, Ohio 45202

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

Dear Mr. Daniel:

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 $400.00 has been proposed for your VFD project completed in the 2008 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 Harp, Duke Energy
Rob Jung, WECC

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

☑ Rebate is accepted. ☐ Rebate is declined.

By accepting this rebate, Cincinnati Bell Telephone 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, Cincinnati Bell Telephone 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, Cincinnati Bell Telephone 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):

Customer Signature	Kevin Daniel Printed Name	2-27-12 Date

Proposed Rebate Amounts

Measure ID	Energy Conservation Measure (ECM)	Proposed Rebate Amount
ECM-1	Domestic Water Pump Package (VFDs added)	$400.00
Total		$400.00

Ohio | Public Utilities Commission

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

Case No.: ____-____-EL-EEC

State of Ohio :

Kevin Daniel, Affiant, being duly sworn according to law, deposes and says that:

1. I am the duly authorized representative of:

Cincinnati Bell Telephone

[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.

Operations Manager
Signature of Affiant & Title

Sworn and subscribed before me this 9th day of February, 2015
Month/Year

Signature of official administering oath

Cherie Ashworth
Print Name and Title

My commission expires on July 31, 2015

NOTARY PUBLIC STATE OF OHIO

CHERIE ASHWORTH
Notary Public, State of Ohio
My Commission Expires 07-31-15

DUKE ENERGY CORPORATION
Mercantile Self Direct Program
139 East Fourth Street
Cincinnati, OH 45202

513 629 5572 fax

Janauary 27, 2012

C/O Mr. Kevin Daniel
Cincinnati Bell Telephone
229 West 7th Street
Mail Location 121-1200
Cincinnati, Ohio 45202

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

Dear Mr. Daniel:

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 $57,000 has been proposed for your plate and frame heat exchanger project completed in the 2011 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 Harp, Duke Energy
Rob Jung, WECC
Jerry Lindsay, Peck, Hannaford, Briggs

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

☒ Rebate is accepted. ☐ Rebate is declined.

By accepting this rebate, Cincinnati Bell Telephone 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, Cincinnati Bell Telephone 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, Cincinnati Bell Telephone 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):

Customer Signature	Kevin Daniel	1-27-12
	Printed Name	Date

Proposed Rebate Amounts

Measure ID	Energy Conservation Measure (ECM)	Proposed Rebate Amount
ECM-1	Installed 1000 Ton –Plate and Frame Heat Exchangers (Qty – 2)	$57,000
Total		$57,000

Ohio | Public Utilities Commission

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

Case No.: ____-____-EL-EEC

State of Ohio :

Kevin Daniel, Affiant, being duly sworn according to law, deposes and says that:

1. I am the duly authorized representative of:

Cincinnati Bell Telephone
[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 7th day of February 2012
Month/Year

Signature of official administering oath

Cherie Ashworth
Print Name and Title

My commission expires on July 31, 2015

NOTARY PUBLIC STATE OF OHIO

CHERIE ASHWORTH
Notary Public, State of Ohio
My Commission Expires 07-31-15

Appendix 1

34800674 01		
CINTI BELL TEL CO		
209 7TH W		
CINCINNATI, OH 45202		
Date	Days	Actual KWH
9/22/2011	30	6,383,118
8/23/2011	29	6,399,714
7/25/2011	32	7,008,074
6/23/2011	30	6,495,600
5/24/2011	29	6,052,707
4/25/2011	32	6,615,081
3/24/2011	29	5,972,643
2/23/2011	29	5,865,793
1/25/2011	34	6,843,733
12/22/2010	33	6,628,584
11/19/2010	29	5,878,295
10/21/2010	29	5,970,012
Total		**76,113,354**

See Appendix B At The End

Appendix C -Cash Rebate Calculation

Heat Exchanger and VFD's

Measure	Quantity	Cash Rebate Rate	Rebate	Cash Rebate
Free Cooling HX Package	1	50% of incentive that would be offered by the Smart $aver Custom program	$57,000	**$57,000**
Cooling Tower #1 VFD's	2	50% of incentive that would be offered by the Smart $aver Custom program	$1,000	**$2,000**
Cooling Tower #2 VFD's	2	50% of incentive that would be offered by the Smart $aver Custom program	$1,000	**$2,000**
Condenser Water Pump 1 VFD	1	50% of incentive that would be offered by the Smart $aver Custom program	$2,375	**$2,375**
Condenser Water Pump 4 VFD	1	50% of incentive that would be offered by the Smart $aver Custom program	$2,375	**$2,375**
Domestic Water Pump Package	1	50% of incentive that would be offered by the Smart $aver Custom program	$400	**$400**
			Total	**$66,150**

Appendix D -UCT Value

Heat Exchanger and VFD's

Measure	Total Avoided Cost	Program Cost	Incentive	Quantity	Measure UCT
Free Cooling HX Package	$2,131,766	$49,216	$57,000	1	**20.07**
Cooling Tower #1 VFD's	$12,447	$623	$1,000	2	**7.67**
Cooling Tower #2 VFD's	$13,328	$615	$1,000	2	**8.25**
Condenser Water Pump 1 VFD	$50,668	$1,693	$2,375	1	**12.46**
Condenser Water Pump 4 VFD	$60,577	$831	$2,375	1	**18.89**
Domestic Water Pump Package	$4,127	$235	$400	1	**6.50**
Totals	$2,298,689	$54,451	$66,150	8	

Total Avoided Supply Costs	$2,298,689	***Aggregate Application UCT***	***19.06***
Total Program Costs	$54,451.22		
Total Incentive	$66,150		

Appendix B – Energy Savings Achieved

	Pre-Project (at the meter)			Post-Project (at the meter)			Savings (at the meter)	
ECM	**As-Found Equipment**	**Total Annual kWh[1]**	**Summer Coincident kW[1]**	**New Equipment**	**Total Annual kWh[1]**	**Summer Coincident kW[2]**	**Energy Savings (kWh)**	**Demand Savings (kW)[2]**
ECM1[3]	(4) 1200 Ton Water Cooled Chillers	3,112,704	N/A	(2) 1000 Ton Free Cooling HEX Added	0	N/A	3,112,704	0
ECM2[4]	125HP Condenser Cooling Water Pump 1 Motor	415,418	94.1	VFD Added	329,911	86.4	85,207	7.7
ECM3[4]	125HP Condenser Cooling Water Pump 4 Motor	408,645	N/A	VFD Added	294,750	N/A	113,895	0
ECM4[4]	3 x 15HP Domestic Water Pump Package	103,216	11.8	VFDs Added	94,968	12.0	8,248	(0.2)
ECM5[4]	60HP Cooling Tower 1 Fan Motor	203,902	46.2	VFD Added	178,941	47.1	24,961	(0.9)
ECM6[4]	60HP Cooling Tower 2 Fan Motor	200,578	N/A	VFD Added	176,661	N/A	23,917	0

Notes:

1. Energy consumption baseline, demand baseline and post-project energy consumption basis are outlined in the following pages.
2. Demand savings are returned by DSMore software as a result of energy savings allocations at the coincident hour. Post-project demand is calculated as the difference between pre-project modeled demand and the DSMore software result. An exception occurs where it was identified that the addition of the VFD introduces the possibility of a demand increase at the coincident hour. In these cases, the expected demand increase is applied.
3. Baseline values for ECM1 are shown as the portion of energy offset by the free cooling heat exchangers. Because of the simplicity of modeling the savings of the heat exchangers, which have capacity that is maximized when in operation, the total energy use for the (4) chillers around the year is not modeled.
4. Baseline and energy savings calculation basis for these VFDs were obtained from facility building management system speed data and are a reflection of actual operation. As such, the savings between two similar pieces of equipment may vary based on actual equipment cycling in the facility. Some equipment is not used during coincident months. Actual building management system data is not included due to file size but is available upon request.

ECM	Quantity	Total Annual Energy Savings (kWh)	Total Demand Savings (kW)
ECM1	1	3,112,704	0
ECM2	1	85,207	7.7
ECM3	1	113,895	0
ECM4	1	8,248	(0.2)
ECM5	2	49,922	(1.8)
ECM6	2	47,834	0
Total		3,417,810	5.7

Application of 7.43% line losses yields **3,671,231 kWh** savings and **6 coincident kW** savings at the plant. This value also reflects minor rounding error resulting from the analytical mode of DSMore software used to model the projects.

Duke Energy Mercantile Self Direct Incentives – CUSTOM

Plate and Frame Exchangers

Model No. VXN-93-SS-FS-1-500

Cincinnati Bell purchased **two, 1000 ton**, plate & frame heat exchangers from Peck, Hannaford, Briggs (PHB), in 2008.

PHB installed the heat exchangers along with associated pipes, valves, etc

Glenwood Electric performed the electric piece of the project.

Installation began 2008 and heat exchangers were commissioned in 2011, after 2010 winter.

Total costs of $725,000.00 is detailed on included letter to Mike Harp from Kevin Daniel.

Energy numbers were calculated as follows:

- Two centrifugal chillers operate at .579 KW/ton.
- Two (2) heat exchangers replace both chillers at full load during [approx] 16 wks of winter @ 1000 tons each = 1158 KW
- 16 weeks (112 days) @ 24 hours a day operation = 2688 hrs.
- 2688 hrs x 1158 KW = 3,112,704 KWh reduction
- 3,112,704 x $.10 = $311,270 savings

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 1-513-419-5572.

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 an/or billing history for other utilities as required):

Account Number	Annual Usage	Account Number	Annual Usage
3480-0674-01	76,828,077		

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 ☐
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 ☐
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 513-419-5572

Mercantile Self Direct
Nonresidential Custom Rebate Application
PART 1

Duke Energy®

1. Contact Information (Required)

Duke Energy Customer Contact Information						
Company Name	Cincinnati Bell Telephone (CBT)					
Address	209 West 7th Street, Mail Location 121-1200					
Project Contact	Kevin Daniel, Building Operations Manager, Real Estate Dept.					
City	Cincinnati	State	OH	Zip Code	45202	
Title	Building Manager					
Office Phone	513-397-5412	Mobile Phone	513-604-6959	Fax	513-397-0847	
E-mail Address	kevin.daniel@cinbell.com					

Equipment Vendor / Contractor / Architect / Engineer Contact Information					
Company Name	Peck, Hannaford, Briggs (hvac installation); Pedco (engineering); Glenwood Electric (switchgear installation); Hunt Bldrs (project management)				
Address	209 West 7th Street				
City	Cincinnati	State	OH	Zip Code	45202
Project Contact	Kevin Daniel				
Title	Building Operations Manager				

Mercantile Self Direct
Nonresidential Custom Rebate Application
PART 1

Office Phone	513-397-5412	Mobile Phone	513-604-6959	Fax	513-397-0847
E-mail Address	kevin.daniel@cinbell.com				
Describe Role	Responsible to oversee all facility capital improvements and maintenance				

Payment Information					
Payee Legal Company Name (as shown on Federal income tax return):	Cincinnati Bell Telephone				
Mailing Address	209 West 7th Street				
City	Cincinnati	State	OH	Zip Code	45202
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:	20-2003820				
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____/___/_____ (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.

Two 1000 ton plate and frame heat exchanger were provided and installed by PHB along with related pipe, valves, controls, insulation. Model no. VXN-93-SS-FS-1-500.

C. When did you start and complete implementation?

Start date 7/2008 (mm/yyyy) End date 3/2011 (mm/yyyy)

D. Are you also applying for Self-Direct Prescriptive incentives and, if so, which one(s)[1]?

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)

[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.

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.

see attached documentation

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) Kevin Daniel, 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).

X _____ As Agent for Cincinnati Bell Telephone
Duke Energy Ohio, Inc Customer Signature

Print Name Kevin Daniel

Date 11-7-11

Mercantile Self Direct
Nonresidential Custom Rebate Application
PART 1

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.

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:

- Submitting this application does not guarantee an incentive will be approved.
- Incentive already decided to proceed.
- Electric demand and/or energy reductions must be well documented with auditable calculations.

- Incomplete applications will not be reviewed; all fields are required.

Refer to the complete list of Instructions and Disclaimers, found in the Mercantile Self Direct 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	Kevin Daniel, Building Manager, Real Estate Dept.
Company	Cincinnati Bell Telephone

Equipment Vendor / Project Engineer Contact Information

Name	Jerry Lindsay, Manager
Company	Peck, Hannaford, Briggs

Before proceeding with the custom application, please verify that your project is not on the Self-Direct Prescriptive application.
The prescriptive incentive applications can be found at:
http://www.duke-energy.com/ohio-large-business/smart-saver/mercantile-self-direct.asp
Prescriptive rebate amounts are pre-approved.

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	Conditioned Square Footage	Facility Age (years)
225	*12345678 01*	*Example: 123 Main Street, Anywhere USA 12345*	*Project Name(s)*	*5,840*	*42,000*	*38,000*	*12*
	3480-0674-01	*209 West 7th Street, Cincinnati, OH 45202*	*Install Plate & Frame HX Ex as part of Chilled Water plant upgrade project serving both 209, 229 W7th St buildings.*	*8,760*	*387,701*	*336,481*	*81*
		229 West 7th Street, Cincinnati, OH 45202	*same*	*same*	*412,536*	*378,366*	*37*

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

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

App No.	0
Rev.	0

Project Name: Chilled Water System Upgrade - Plate & Frame Heat Exchangers

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

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

Brief Project Description

Describe the Baseline (see note 3) Equipment/System	Describe the Proposed High Efficiency Project
Existing Chiller plant is supported by four (4) 1200 ton centrifugal chillers.	Installed two (2) 1000 ton Plate and Frame Heat Exchangers to reduce the centrifugal chiller load during the cooler/colder periods of the year (winter).

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

Detailed Project Description Attached? Yes (Required)

Operating Hours (see note 4)

	Weekday		Saturday		Sunday		Weeks of Use in Year	Total Annual
24 x 7	Start Hour	End Hour	Start Hour	End Hour	Start Hour	End Hour	(see note 5)	Hours of Use
Yes							*12 wks*	*2,016*

Energy Savings

	Baseline (see Note 3)	Proposed	Savings	Describe how energy numbers were calculated
Annual Electric Energy	3,112,704 kWh	0 kWh	3,112,704 kWh	See attached for details. Two centrifugal chillers operate at .579 KW/ton. Two (2) heat exchangers replace both chillers at full load during 16 wks of winter @ 1000 tons each = 1158 KW @ 24 hours a day operation = 2688 hrs. x 1158 KW = 3,112,704 KWh reduction. 3,112,704 KWh x $.10 = $311,270 savings
Electric Demand	1,158 kW	0 kW	1,158 kW	
Calculations attached	Yes	Yes	(Required)	

Simple Payback

Average electric rate ($/kWh) on the applicable accounts (see note 6)			$0.10
Estimated annual electric savings			$311,270
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)			$725,000.00
Copy of vendor proposal is attached (see note 8)			Yes
Simple Electric Payback in years (see note 9)	2.329164611	Total Payback in years	2.329164611

3 Baseline
Retrofit projects: the existing equipment is the baseline.
New construction projects: 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: Two HX are used for approx 2688 hrs in the winter months to take the load off two chillers.

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 invoice is attached
Vendor invoices detailing costs of the project are 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, the rebate structure is affected. Double check average electric rate for correct payback.

Plate & Frame

Viexplate®
Gasketed PHE
Data Sheet

Customer: PPE Premium Process Equipment
Location: DE
Customer Ref:

Quote: V07-25811G
Item No.: Option #3

	TOTAL PERFORMANCE	UNIT	Hot Side	Cold Side
1	Fluid Circulated		Water	Water
2	Flow Rate Total	lb/hr / US GPM	1,201,144 / 2,400	2,001,910 / 4,000
3	Vapor Flow Rate (In/Out)			
4	Evaporation Temperature			
5	Superheat/Subcooling			
6	Specific Gravity (Ave)		0.9995	0.9995
7	Specific Heat Capacity (Ave)	Btu/lbm, F	1.0009	1.0009
8	Thermal Conductivity (Ave)	Btu/ft, h, F	0.3388	0.3357
9	Dynamic Viscosity (Ave)	cp	1.32	1.45
10	Temperature (In/Out)	F	54.00 --> 44.00	40.00 --> 46.00
11	Excess Area		1.24%	
12	Total Heat Exchanged	Btu/h	12,021,840	
13	LMTD/Correction	F	5.7708 / 0.9998	
14				
15				
16				
	DEFINITION OF ONE HEAT EXCHANGER			
17	Heat Transfer Rate	Btu/hr, ft2, F	436	
18	Area Calculated/Provided	ft2	4775.8 / 4835.	
19	Number of Plates		485 plates	
20	Model		VXN-93-SS-FS-1-500	
21	Number of Passes/Channels		1	1
22	Inter-plate Velocity	ft/s	0.96	1.60
23	Pressure Drop	PSI	2.61	6.99
24	Design Pressure/Test Pressure	PSIG	150 / 195	150 / 195
25	Design Temperature	F	250	250
26	Connection Size In/Out		10.0"-150# ANSI STUDDED	10.0"-150# ANSI STUDDED
27	Fluid Volume Inside	gal	167.88	167.88
28	Nozzles Material		Mild Steel	Mild Steel
29	Connection Location In/Out		F1 / F4	F3 / F2
30	Plate Material		SS304	
31	Gasket Material		Nitrile	
32	Frame Material		CS-EPOXY-PAINTED	
33	Weight Dry/Flooded	lb	9415 / 12217	
34	Plate Pack Dim (Min/Max)	mm	1698 / 1795	

Remarks: Plate pack: 485 CLP plates.

4852VMRW

Your Right Choice in Heat Exchangers!

Viexcoil®, Viexbank®, Viexplate®, Viexshell®, Viexbox®, Viexbloc®, Viexspiral®

By: Garry McIntosh
Rev:
Date: 5/10/07

ViEX heat exchanger performance accuracy is dependent on accuracy of customer data and conformance to specified operating conditions.

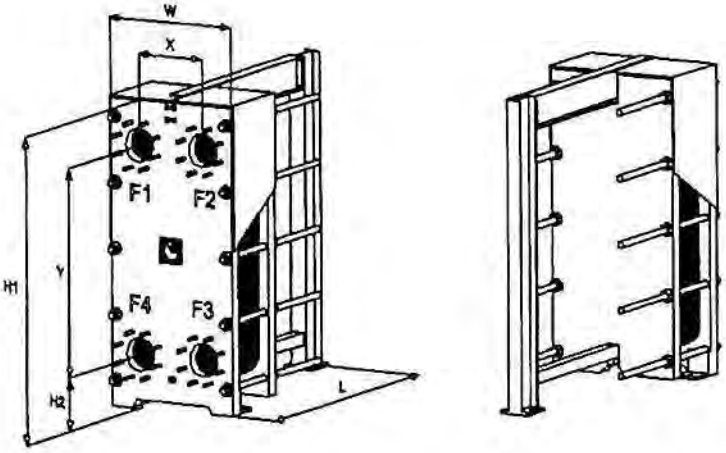
Plate + Frame HX

Viexplate®

Gasketed PHE
Quotation Drawing

Model: VXN-93-SS-FS-1-500

Customer:	PPE Premium Process Equipment	Quote:	V07-25811G
Location:	DE	Rev:	
Customer Ref:		Page:	8 of 8
Item No.:	Option #3	Date:	5/10/07



This is a representative drawing for quotation purpose only.
Specified dimensions are not to be used for construction purposes.

Dimensions:		**Design Parameters:**	
H1:	76.5" / 1944 mm	No. of Plates:	485
H2:	13.0" / 330 mm	Plate Material:	SS304
Y:	50.8" / 1290 mm	Gasket Material:	Nitrile
L (Max):	152.3" / 3867 mm	Design Pressure:	150 psig / 1034 kPag
W:	37.0" / 940 mm	Design Temp.:	250 °F / 121 °C
X:	18.3" / 465 mm	Min Design Temp.:	32.0 °F / 0.0 °C
Connections:		**Weight**	
Hot Side:	F1 / F4 - 10.0" - Mild Steel - 150# ANSI STUDDED	Dry Weight:	9415 lbs / 4271 kg
Cold Side:	F3 / F2 - 10.0" - Mild Steel - 150# ANSI STUDDED	Number of Units:	1

ViEX heat exchangers are designed & manufactured in accordance with ASME Code Section VIII, DIV. I

Your Right Choice in Heat Exchangers!

PECK, HANNAFORD & BRIGGS
SERVICE CORPORATION
4673 SPRING GROVE AVENUE
CINCINNATI, OH 45232
(513) 681-1200

11/13/2007
09/12/2011 12:47
PURCHASE ORDER 095914

SERVICE BILL

TO:
VIEX INC.
1201 NICHOLSON ROAD
NEWMARKET, ONTARIO
CANADA L3Y-9C3

JOB 960
CBT 7TH ST. DEMO CHILLER
PECK, HANNAFORD & BRIGGS
4673 SPRING GROVE AVE.
CINCINNATI, OH 45232

JERRY LINDSAY NET 30 DAYS 10/29/2007

1.000	1310 (2) P&F HEAT X PLUS FREIGHT 00	1-001-00001-M1	EA	99000.000	99000.00
1.000	1310 P&F HEAT X - 10% W/ GA DRAWING	1-001-00001-M1	EA	11000.000	11000.00
.000	1310 FREIGHT	1-001-00001-M1	EA	1092.000	1092.00

11000.00
.00
11000.00

YORK
A JOHNSON CONTROLS COMPANY

YK MAXE CHILLER
PERFORMANCE SPECIFICATION

Unit Tag	Qty	Model No.	Capacity (tons)	Power	Refrigerant
CH-3, CH-4	2	YKMQM4K2-CBGS	1200	460/3/60	R-134A

Unit Data	Evaporator	Condenser
EWT (°F):	54.00	85.00
LWT (°F):	44.00	94.25
Flow Rate (gpm):	2880	3600
Pressure Drop (ft):	26.3	15.7
Fluid Type (%):	WATER	WATER
Circuit No. of Passes:	2	2
Fouling Factor (ft² °F hr / Btu):	0.00010	0.00025
Tube No. / Description:	271 - 0.025" Enhanced Copper	266 - 0.025" CSL Enhanced Copper (1")
Design Working Pressure (psig):	150	150
Entering Water Nozzle @ Location:	2	12
Leaving Water Nozzle @ Location:	3	13
Water Box Weight, ea (lbs)(2):	1173	836
Cover Plate Weight , ea (lbs):	1568	792
Return Head Weight (lbs):	509	214
Water Weight (lbs):	3934	3572
Water Volume(gal):	472	429

Performance Data		Electrical Data		Other	
Job KW:	695	Job FLA:	958	Operating Wt. (lbs):	51823
Motor KW:	675	Motor FLA:	946	Per Isolator (lbs):	12956
KW/Ton:	0.579	LRA:	5780	Refrigerant Wt. (lbs):	3385
IPLV (1):	0.357	Inrush Amps:	958	Oil Charge (gal):	20
Gear Code:	TZ	Min Circuit Ampacity (Amps):	1198	Motor Wt. (lbs):	5750
OptiSound Cntrl:	Yes	Max Fuse/Breaker:	2000	Compressor Wt. (lbs):	4600
Shaft HP:	859			Starter Wt. (lbs):	1920
Isolation Valves:	YES			Ship. Wt. - Shells (lbs):	27422
Oil Cooler Type:	Standard			Ship. Wt. - Driveline (lbs):	10750
Condenser Inlet:	Standard				
		Type Starter: VSD w/ IEEE filter			

Notes:

(1) Chiller IPLV value calculated to ARI Standard 550/590 equation.
(2) Not including cover plate on marine water boxes.

Project Name: CINCINNATI BELL '07	Sold To: JOHNSON CONTROLS, INC.	
Location: CINCINNATI, OH	Customer Purchase Order No.: 2372646	
Engineer:	York Contract No.: 07132507	
Contractor:	Date:	Revision Date:

P. O. Box 2301
Cincinnati, OH 45202

November 8, 2011

Mr. Mike Harp
Account Executive, Large Business
Duke Energy
201 E. 4th Street
Cincinnati, OH 45202

RE: Capital Improvements Cost Breakdown

Dear Mike,

Below I have copied a portion of our internal cost tracking document for the 2008 calendar year facility capital improvements. Some of these improvements continued into 2011 such as the Plate & Frame Heat Exchanger. We have not yet utilized the heat exchangers since they were commissioned in 2011 after the 2010 winter season was over.

1 .Commercial Main Replacement	$	275,000.00
2. Domestic Water Pump Replacement Includes VFD's	$	195,000.00
3. Plate and Frame Heat Exchangers	$	225,000.00
4. Engineering Applies to all projects listed.	$	500,000.00
5. Install 2-1200 ton Chillers – Chillers #3 & #4. Includes chilled water pumps & VFD's & condenser water pumps and VFD's	$	1,400,000.00
6. Install Switchboards #1 and #7, Need more Breaker Cubicles	$	2,400,000.00
7. Install 4 New Cooling Towers - Fills out the Tower Capacity includes VFD's	$	1,200,000.00
Total	**$**	**6,195,000.00**

Item 1& 6 above do not apply to the credits, but the balance of the costs do.

Let me know if you require further detail.

Sincerely,

Kevin W. Daniel, SMA as Agent for CBT
Operations Manager

Hunt Builders Corporation
Suite 2310, Atrium Two
221 East Fourth Street
Cincinnati, Ohio 45202-4148
Tel: 513/579-9770
Fax: 513/579-0333

Please process - sh

June 26, 2008

06 26081

Mr. Steve Herman
Director, Business Development
Cincinnati Bell Technology Solutions
4650 Montgomery Road
Fifth Floor
Cincinnati, Ohio 45212-2690

Dear Steve:

Hunt Builders Corporation is progressing with the 2008 Infrastructure project. The total cost for the work completed is $2,000,000, per the attached Application and Certificate for Payment.

Please allow the attached document to serve as our invoice and forward payment to Hunt Builders Corporation. Should you have any questions or concerns regarding this information, please feel free to call.

Sincerely,

R. Marty Jones
Project Manager

Attachment

AFFIDAVIT OF ORIGINAL CONTRACTOR

STATE OF OHIO)
)SS
COUNTY OF HAMILTON)

The undersigned Contractor states that no persons have made a claim for payment for work performed or for labor, materials, machinery or fuel furnished in connection with the 2008 Infrastructure project for Cincinnati Bell Technology Solutions.

Upon receipt of payment for Payment Application #1 in the amount of $2,000,000, Hunt Builders Corporation waives all rights to a mechanics lien on the partial contract amount of $2,000,000 or any other similar lien on the above premises for work performed and/or material furnished to date hereof.

Contractor: Hunt Builders Corporation

Signature:

R. Mary Jones

Title: Project Manager

SWORN to before me and subscribed in my presence this 26th day of June 2008.

Cherie Ashworth
Notary Public State of Ohio
My Commission Expires July 31, 2010

Hunt Builders Corporation, 221 East Fourth Street, Suite 2510, Cincinnati, Ohio 45202
Telephone: 513/579-9770, Fax: 513/579-0333

AIA Type Document
Application and Certification for Payment

TO (OWNER): Cincinnati Bell Tech Solutions
Accounts Payable (345-400)
P.O. Box 2301
Cincinnati, OH 45201

PROJECT: 225W7-CBT-08 Infrastructure>MJ

APPLICATION NO: 1
PERIOD TO: 6/26/2008

DISTRIBUTION TO:
_ OWNER
_ ARCHITECT
_ CONTRACTOR

FROM (CONTRACTOR): Hunt Builders Corporation
221 East Fourth Street
Suite 2310
Cincinnati, OH 45202-4148

VIA (ARCHITECT):

ARCHITECT'S PROJECT NO

CONTRACT FOR: 1573-08 CBT Infrastructure

CONTRACT DATE:

CONTRACTOR'S APPLICATION FOR PAYMENT

Application is made for Payment, as shown below, in connection with the Contract.
Continuation Sheet, AIA Type Document is attached

1. ORIGINAL CONTRACT SUM	$	9,785,000.00
2. Net Change by Change Orders	$	0.00
3. CONTRACT SUM TO DATE (Line 1 + 2)	$	9,785,000.00
4. TOTAL COMPLETED AND STORED TO DATE	$	2,000,000.00
5. RETAINAGE:		
a 0.00 % of Completed Work	$	0.00
b 0.00 % of Stored Material	$	0.00
Total retainage (Line 5a + 5b)	$	0.00
6. TOTAL EARNED LESS RETAINAGE (Line 4 less Line 5 Total)	$	2,000,000.00
7. LESS PREVIOUS CERTIFICATES FOR PAYMENT (Line 6 from prior Certificate)	$	0.00
8. CURRENT PAYMENT DUE	$	2,000,000.00
9. BALANCE TO FINISH, INCLUDING RETAINAGE (Line 3 less Line 6)	$	7,785,000.00

CHANGE ORDER SUMMARY	ADDITIONS	DEDUCTIONS
Total changes approved in previous months by Owner	0.00	0.00
Total approved this Month	0.00	0.00
TOTALS	0.00	0.00
NET CHANGES by Change Order	0.00	

The Undersigned Contractor certifies that to the best of the Contractor's knowledge, information and belief the work covered by this application for Payment has been completed in accordance with the Contract Documents, that all amounts have been paid by Contractor for Work for which previous Certificates for Payment were issued and payments received from the owner, and that current payment shown herein is now due.

CONTRACTOR: Hunt Builders Corporation
221 East Fourth Street Suite 2310
Cincinnati, OH 45202-4148

By: _____ Date: 6/27/08

R. Matty Jones / Project Manager

State of: OH
County of: Hamilton
Subscribed and Sworn to before me this 27th Day of June 2008

Notary Public: _____

My Commission Expires: _____

ARCHITECT'S CERTIFICATE FOR PAYMENT

In Accordance with the Contract Documents, based on on-site observations and the data comprising the above application, the Architect certifies to owner that to the best of the Architect's knowledge, information and belief the Work has progressed as indicated, the quality of the work is in accordance with the Contract Documents, and the Contractor is entitled to payment of the AMOUNT CERTIFIED.

AMOUNT CERTIFIED $ _____

(Attach explanation if amount certified differs from the amount applied for. Initial all figures on this Application and on the Continuation Sheet that are changed to conform to the amount certified.)

ARCHITECT:

By: _____ Date: _____

This Certificate is not negotiable. The AMOUNT CERTIFIED is payable only to the Contractor named herein. Issuance, Payment and acceptance of payment are without prejudice to any rights of the Owner or Contractor under this Contract

AIA Type Document
Application and Certification for Payment

TO (OWNER): Cincinnati Bell Tech Solutions
Accounts Payable (346-400)
P.O. Box 2301
Cincinnati, OH 45201

PROJECT: 229W7-CBT-'08 Infastructure>MJ

APPLICATION NO: 1
PERIOD TO: 6/26/2008

DISTRIBUTION TO:
_ OWNER
_ ARCHITECT
_ CONTRACTOR

FROM (CONTRACTOR): Hunt Builders Corporation
221 East Fourth Stree)
Suite 2310
Cincinnati, OH 45202-4148

VIA (ARCHITECT):

ARCHITECT'S PROJECT NO:

CONTRACT FOR: 1573-08 CBT Infrastructure

CONTRACT DATE:

ITEM	DESCRIPTION	SCHEDULE VALUE	PREVIOUS APPLICATIONS	COMPLETED THIS PERIOD	STORED MATERIAL	COMPLETED STORED	%	BALANCE	RETAINAGE
1	A.H.U. Modifications	1,323,000.00	0.00	1,000,000.00	0.00	1,000,000.00	75.59	323,000.00	0.00
2	New 16" Chilled Water Risers	2,990,000.00	0.00	500,000.00	0.00	500,000.00	16.72	2,490,000.00	0.00
3	Domestic Water Pump Replace	175,000.00	0.00	0.00	0.00	0.00	0.00	175,000.00	0.00
4	Plate and Frame Exchangers	325,000.00	0.00	0.00	0.00	0.00	0.00	325,000.00	0.00
5	Installation of Chillers 3 & 4	2,200,000.00	0.00	500,000.00	0.00	500,000.00	22.22	1,750,000.00	0.00
6	Chiller Auto Diff Sensors,Etc	285,000.00	0.00	0.00	0.00	0.00	0.00	285,000.00	0.00
7	Install New Cooling Towers	889,000.00	0.00	0.00	0.00	0.00	0.00	889,000.00	0.00
8	Install Main Switchbrds 1 & 7	925,000.00	0.00	0.00	0.00	0.00	0.00	925,000.00	0.00
9	ARC Flash Study	80,000.00	0.00	0.00	0.00	0.00	0.00	80,000.00	0.00
10	Hoist Beam Installation	80,000.00	0.00	0.00	0.00	0.00	0.00	80,000.00	0.00
11	Replace Circuit Breaker Mains	463,000.00	0.00	0.00	0.00	0.00	0.00	463,000.00	0.00
	REPORT TOTALS	58,785,000.00	$0.00	$2,000,000.00	$0.00	$2,000,000.00	20.44	$57,785,000.00	$0.00

PECK, HANNAFORD & BRIGGS
SERVICE CORPORATION
4673 SPRING GROVE AVENUE
CINCINNATI, OH 45232
(513) 681-1200

11/13/2007
09/12/2011 12:47
PURCHASE ORDER 095914

SERVICE BILL

TO:
VIEX INC.
1201 NICHOLSON ROAD
NEWMARKET, ONTARIO
CANADA L3Y-9C3

JOB 960
CBT 7TH ST. DEMO CHILLER
PECK, HANNAFORD & BRIGGS
4673 SPRING GROVE AVE.
CINCINNATI, OH 45232

JERRY LINDSAY NET 30 DAYS 10/29/2007

1.000	1310 (2) P&F HEAT X PLUS FREIGHT 00	1-001-00001-M1	EA	99000.000	99000.00
1.000	1310 P&F HEAT X - 10% W/ GA DRAWING	1-001-00001-M1	EA	11000.000	11000.00
.000	1310 FREIGHT	1-001-00001-M1	EA	1092.000	1092.00

11000.00
.00
11000.00

EQUAL OPPORTUNITY EMPLOYER

PECK, HANNAFORD & BRIGGS
SERVICE CORPORATION
4673 SPRING GROVE AVENUE
CINCINNATI, OH 45232
(513) 681-1200

1/31/2007
09/12/2011 12:39
PURCHASE ORDER 089689

SERVICE BILL

TO:
EVAPCO, INC
P.O. BOX 62140
CHICAGO IL 60693-0621

JOB 914
CBT 7TH ST. CHILLER PLANT
PECK, HANNAFORD & BRIGGS
4673 SPRING GROVE AVE.
CINCINNATI, OH 45232

JERRY LINDSAY NET 30 DAYS 1/31/2007
JERRY

2.000	1310 COOLING TOWER PER QUOTED DATED 1/16/07 00	1-001-00001-M1	EA169288.000338576.00

338576.00
.00
338576.00

EQUAL OPPORTUNITY EMPLOYER

ENERGY SAVINGS CALCULATIONS - INPUT DATA

VARIABLE FREQUENCY DRIVE (VFD)

SECTION 1 - GENERAL INFORMATION

Applicant name	Cincinnati Bell Telephone
Facility name	209-229 W 7th St, Cincinnati, OH
ECM	ECM-1: Condenser Water Pump VFDs, Pump #1

App No.	11-467
Rev.	0

Driven Equipment and Motor Information		
Equipment Identification	125 hp pump	
Quantity of Equipment	1	*NOTE: Savings here calculated for Pump #1 which serves the plate & frame HX (winter) and chillers.*
Brake HP (BHP) @ Full Load Operating Condition (see Note 1)	120.30	BHP
Nameplate HP of Driven Equipment Motor	125.0	motor HP

SECTION 2 - BASE CONDITION OPERATION without VFD

All data below is from "Custom-VFD-App Condenser pump1.xls" unless otherwise noted.

% of Full Load bHP of Driven Equipment		BHP of Driven Equipment @ Actual Load (BHP)	Motor output HP as % of Motor Nameplate HP	Motor Efficiency @ Motor Output HP (%)		Motor Electrical Power Draw (kw)	Hours that each motor runs during the year (see Notes 2 & 3)	Hours that each motor runs during the month (see Notes 3 & 4)											Yearly Total (hr)
								Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
100	%	120.3	96%	95.4	%	94.07	4,416	744		744		744		744		720		720		4,416
	%	0.0	0%		%	#DIV/0!														0
Not Running		0.0	0%	NA	%	0.00	4,344	0	672	0	720	0	720	0	744	0	744	0	744	4,344
						Totals	**8,760**	**744**	**672**	**744**	**720**	**744**	**720**	**744**	**744**	**720**	**744**	**720**	**744**	**8,760**

SECTION 3 - PROPOSED OPERATION with VFD

All data below is from "Custom-VFD-App Condenser pump1.xls" unless otherwise noted

Efficiency of VFD	98.0	%

% of Full Load Capacity of Driven Equipment		BHP of Driven Equipment @ Actual Load (BHP)	Motor output HP as % of Motor Nameplate HP	Motor Efficiency @ Motor Output HP (%)		Motor Electrical Power Draw (kw)	Hours that each motor runs during the year (Notes 2 & 3)	Hours that each motor runs during the period (see Notes 3 & 4)											Yearly Total (hr)
								Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
100	%	120.3	96%	95.4	%	94.07	650	300		350										650
90	%	108.3	87%	95.4	%	84.66	585	250		275		20		20		10		10		585
80	%	96.2	77%	95.4	%	75.26	337	150		119		24		24		10		10		337
70	%	84.2	67%	95.4	%	65.85	2,844	44		0		700		700		700		700		2844
60	%	72.2	58%	95.4	%	56.44														0
50	%	60.2	48%	95.4	%	47.04														0
40	%	48.1	38%	95.4	%	37.63														0
30	%	36.1	29%	95.4	%	28.22														0
20	%	24.1	19%	95.4	%	18.81														0
10	%	12.0	10%	95.4	%	9.41														0
Total Running		NA	NA	NA	%	NA	4416	744	0	744	0	744	0	744	0	720	0	720	0	4,416
Not Running		NA	NA	NA	%	NA	4344	0	672	0	720	0	720	0	744	0	744	0	744	4,344
						Totals	**8,760**	**744**	**672**	**744**	**720**	**744**	**720**	**744**	**744**	**720**	**744**	**720**	**744**	**8,760**

ENERGY SAVINGS CALCULATIONS - INPUT DATA

VARIABLE FREQUENCY DRIVE (VFD)

SECTION 1 - GENERAL INFORMATION

Applicant name	Cincinnati Bell Telephone
Facility name	209-229 W 7th St, Cincinnati, OH

App No.	11-467
Rev.	0

NOTES:

1. The "full load" operating condition is the condition at which the driven equipment operates for the base condition (i.e., without the VFD
2. If the % operating loads are the same for each month of the year, fill in Column H only; if the % operating loads vary during the year (e.g., dependin on weather conditions or other season conditions), then leave column H blank and fill in Columns I through
3. Input values are to be entered for **ONE** driven equipment and its motor. The energy savings will be calculated by multiplying the saving per motor by the quantity listed in Section 1
4. If the motor runs continuously during a month, use the following values for the total hours for that month:
   * 744 for Jan, Mar, May, Jul, Aug, Oct, & Dec
   * 672 for Feb
   * 720 for Apr, Jun, Sep, & Nov

   If the motor runs only a percentage of the time, use a value proportional to these values

SECTION 4 - BASE CONDITION DEMAND AND CONSUMPTION

	Energy Demand (kw)												
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Annual**
100%	94.1	0.0	94.1	0.0	94.1	0.0	94.1	0.0	94.1	0.0	94.1	0.0	94.1
Other													0.0
Maximum	**94.1**	**0.0**	**94.1**	**0.0**	**94.1**	**0.0**	**94.1**	**0.0**	**94.1**	**0.0**	**94.1**	**0.0**	**94.1**

	Energy Usage (kw-hr)												
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Annual**
100%	69,989	0	69,989	0	69,989	0	69,989	0	67,731	0	67,731	0	415,418
Other													0
Total	**69,989**	**0**	**69,989**	**0**	**69,989**	**0**	**69,989**	**0**	**67,731**	**0**	**67,731**	**0**	**415,418**

ENERGY SAVINGS CALCULATIONS - INPUT DATA

VARIABLE FREQUENCY DRIVE (VFD)

SECTION 1 - GENERAL INFORMATION

Applicant name	Cincinnati Bell Telephone
Facility name	209-229 W 7th St, Cincinnati, OH

App No.	11-467
Rev.	0

SECTION 5 - PROPOSED DEMAND AND CONSUMPTION

% of Full Load Capacity of Driven Equipment	Energy Demand (kw)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
100%	96.0	0.0	96.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	96.0
90%	86.4	0.0	86.4	0.0	86.4	0.0	86.4	0.0	86.4	0.0	86.4	0.0	86.4
80%	76.8	0.0	76.8	0.0	76.8	0.0	76.8	0.0	76.8	0.0	76.8	0.0	76.8
70%	67.2	0.0	0.0	0.0	67.2	0.0	67.2	0.0	67.2	0.0	67.2	0.0	67.2
60%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
50%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
40%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
30%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
10%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Maximum	**96.0**	**0.0**	**96.0**	**0.0**	**86.4**	**0.0**	**86.4**	**0.0**	**86.4**	**0.0**	**86.4**	**0.0**	**96.0**

% of Full Load Capacity of Driven Equipment	Energy Usage (kw-hr)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
100%	28,797	0	33,597	0	0	0	0	0	0	0	0	0	62,394
90%	21,598	0	23,758	0	1,728	0	1,728	0	864	0	864	0	50,539
80%	11,519	0	9,138	0	1,843	0	1,843	0	768	0	768	0	25,879
70%	2,957	0	0	0	47,036	0	47,036	0	47,036	0	47,036	0	191,099
60%	0	0	0	0	0	0	0	0	0	0	0	0	0
50%	0	0	0	0	0	0	0	0	0	0	0	0	0
40%	0	0	0	0	0	0	0	0	0	0	0	0	0
30%	0	0	0	0	0	0	0	0	0	0	0	0	0
20%	0	0	0	0	0	0	0	0	0	0	0	0	0
10%	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	**64,871**	**0**	**66,493**	**0**	**50,606**	**0**	**50,606**	**0**	**48,667**	**0**	**48,667**	**0**	**329,911**

SECTION 6 - SAVINGS

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Energy Demand (kw)	-1.9	0.0	-1.9	0.0	7.7	0.0	7.7	0.0	7.7	0.0	7.7	0.0	7.7
Energy Use (kw-hr)	5,118	0	3,496	0	19,382	0	19,382	0	19,064	0	19,064	0	85,507

ENERGY SAVINGS CALCULATIONS - INPUT DATA

VARIABLE FREQUENCY DRIVE (VFD)

SECTION 1 - GENERAL INFORMATION

Applicant name	Cincinnati Bell Telephone
Facility name	209-229 W 7th St, Cincinnati, OH
ECM	ECM-1: Condenser Water Pump VFDs, Pump #4

App No.	11-467
Rev.	0

Driven Equipment and Motor Information		
Equipment Identification	125 hp pump	
Quantity of Equipment	1	*NOTE: Savings here calculated for Pump #4 which serves only the chillers.*
Brake HP (BHP) @ Full Load Operating Condition (see Note 1)	120.30	BHP
Nameplate HP of Driven Equipment Motor	125.0	motor HP

SECTION 2 - BASE CONDITION OPERATION without VFD

All data below is from "Custom-VFD-App Condenser pump4.xls" unless otherwise noted.

% of Full Load bHP of Driven Equipment		BHP of Driven Equipment @ Actual Load (BHP)	Motor output HP as % of Motor Nameplate HP	Motor Efficiency @ Motor Output HP (%)		Motor Electrical Power Draw (kw)	Hours that each motor runs during the year (see Notes 2 & 3)	Hours that each motor runs during the month (see Notes 3 & 4)											Yearly Total (hr)
								Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
100	%	120.3	96%	95.4	%	94.07	4,344		672		720		720		744		744		744	4,344
	%	0.0	0%		%	#DIV/0!														0
Not Running		0.0	0%	NA	%	0.00	4,416	744	0	744	0	744	0	744	0	720	0	720	0	4,416
						Totals	**8,760**	**744**	**672**	**744**	**720**	**744**	**720**	**744**	**744**	**720**	**744**	**720**	**744**	**8,760**

SECTION 3 - PROPOSED OPERATION with VFD

All data below is from "Custom-VFD-App Condenser pump4.xls" unless otherwise noted

Efficiency of VFD	98.0	%

% of Full Load Capacity of Driven Equipment		BHP of Driven Equipment @ Actual Load (BHP)	Motor output HP as % of Motor Nameplate HP	Motor Efficiency @ Motor Output HP (%)		Motor Electrical Power Draw (kw)	Hours that each motor runs during the year (Notes 2 & 3)	Hours that each motor runs during the period (see Notes 3 & 4)											Yearly Total (hr)
								Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
100	%	120.3	96%	95.4	%	94.07	0													0
90	%	108.3	87%	95.4	%	84.66	98		14		10		14		20		20		20	98
80	%	96.2	77%	95.4	%	75.26	102		14		10		6		24		24		24	102
70	%	84.2	67%	95.4	%	65.85	4,144		644		700		700		700		700		700	4144
60	%	72.2	58%	95.4	%	56.44														0
50	%	60.2	48%	95.4	%	47.04														0
40	%	48.1	38%	95.4	%	37.63														0
30	%	36.1	29%	95.4	%	28.22														0
20	%	24.1	19%	95.4	%	18.81														0
10	%	12.0	10%	95.4	%	9.41														0
Total Running		NA	NA	NA	%	NA	4344	0	672	0	720	0	720	0	744	0	744	0	744	4,344
Not Running		NA	NA	NA	%	NA	4416	744	0	744	0	744	0	744	0	720	0	720	0	4,416
						Totals	**8,760**	**744**	**672**	**744**	**720**	**744**	**720**	**744**	**744**	**720**	**744**	**720**	**744**	**8,760**

ENERGY SAVINGS CALCULATIONS - INPUT DATA

VARIABLE FREQUENCY DRIVE (VFD)

SECTION 1 - GENERAL INFORMATION

Applicant name	Cincinnati Bell Telephone
Facility name	209-229 W 7th St, Cincinnati, OH

App No.	11-467
Rev.	0

NOTES:

1. The "full load" operating condition is the condition at which the driven equipment operates for the base condition (i.e., without the VFD
2. If the % operating loads are the same for each month of the year, fill in Column H only; if the % operating loads vary during the year (e.g., dependin on weather conditions or other season conditions), then leave column H blank and fill in Columns I through
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4. If the motor runs continuously during a month, use the following values for the total hours for that month:
   * 744 for Jan, Mar, May, Jul, Aug, Oct, & Dec
   * 672 for Feb
   * 720 for Apr, Jun, Sep, & Nov

   If the motor runs only a percentage of the time, use a value proportional to these values

SECTION 4 - BASE CONDITION DEMAND AND CONSUMPTION

	Energy Demand (kw)												
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Annual**
100%	0.0	94.1	0.0	94.1	0.0	94.1	0.0	94.1	0.0	94.1	0.0	94.1	94.1
Other													0.0
Maximum	**0.0**	**94.1**	**0.0**	**94.1**	**0.0**	**94.1**	**0.0**	**94.1**	**0.0**	**94.1**	**0.0**	**94.1**	**94.1**

	Energy Usage (kw-hr)												
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Annual**
100%	0	63,216	0	67,731	0	67,731	0	69,989	0	69,989	0	69,989	408,645
Other													0
Total	**0**	**63,216**	**0**	**67,731**	**0**	**67,731**	**0**	**69,989**	**0**	**69,989**	**0**	**69,989**	**408,645**

ENERGY SAVINGS CALCULATIONS - INPUT DATA

VARIABLE FREQUENCY DRIVE (VFD)

SECTION 1 - GENERAL INFORMATION

Applicant name	Cincinnati Bell Telephone
Facility name	209-229 W 7th St, Cincinnati, OH

App No.	11-467
Rev.	0

SECTION 5 - PROPOSED DEMAND AND CONSUMPTION

	Energy Demand (kw)												
% of Full Load Capacity of Driven Equipment	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Annual**
100%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
90%	0.0	86.4	0.0	86.4	0.0	86.4	0.0	86.4	0.0	86.4	0.0	86.4	86.4
80%	0.0	76.8	0.0	76.8	0.0	76.8	0.0	76.8	0.0	76.8	0.0	76.8	76.8
70%	0.0	67.2	0.0	67.2	0.0	67.2	0.0	67.2	0.0	67.2	0.0	67.2	67.2
60%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
50%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
40%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
30%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
10%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Maximum	**0.0**	**86.4**	**0.0**	**86.4**	**0.0**	**86.4**	**0.0**	**86.4**	**0.0**	**86.4**	**0.0**	**86.4**	**86.4**

	Energy Usage (kw-hr)												
% of Full Load Capacity of Driven Equipment	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Annual**
100%	0	0	0	0	0	0	0	0	0	0	0	0	0
90%	0	1,209	0	864	0	1,209	0	1,728	0	1,728	0	1,728	8,466
80%	0	1,075	0	768	0	461	0	1,843	0	1,843	0	1,843	7,833
70%	0	43,273	0	47,036	0	47,036	0	47,036	0	47,036	0	47,036	278,450
60%	0	0	0	0	0	0	0	0	0	0	0	0	0
50%	0	0	0	0	0	0	0	0	0	0	0	0	0
40%	0	0	0	0	0	0	0	0	0	0	0	0	0
30%	0	0	0	0	0	0	0	0	0	0	0	0	0
20%	0	0	0	0	0	0	0	0	0	0	0	0	0
10%	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	**0**	**45,557**	**0**	**48,667**	**0**	**48,706**	**0**	**50,606**	**0**	**50,606**	**0**	**50,606**	**294,750**

SECTION 6 - SAVINGS

	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Annual**
Energy Demand (kw)	0.0	7.7	0.0	7.7	0.0	7.7	0.0	7.7	0.0	7.7	0.0	7.7	7.7
Energy Use (kw-hr)	0	17,658	0	19,064	0	19,025	0	19,382	0	19,382	0	19,382	113,895

Project Submittal for Cincinnati Bell Technology Solutions

Contractor: Glenwood Electric

End Customer (User): Cincinnati Bell technology Solutions

Submitted By: WRP Associates, LLC

Revision:

Date: May 29, 2008

Submittal Schedule

This schedule includes the products supplied as part of this submittal.

Schedule			Motor Data[1]			Drive Data			
Item	Qty	Tag / Equipment ID	HP	FLA	Voltage	Product ID	HP	Output Amps	Voltage
1	4	60 HP	60	77	460 VAC	ACH550-BCR-078A-4+B055+E213	60	77	480 VAC
2	2	125 HP	125	156	460 VAC	ACH550-BCR-157A-4+B055	125	157	480 VAC
3	2	150 HP	150	180	460 VAC	ACH550-BCR-180A-4+B055	150	180	480 VAC

Notes: 1. AC Motor Data is per National Electrical Code Table 430.250 for typical motors used in most applications and is provided as typical data only. DC motor data is per typical industry standards. Actual motor data may vary.

Submittal Schedule Details for 60 HP

Item	Tag / Equipment ID	Product ID
1	60 HP	ACH550-BCR-078A-4+B055+E213

Item Description
Input Voltage: 480 VAC **Rated Output Current:** 77 AMPS **Construction:** E-clipse-Bypass, Circuit Breaker **Enclosure:** NEMA 12 UL Type 12 **Nominal Horsepower:** 60 **Frame Size:** R4 **Input Disconnecting Means:** Circuit Breaker **Bypass:** E-Clipse Bypass **Input Impedance:** 5% **Short Circuit Current Rating:** 100 kA **Communication Protocols:** Johnson Controls N2 **Other Options:** AC Line Reactor

Drive Input Fuse Ratings[1]	
(Note: Drive is UL approved without the need for input fuses. Fuse rating information provided for customer reference)	
Amps (600 V)	**Bussmann Type**
100	JJS-100

Wire Size Capacities of Power Terminals				
Circuit Breaker	**Disconnect Switch**	**Terminal Block**	**Overload Relay**	**Ground Lug**
#1 50 in-lbs	N/A N/A	#1 120 in-lbs	N/A N/A	#2 50 in-lbs

Dimensions and Weights				
Height in / mm	**Width in / mm**	**Depth in / mm**	**Weight lbs / kg**	**Dimension Drawing**
37.4 / 950	20.5 / 521	15.3 / 389	138 / 62.6	3AUA0000016379 1

Heat Dissipation & Airflow Requirements			
Power Losses		**Airflow**	
Watts	**BTU/Hr**	**CFM**	**CM/Hr**
1295	4420	165	280

Reference Drawings		
Power Wiring	**Connection Diagram**	**Dimension Detail**
BC00R024PW-B	BCBDR018CC-A 0	3AUA0000016379

Submittal Schedule Details for 125 HP

Item	Tag / Equipment ID	Product ID
2	125 HP	ACH550-BCR-157A-4+B055

Item Description
Input Voltage: 480 VAC **Rated Output Current:** 157 AMPS **Construction:** E-clipse-Bypass, Circuit Breaker **Enclosure:** NEMA 12 UL Type 12 **Nominal Horsepower:** 125 **Frame Size:** R6 **Input Disconnecting Means:** Circuit Breaker **Bypass:** E-Clipse Bypass **Input Impedance:** 5% **Short Circuit Current Rating:** 100 kA **Communication Protocols:** Johnson Controls N2 **Other Options:**

Drive Input Fuse Ratings[1]	
(Note: Drive is UL approved without the need for input fuses. Fuse rating information provided for customer reference)	
Amps (600 V)	**Bussmann Type**
200	170M1370 or M2617

Wire Size Capacities of Power Terminals				
Circuit Breaker	**Disconnect Switch**	**Terminal Block**	**Overload Relay**	**Ground Lug**
350MCM 274 in-lbs	N/A N/A	250 MCM 300 in-lbs	N/A N/A	3 x #3/0 250 in-lbs

Dimensions and Weights				
Height in / mm	**Width in / mm**	**Depth in / mm**	**Weight lbs / kg**	**Dimension Drawing**
54.3 / 1380	28.1 / 713	19.0 / 483	360 / 163	3AUA0000016382 1

Heat Dissipation & Airflow Requirements			
Power Losses		**Airflow**	
Watts	**BTU/Hr**	**CFM**	**CM/Hr**
2310	7884	238	405

Reference Drawings		
Power Wiring	**Connection Diagram**	**Dimension Detail**
BC00R046PW-A	BCBDR018CC-A 0	3AUA0000016382

Submittal Schedule Details for 150 HP

Item	Tag / Equipment ID	Product ID
3	150 HP	ACH550-BCR-180A-4+B055

Item Description
Input Voltage: 480 VAC **Rated Output Current:** 180 AMPS **Construction:** E-clipse-Bypass, Circuit Breaker **Enclosure:** NEMA 12 UL Type 12 **Nominal Horsepower:** 150 **Frame Size:** R6 **Input Disconnecting Means:** Circuit Breaker **Bypass:** E-Clipse Bypass **Input Impedance:** 5% **Short Circuit Current Rating:** 100 kA **Communication Protocols:** Johnson Controls N2 **Other Options:**

Drive Input Fuse Ratings[1]	
(Note: Drive is UL approved without the need for input fuses. Fuse rating information provided for customer reference)	
Amps (600 V)	**Bussmann Type**
315	170M1372 or M2619

Wire Size Capacities of Power Terminals				
Circuit Breaker	**Disconnect Switch**	**Terminal Block**	**Overload Relay**	**Ground Lug**
350MCM 274 in-lbs	N/A N/A	350 MCM 375 in-lbs	N/A N/A	3 x #3/0 250 in-lbs

Dimensions and Weights				
Height in / mm	**Width in / mm**	**Depth in / mm**	**Weight lbs / kg**	**Dimension Drawing**
54.3 / 1380	28.1 / 713	19.0 / 483	360 / 163	3AUA0000016382 1

Heat Dissipation & Airflow Requirements			
Power Losses		**Airflow**	
Watts	**BTU/Hr**	**CFM**	**CM/Hr**
2810	9590	238	405

Reference Drawings		
Power Wiring	**Connection Diagram**	**Dimension Detail**
BC00R046PW-A	BCBDR018CC-A 0	3AUA0000016382

ACH550 Product Overview

Description

The ACH550 series is a microprocessor based Pulse Width Modulated (PWM) adjustable speed AC drive. The ACH550 drive takes advantage of sophisticated microprocessor control and advanced IGBT power switching technology to deliver high-performance control of AC motors for a wide range of HVAC applications.

With drives ranging from 1 to 550 HP, the ACH550 series features a universal full graphic interface that “speaks” to the operator in plain English phrases, greatly simplifying set-up, operation, and fault diagnosis. The ACH550 is also programmable in fourteen other languages.

Each ACH550 drive comes equipped with an extensive library of pre-programmed HVAC application macros which, at a touch of a button, allow rapid configuration of inputs, outputs, and performance parameters for specific HVAC applications to maximize convenience and minimize start-up time. The ACH550 series can handle the most demanding commercial applications in an efficient, dependable, and economic manner.

ACH550 Standard Features

- UL, cUL labeled and CE marked
- EMI/RFI Filter (1st Environment, Restricted Distribution)
- Start-Up Assistants
- Maintenance Assistants
- Diagnostic Assistants
- Real Time Clock
  - Includes Day, Date and Time
- Operator Panel Parameter Backup (read/write)
- Full Graphic and Multilingual Display for Operator Control, Parameter Set-Up and Operating
  - Data Display:
    - Output Frequency (Hz)
    - Speed (RPM)
    - Motor Current
    - Calculated % Motor Torque
    - Calculated Motor Power (kW)
    - DC Bus Voltage
    - Output Voltage
    - Heatsink Temperature
    - Elapsed Time Meter (reset-able)
    - KWh (reset-able)
    - Input / Output Terminal Monitor
    - PID Actual Value (Feedback) & Error
    - Fault Text
    - Warning Text
    - Three (3) Scalable Process Variable Displays
    - User Definable Engineering Units
- Two (2) Programmable Analog Inputs
- Six (6) Programmable Digital Inputs
- Two (2) Programmable Analog Outputs
- Up to six (6) Programmable Relay Outputs (Three (3) Standard)
- Adjustable Filters on Analog Inputs and Outputs
- Mathematical Functions on Analog Reference Signals
- All Control Inputs Isolated from Ground and Power
- Four (4) Resident Serial Communication Protocols
  - Johnson Controls N2
  - Siemens Building Technologies FLN (P1)
  - Modbus RTU
  - BACnet (MS/TP)
- Input Speed Signals
  - Current 0 (4) to 20 mA
  - Voltage 0 (2) to 10 VDC
  - Increase/Decrease Reference Contacts (Floating Point)
  - Serial Communications
- Start/Stop
  - 2 Wire (Dry Contact Closure)
  - 3 Wire (Momentary Contact)
  - Application of Input Power
  - Application of Reference Signal (PID Sleep/Wake-Up)
  - Serial Communications
- Start Functions
  - Ramp
  - Flying Start
  - Premagnetization on Start
  - Automatic Torque Boost
  - Automatic Torque Boost with Flying Start
  - Auto Restart (Reset) – Customer Selectable and Adjustable
- Stop Functions
  - Ramp or Coast to Stop
  - Emergency Stop
  - DC Braking / Hold at Stop
  - Flux Braking
- Accel/Decel
  - Two (2) sets of Independently Ramps
  - Linear or Adjustable ‘S’ Curve Accel/Decel Ramps
- HVAC Specific Application Macros
- Separate Safeties (2) and Run Permissive Inputs
- Damper Control
- Override Input (Fire Mode)
- Timer Functions
  - Four (4) Daily Start/Stop Time Periods
  - Four (4) Weekly Start/Stop Time Periods
  - Four Timers for Collecting Time Periods and Overrides
- Seven (7) Preset Speeds
- Supervision Functions
- Adjustable Current Limit
- Electronic Reverse
- Automatic Extended Power Loss Ride Through (Selectable)
- Programmable Maximum Frequency to 500 Hz
- PID Control
  - Two (2) Integral Independent Programmable PID Setpoint Controllers (Process and External)
  - External Selection between Two (2) Sets of Process
    - PID Controller Parameters
  - PID Sleep/Wake-Up
- Motor Control Features
  - Scalar (V/Hz) and Vector Modes of Motor Control
  - V/Hz Shapes
    - Linear
    - Squared
  - Energy Optimization
  - IR Compensation
  - Slip Compensation
  - Three (3) Critical Frequency Lockout Bands
- Preprogrammed Protection Circuits
  - Overcurrent
  - Short Circuit
  - Ground Fault
  - Overvoltage
  - Undervoltage
    - Input Phase Loss
  - Output Device (IGBT) Overtemperature
  - Adjustable Current Limit Regulator
  - UL508C approved Electronic Motor Overload (I^2T)
- Programmable Fault Functions for Protection Include
  - Loss of Analog Input
  - Panel Loss
  - External Fault
  - Motor Thermal Protection
  - Stall
  - Underload
  - Motor Phase Loss
  - Ground Fault
- 5% Input Impedance
  - Equivalent 5% Impedance with Internal Reactor(s)
  - Patented Swinging Choke Design for Superior Harmonic Mitigation (R1 to R4)

ACH550 Specifications

Input Connection

Input Voltage (U_1)	208/220/230/240 VAC 3-phase +/-10% 208/220/230/240 VAC 1-phase +/-10% 380/400/415/440/460/480 VAC 3-phase +/-10% 500/600 VAC 3-phase +/-10%
Frequency:	48 - 63 Hz
Line Limitations:	Max +/-3% of nominal phase to phase input voltage
Fundamental Power Factor (cos φ):	0.98 at nominal load
Connection:	U_1, V_1, W_1 (U_1, V_1, 1-phase)
Output (Motor) Connection	
Output Voltage:	0 to U_1, 3-phase symmetrical, U_2 at the field weakening point
Output Frequency:	-500 to 500 Hz
Frequency Resolution:	0.01 Hz
Continuous Output Current:	
Variable Torque:	1.0 * I_{2N} (Nominal rated output current, Variable Torque)
Short Term Overload Capacity:	
Variable Torque:	1.1 * I_{2N}, (1 min/10 min)
Peak Overload Capacity:	
Variable Torque:	1.35 * I_{2N}, (2 sec/1 min)
Base Motor Frequency Range:	10 to 500 Hz
Switching Frequency:	1, 4, 8 or 12 kHz
Acceleration Time:	0.1 to 1800 s
Deceleration Time:	0.1 to 1800 s
Efficiency:	0.98 at nominal power level
Short Circuit Withstand Rating:	100,000 AIC (UL) w/o fuses
Connection:	U_2, V_2, W_2
Enclosure	
Style:	UL (NEMA) Type 1, Type 12, or Type 3R UL Plenum Rated Type 1, Type 12
Agency Approval	
Listing and Compliance:	UL, cUL, CE
Ambient Conditions, Operation	
Air Temperature:	0^0 to 40^0C (32^0 to 104^0F), above 40^0C the maximum output current is de-rated 1% for every additional 1^0C (up to 50^0C (122^0F)) maximum limit.
Relative Humidity:	5 to 95%, no condensation allowed, maximum relative humidity is 60% in the presence of corrosive gasses
Contamination Levels:	
IEC:	60721-3-1, 60721-3-2 and 60721-3-3
Chemical Gasses:	3C1 and 3C2
Solid Particles:	3S2
Installation Site Altitude:	0 to 1000 m (3300 ft) above sea level. At sites over 1000 m (3300 ft) above sea level, the maximum power is de-rated 1% for every additional 100 m (330 ft). If the installation site is higher than 2000 m (6600 ft) above sea level, please contact your local ABB distributor or representative for further information
Vibration:	Max 3.0 mm (0.12 in) 2 to 9 Hz, Max 10 m/s^2 (33 ft/s^2) 9 to 200 Hz sinusoidal
Ambient Conditions, Storage (in Protective Shipping Package)	
Air Temperature:	-40^0 to 70^0C (-40^0 to 158^0F)
Relative Humidity:	Less than 95%, no condensation allowed
Vibration Tested to (IEC 60068-2-6):	In accordance with ISTA 1A and 1B specifications
Bump Tested to (IEC 60068-2-29):	Max 100 m/s^2 (330 ft/s^2) 11 ms (Tested 500 times each axis, each pole; 3000 times total)
Ambient Conditions, Transportation (in Protective Shipping Package)	
Air Temperature:	-40^0 to 70^0C (-40^0 to 158^0F)
Relative Humidity:	Less than 95%, no condensation allowed
Atmospheric Pressure:	60 to 106 kPa (8.7 to 15.4 PSI)
Vibration Tested to (IEC 60068-2-6):	Max 3.0 mm (0.14 in) 2 to 9 Hz, Max 15 m/s^2 (49 ft/s^2) 9 to 200 Hz sinusoidal
Bump Tested to (IEC 60068-2-29):	Max 100 m/s^2 (330 ft/s^2) 11 ms (Tested 500 times each axis, each pole; 3000 times total)
Shock Tested to (IEC 60068-2-27)	

R1: 76 cm (30 in) R2: 61 cm (24 in) R3: 46 cm (18 in) R4: 31 cm (12 in) R5 & 6: 25 cm (10 in)

ACH550 Specifications (continued)

Cooling Information

Cooling Method: ..... Integral fan(s)
Power Loss: ..... Approximately 3% of rated power

Analog Inputs

Quantity ..... Two (2) programmable
Voltage Reference: ..... 0 (2) to 10 V, 250kOhm, single ended
Current Reference: ..... 0 (4) to 20 mA, 100Ohm, single ended
Potentiometer: ..... 10 VDC, 10 mA (1K to 10KOhms)
Input Updating Time ..... 8 ms
Terminal Block Size ..... 2.3mm^2 / 14AWG

Reference Power Supply

Reference Voltage ..... +10 VDC, 1% at 25^{0}C (77^{0}F)
Maximum Load ..... 10 mA
Applicable Potentiometer ..... 1 kOhm to 10 kOhm
Terminal Block Size ..... 2.3mm^2 / 14AWG

Analog Outputs

Quantity ..... Two (2) programmable current outputs
Signal Level ..... 0 (4) to 20 mA
Accuracy ..... +/- 1% full scale range at 25^{0}C (77^{0}F)
Maximum Load Impedance ..... 500 Ohms
Output Updating Time ..... 2 ms
Terminal Block Size ..... 2.3mm^2 / 14AWG

Digital Inputs

Quantity ..... Six (6) programmable digital inputs
Isolation ..... Isolated as one group
Signal Level ..... 24 VDC, (10V Logic 0)
Input Current ..... 15 mA at 24 VDC
Input Updating Time: ..... 4 ms
Terminal Block Size ..... 2.3mm^2 / 14AWG

Internal Power Supply

Primary Use ..... Internal supply for digital inputs
Voltage: ..... +24 VDC, max 250 mA
Maximum Current: ..... 250 mA
Protection: ..... Short circuit protected

Relay Outputs

Quantity ..... Three (3) programmable relay (Form C) outputs
Switching Capacity: ..... 8 A at 24 VDC or 250 VAC, 0.4 A at 120 VDC
Max Continuous Current: ..... 2A RMS
Contact Material: ..... Silver Cadmium Oxide (AgCdO)
Isolation Test Voltage ..... 4 kVAC, 1 minute
Output Updating Time ..... 12 ms
Terminal Block Size ..... 2.3mm^2 / 14AWG

Protections

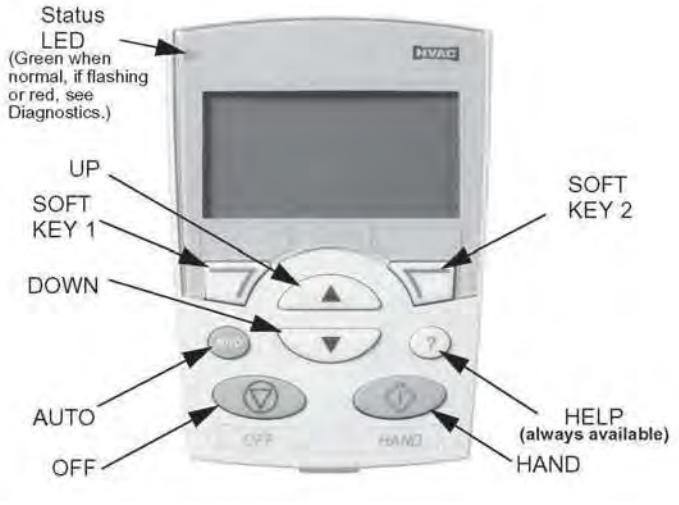
Single Phase ..... Protected (input & output)
Overcurrent Trip Limit: ..... 3.5 x I_{2N} instantaneous
Adjustable Current Regulation Limit: ..... 1.1 x I_{2N} (RMS) max.
Overvoltage Trip Limit: ..... 1.30 x U_N
Undervoltage Trip Limit: ..... 0.65 x U_N
Overtemperature (Heatsink): ..... +115°C (+239°F)
Auxiliary Voltage: ..... Short Circuit Protected
Ground Fault: ..... Protected
Short Circuit: ..... Protected
Microprocessor fault: ..... Protected
Motor Stall Protection: ..... Protected
Motor Overtemperature Protection (I^2t): ..... Protected
Input Power Loss of Phase: ..... Protected
Loss of Reference: ..... Protected
Short Circuit Current Rating: ..... 100,000 RMS symmetrical Amperes
Input Line Impedance: ..... Swinging choke 5% equivalent R1-R6, 3% equivalent R8

U_1 = Input Voltage
U_2 = Output Voltage
P_N = Power – Normal Duty (HP)
U_N = Nominal Motor Voltage
f_N = Nominal Motor Frequency
I_{2N} = Nominal Motor Current – Normal Duty

Specifications are subject to change without notice. Please consult the factory when specifications are critical.

ACH550 Control Panel

The ACH550 Control Panel is a multifunction control panel with full graphic LCD display and multiple language capability. The control panel can be connected to and detached from the ACH550 at any time. The panel can be used to upload and copy parameters to other ACH550 drives.



Run Indication and Shaft Direction

Control Panel Display	Significance
Rotating arrow (clockwise or counterclockwise)	Drive is running and at set point Shaft direction is forward or reverse
Rotating arrow blinking	Drive is operating but not at setpoint
Stationary arrow	Drive is stopped

LED Indicators

The green LED indicates that the power is on and the drive is operating normally. The red LED indicates a fault. A blinking green LED indicates an alarm condition. A blinking red LED indicates a fault that requires power to be cycled off and on to reset the drive.

Fault Indications

The ACH550 Control Panel can display over 20 alarm and fault messages. The last fault and previous faults (1 to 9) are retained in memory. The last fault and previous faults (1 & 2) also record important diagnostic information to assist in troubleshooting. Most faults can be reset by pressing the RESET key (Soft Key 1).

Parameters

Application specific parameters are immediately accessible through a selection of start-up “Assistants”. A complete list of parameters is also available grouped by function in approximately 33 menu groups. One of the basic menu functions can be used to display the complete list of changed parameters.

Real Time Clock

The Operator Control Panel includes a real time clock which provides Day, Date and Time information, displayed in a choice of formats. The real time clock has a 10 year battery back up and provides time and date stamping of drive faults and other events. The clock is also used by the ACH550s internal timer functions, providing an integral time clock for start/stop control as well
as other control operations.

Control Modes

When the HAND key is pressed, the drive starts and pressing the UP/DOWN keys can modify the reference frequency. The HAND (keypad) control mode is indicated.

When the OFF key is pressed, the drive stops and the OFF control mode is indicated.

When the AUTO key is pressed, the AUTO control mode is indicated. The drive can be started and stopped using whichever remote start/stop command has been configured, a contact closure applied to the start/stop input, a serial communication command or a process feedback signal. In AUTO mode the drive speed is typically controlled by the external speed reference input or by the PID controller.

If the HAND key is pressed while the drive is running in the AUTO control mode, the drive continues to run without changing speed, but ceases to respond to external input or PID speed reference changes. (Bumpless transfer) Pressing the UP/DOWN keys can modify the reference frequency.

If the AUTO key is pressed while the drive is running in the HAND control mode and an external start command is present, the drive continues to run and follows the acceleration or deceleration control ramp to the speed set by the external input or PID speed reference. (Bumpless transfer)

Cable Connections

Terminal	Description	Note
U1, V1, W1	3~ power supply input	Use of 1~ supply requires 50% derate of output current and is applicable for 208 to 240 VAC operation only.
PE / GND	Protective Ground	Follow local rules for cable size.
U2, V2, W2	Power output to motor	
Uc+, Uc-	DC bus	
X1 1 to 18	Control Wiring	Low voltage control – Use shielded cable
X1 19 to 27	Control Wiring	Low voltage or 115VAC
X1 28 to 32	Serial Communications	Use shielded cable

Follow local codes for cable size. To avoid electromagnetic interference, use separate metallic conduits for input power wiring, motor wiring, control and communications wiring. Keep these four classes of wiring separated in situations where the wiring is not enclosed in metallic conduit. Also, keep 115VAC control wiring separated from low voltage control wiring and power wiring.

Use shielded cable for control wiring.

Ampacity is based on the use of 60 °C rated power cable up to 100 Amps (75 °C over 100 Amps).

Refer to the included tables for current ratings, fuse recommendations and maximum wire size capacities and tightening torques for the terminals. The ACH550 is suitable for use on a circuit capable of delivering not more than 100,000 RMS symmetrical amperes, 480 V maximum. The ACH550 has an electronic motor protection feature that complies with the requirements of the National Electric Code (NEC). When this feature is selected and properly adjusted. Additional overload protection is not required unless more than one motor is connected to the drive or unless additional protection is required by applicable safety regulations.

For CE installation requirements, see ABB publication CE-US-02 “CE Council Directives and Variable Speed Drives.” Contact your local ABB representative for specific IEC installation instructions.

ACH550 with ABB E-Clipse bypass Overview

ABB E-Clipse bypass Standard Features

- Door Interlocked Disconnect or Circuit Breaker
- English Language Back-Lit LCD Display
- Operator Control Panel
- LED Status Pilot Lights
- Smoke Control
- Override Mode
- Serial Communications
- 5 Programmable Relay Outputs (Form C)
- 100% Functionality with Drive Removed
- Programmable Auto Transfer to Bypass
- Plain English Safety Annunciation
- UL & cUL Listed
- Seismic Zone 4 Certified (IBC 2006)
- UL Type 1 or Type 12 Enclosure
- Programmable Class 10, 20, or 30 OL
- Automatic Restart
- 24 Month Parts and Labor Warranty (with Certified Start-up)
- Two Contactor Bypass
- System Status Display
- Bypass Diagnostics Display
- Drive Exclusive Fast-Acting Fuses
- Electronic Motor Overload Protection
- Damper Control - VFD and Bypass Modes
- 6 Digital Inputs (5 programmable)
- Single Phase Protection in VFD & Bypass Mode
- Bullet Proof Contactor Protection
- Serial Communications Pass Through I/O
- Proof-of-Flow Indication & Action
- Conformal Coated Circuit Boards
- +30%; -35% Input Voltage Tolerance
- Run Permissive Circuit
- Supervisory Control
- UL Listed I^2T Electronic Overload
- UL Listed and tested 100,000 Ampere SCCR (VCR and BCR Units)

The ACH550 with ABB E-Clipse bypass is an ACH550 HVAC Drive in an integrated UL Type 1, UL Type 12 or NEMA 3R enclosure with a bypass motor starter. The ACH550 with ABB E-Clipse bypass provides an input disconnect switch or circuit breaker with door mounted and interlocked operator (padlockable in the OFF position), a bypass starter, electronic motor overload protection, a local programming and operator keypad with indicating lights, provisions for external control connections, and serial communications capability. Certain configurations (+F267) also provide a drive service switch.

The ACH550 with ABB E-Clipse bypass includes two contactors. One contactor is the bypass contactor, used to connect the motor directly to the incoming power line in the event that the ACH550 is out of service. The other contactor is the ACH550 output contactor that disconnects the ACH550 from the motor when the motor is operating in the Bypass mode. The drive output contactor and the bypass contactor are electrically interlocked to prevent “back feeding”.

The ACH550 with ABB E-Clipse bypass is a microprocessor-controlled “intelligent” system which features programmable Class 20 or 30 overload curves, programmable underload (broken belt) and overload trip or indication. Also included as standard features are single-phase protection in bypass mode, programmable manual or automatic transfer to bypass, fireman’s override, smoke control, damper control, no contactor chatter on brown-out power conditions and serial communications. Should a drive problem occur, fast acting fuses exclusive to the ACH550 drive path disconnect the drive from the line prior to clearing upstream branch circuit protection, maintaining bypass capability.

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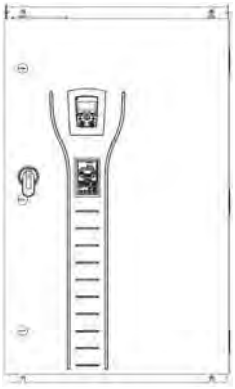
Serial communications

All ABB E-Clipse bypass units have the following Embedded Fieldbus (EFB) protocols included as standard: Modbus RTU; Johnson Controls N2; Siemens Building Technologies FLN (P1); and BACnet (MS/TP).

The ACH550 with ABB E-Clipse bypass has the ability to monitor VFD/Bypass mode of operation, the status of the bypass H-O-A switch, bypass fault and override status over serial communication. In addition, the user can monitor and / or control over 45 points of bypass information via the communications protocols. Serial communication capabilities include - bypass run-stop control; the ability to force the unit to bypass; and the ability to control all relay outputs. The DDC system can monitor bypass feedback such as, current (in amps), kilowatt hours (resettable), operating hours (resettable), and bypass logic board temperature. The DDC system is also capable of monitoring the bypass relay output status, and all digital input status'. All bypass diagnostic warning and fault information is transmitted over the serial communications bus. Remote system (drive or bypass) fault reset is possible.



Vertical & Standard ABB E-Clipse bypass Exterior Views

ABB E-Clipse bypass Operator Control

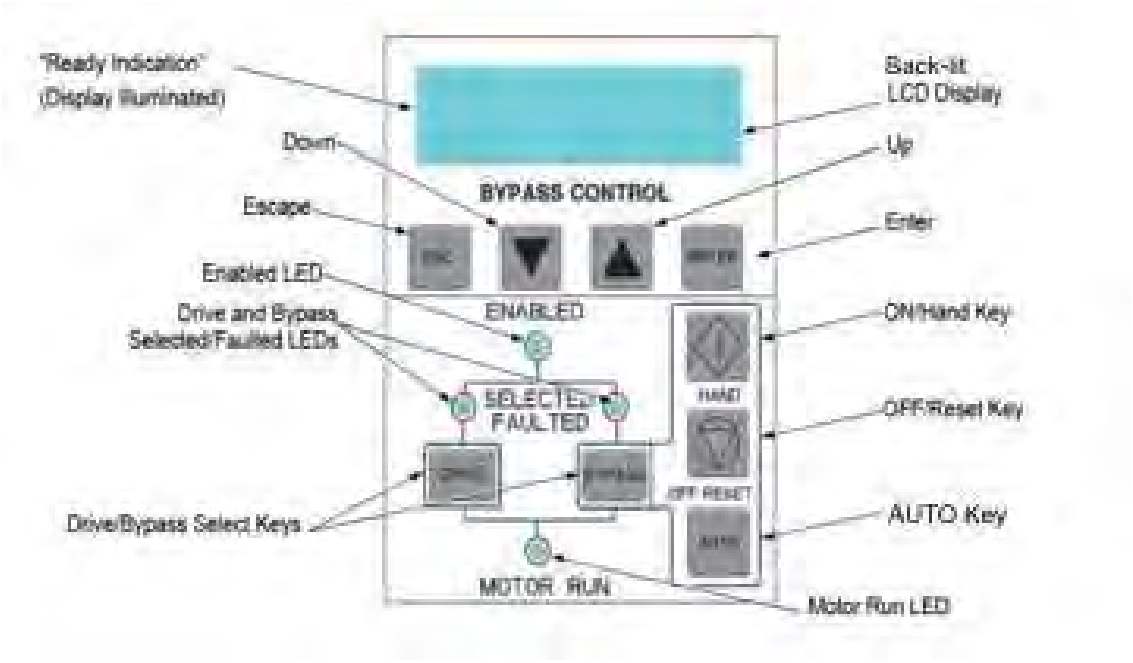
ACH550 Control Panel

The ACH550 Control Panel is a keypad with an LCD unit that provides status indication and operator controls for the ACH550 drive. In normal operation with the ABB E-Clipse bypass, the ACH550 should be placed in the *Auto* mode of operation by pressing the *Auto* key on the ACH550 Control Panel. Refer to the *ACH550 User's Manual* for additional information on the ACH550 Control Panel and other aspects of ACH550 operation.

Bypass Control Keypad

The ABB E-Clipse bypass has a separate keypad with an LCD unit that provides status indication and programming of the system. This keypad is also used for selecting the *Drive* or *Bypass* mode of operation and manually starting and stopping the motor in the *Bypass* mode. The bypass keypad has LED indicating lights that indicate the status of both the bypass and the drive as well as an LCD display that provides programming, status and warning/fault indications.

The illustration below shows the bypass control keypad and identifies the keys and LED indicating lights.



The functions of the various keys and LEDs are described in the following table.

Enabled LED	The *Enabled* LED is illuminated green under the following conditions: • Both the Safety Interlock(s) and Run Enable contacts are closed. • The Safety Interlock(s) contact are closed with no Start command present. The *Enable* LED flashes green if the Run Enable contact is open and when the Safety Interlock contact(s) are closed and a Start command is present. The Enable LED is illuminated red when the Safety Interlock contact(s) are open.
Drive Selected LED	The *Drive Selected* LED is illuminated green when the drive has been selected as the power source for the motor and no drive fault is present.
Bypass Selected LED	The *Bypass Selected* LED is illuminated green when the bypass has been selected as the power source for the motor and no bypass fault is present.
Motor Run LED	The *Motor Run* LED is illuminated green whenever the system is running. The *Motor Run* LED flashes green to indicate the system has been placed in an Override operating mode.
Drive Faulted LED	The *Drive Fault* LED is illuminated red when the bypass has lost its' communications link with the drive or when the motor or drive protection functions have shut down the drive.
Bypass Faulted LED	The *Bypass Faulted* LED is illuminated or flashes red when the motor or bypass protective functions have shut down the bypass.
Drive Key	The *Drive* Key selects the drive as the power source for the motor.
Bypass Key	The *Bypass* Key selects the bypass as the power source for the motor.
Auto Key	The *Auto* key selects the *Auto Start* contact or serial communications as the means for starting and stopping the motor in the bypass mode.
Off/Reset Key	The *Off*/*Reset* key may be used to manually stop the motor if the motor is running on bypass power. The *Off/Reset* Key also resets most bypass faults. It may take several minutes before the bypass can be reset after an overload trip. If a bypass fault condition is present, the second push of the *Off/Reset* key puts the bypass in the Off mode.
Hand Key	The *Hand* key can be used to manually start the motor when the bypass has been selected as the power source for the motor.
UP Key	Used to navigate through system programming steps.
Down Key	Used to navigate through system programming steps.

Control Modes

Drive mode

Under normal conditions the system is in the *Drive* mode. The ACH550 drive provides power to the motor and controls its speed. The source of the drive's start/stop and speed commands is determined by the *Auto* or *Hand* mode selection of the drive's keypad. Commands come from the control terminals or serial communications when the *Auto* mode has been selected or from the drive keypad when the *Hand* mode has been selected. The user can normally switch to the *Drive* mode by pressing the *Drive* key on the bypass keypad.

Bypass mode

In the *Bypass* mode, the motor is powered by AC line power through the bypass contactor. The source of the bypass'start/stop commands is determined by the *Auto* or *Hand* mode selection of the bypass' keypad. Commands come from the control terminals or serial communications when the *Auto* mode has been selected or from the bypass keypad when the *Hand* mode has been selected. The user can normally switch to the *Bypass* mode by pressing the *Bypass* key on the bypass keypad.

Bypass Override mode

In the *Bypass Override (Override 2)* mode, the motor is powered by AC line power through the bypass contactor. The source of the start command is internal and unaffected by external stop commands. The VFD Keypad and the Bypass Keypad will not accept user commands when the system is in Bypass Override mode (the keypad user inputs are disabled). The user can switch to the *Bypass Override* mode by closing the *Bypass Override* input contact (DI 5-if programmed). When the *Bypass Override* input contact is closed, the system is forced to bypass and does not respond to the *Drive* and *Bypass* keys. The Motor Run LED flashes green when the system is in override. While in *Bypass Override* the system responds to bypass overloads and programmed faults. The system may be custom programmed to acknowledge or disregard certain faults, safeties and enables. The unit is default programmed to ignore all external safeties and run enables. See Group 17 for programmability of the digital input and fault functions. Normally when the *Bypass Override* input contact is switched from closed to open, the system switches to the *Drive* mode and can be controlled using the *Drive* and *Bypass* keys. The exception to this is when the *Smoke Control (Override 1)* input contact is closed, in which case the system remains in *Smoke Control* operation.

Hand mode

When the system is in the *Bypass* mode, the operator can manually start the motor by pressing the *Hand* key. The motor will run and the *Hand* LED will be illuminated green. In order to run the motor, the *Safety Interlock* and *Run Enable* contacts must be closed (green *Enable* LED) and any bypass fault must be reset.

Auto mode

In the *Auto* mode the bypass start/stop command comes from the *Start/Stop* input terminal on the bypass control board or from serial communications – if programmed. The *Auto* mode is selected by pressing the *Auto* key on the bypass keypad. The *Auto* LED is illuminated green when the bypass is in the *Auto* mode. If the system is in the *Bypass* mode, the motor will run across the line if the *Auto* mode is selected, the *Start/Stop, Safety Interlock* and *Run Enable* contacts are closed and any bypass fault is reset.

Off Mode

If the motor is running in the *Bypass* mode, the operator can manually stop the motor by pressing the *OFF* key. The *Motor Running* LED will go out. The motor can be restarted by pressing the *Hand* key or the bypass can be returned to the *Auto* mode by pressing the *Auto* key. If the system is in the *Drive* mode, pressing the *OFF* key will take the bypass out of the *Auto* mode, but will not affect motor operation from the drive. If the system is switched to the *Bypass* mode, a motor that is running will stop.

Programmable Relay Contact Outputs

The ABB E-Clipse bypass has five programmable relay outputs as standard. The default programming descriptions for these relay outputs is described below.

Bypass Not Faulted

The *Bypass Not Faulted* relay is energized during normal operation. The *Bypass Not Faulted* relay is de-energized when a bypass fault has occurred.

System Running

The *System Running* relay is energized when the ABB E-Clipse bypass System is running. The *System Running* relay provides an output when the motor is running whether powered by the ACH550 drive or the bypass.

System Started

The *System Started* relay is energized when the ABB E-Clipse bypass system is started. Three conditions must be met in order for the relay to energize. 1) a *Start* command must be present, 2) the *Safety Interlock* input contact must be closed and 3) there can be no fault present in the system. The *Start* command can come from the bypass control board terminal block, the ACH550 keypad, the bypass keypad, or serial communications depending on the operational mode selected. The *System Started* relay is ideal for use in damper actuator circuits, opening the dampers only under those conditions where the system is preparing to run the motor. The *System Started* relay will de-energize, closing the dampers if the safeties open, the system faults, or when a *Stop* command is issued.

Bypass Selected

Relay output four is factory default programmed for Bypass Selected. The relay will be energized anytime the user has placed the system in Bypass mode.

Bypass Auto

Relay Output five is factory default programmed for *Bypass Auto*. The relay will be energized anytime the user has placed the bypass in the Auto mode.

The complete list of programmable relay output functions follows:

0 = NOT SEL	10 = DRV NOT FLT	20 = BYP UNDERLD
1 = SYS READY	11 = DRIVE ALARM	21 = PCB OVERTMP
2 = SYS RUNNING	12 = OVERRIDE	22 = SYS UNDERLD
3 = SYS STARTED	13 = BYPASS HAND	23 = SYSTEM FLT
4 = BYPASS SEL	14 = BYPASS OFF	24 = SYS FLT/ALM
5 = BYPASS RUN	15 = BYPASS AUTO	25 = SYS EXT CTL
6 = BYPASS FLT	16 = COM CTRL	26 = SYS OVERLD
7 = BYP NOT FLT	17 = SYS ALARM	27 = CONTACT FLT
8 = BYPASS ALRM	18 = BYPASS FLT/ALM	
9 = DRIVE FAULT	19 = BYP OVERLD	

Cable Connections

The following illustrations show the ACH550 with ABB E-Clipse bypass cable connection points for the various enclosure styles. The illustrations indicate the location of input and output power connections as well as equipment and motor grounding connection points.

ACH550 drives are configured for wiring access from the bottom only on Vertical ABB E-Clipse bypass units and from the top only on Standard ABB E-Clipse bypass units. At least three separate metallic conduits are required, one for input power, one for output power to the motor and one for control signals.

All ABB E-Clipse bypass units provided with a circuit breaker input - VCR and BCR configurations have a panel short circuit current rating of 100,000 RMS symmetrical Amperes. Units provided with a disconnect input - VDR and BDR configurations require separate external low peak fuses (supplied by others) to obtain the 100,000 KAIC SCCR.

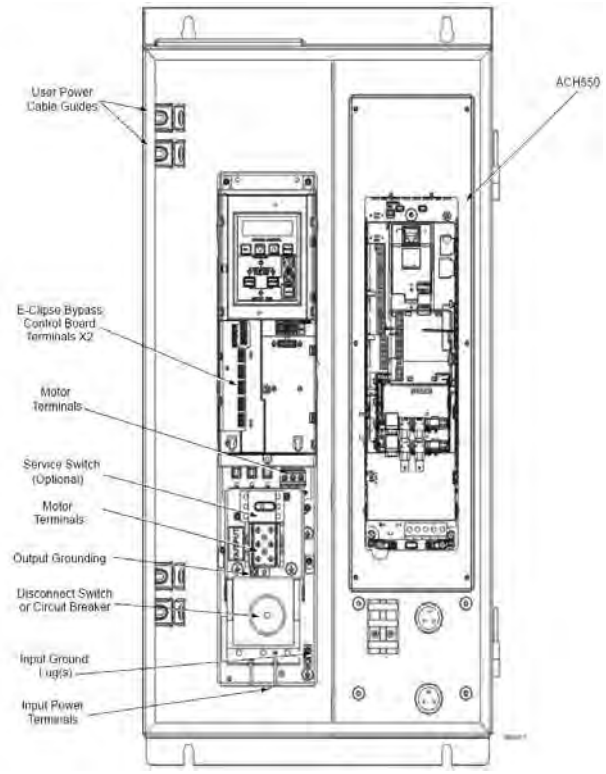
Terminal Sizes

Power and motor cable terminal sizes are shown in the *Submittal Schedule Details* and in the *Wire Size Capacities of Power Terminals* Table. The information provided is for connections to an input circuit breaker or disconnect switch, a motor terminal block, overload relay and ground lugs. The table also lists torque that should be applied when tightening the connections.

Protections

All ABB E-Clipse bypass units include the following protective features: single phase input and output; motor open phase; motor overload (UL Listed); stuck contactor; contactor coil open; undervoltage; motor underload (proof-of-flow / broken belt); serial communications loss; and overtemperature. All printed circuit boards are conformally coated as standard.

Internal Layout Drawings

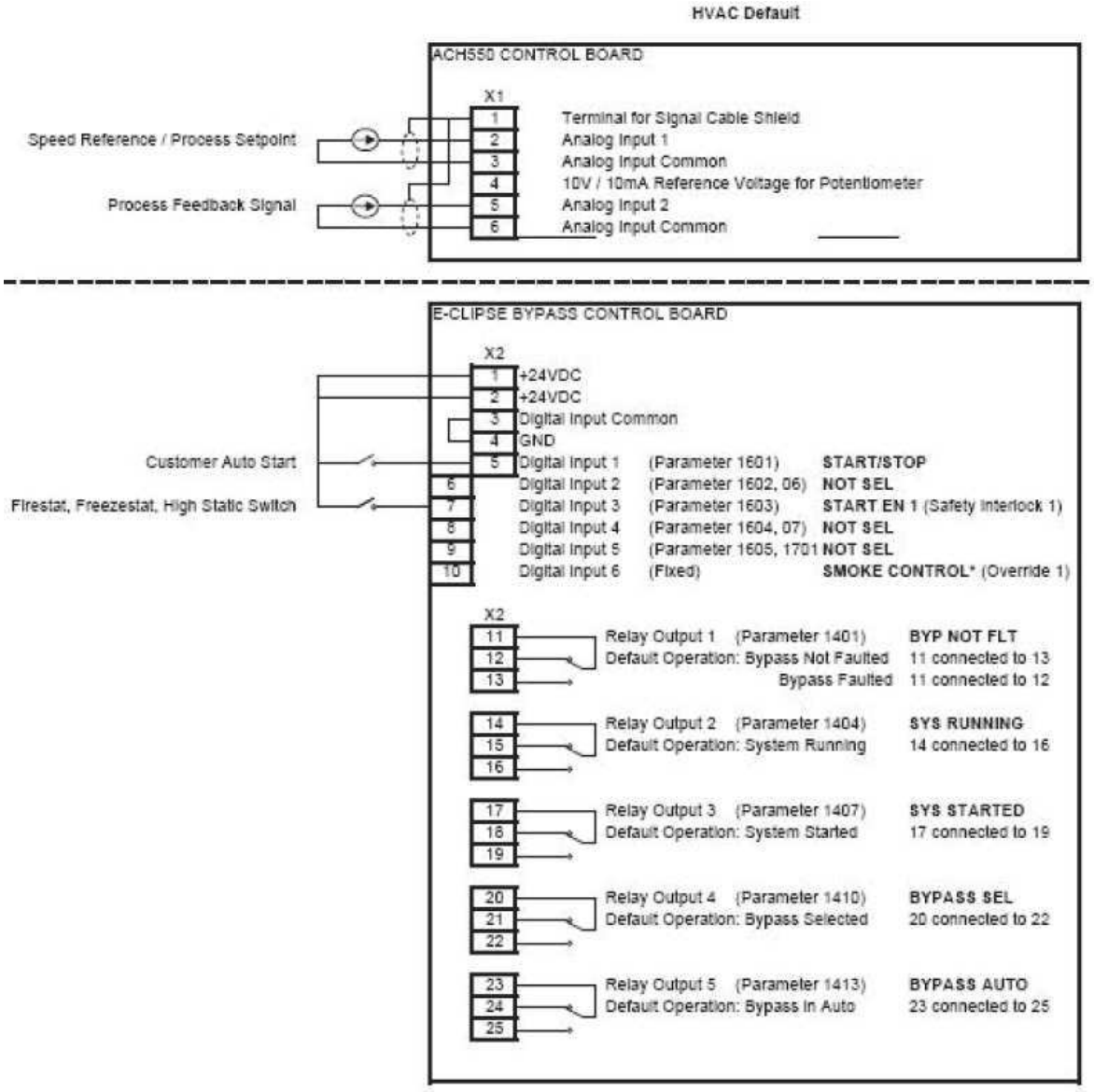


Standard Wall Mount ABB E-Clipse Bypass

Standard Floor Mount ABB E-Clipse Bypass

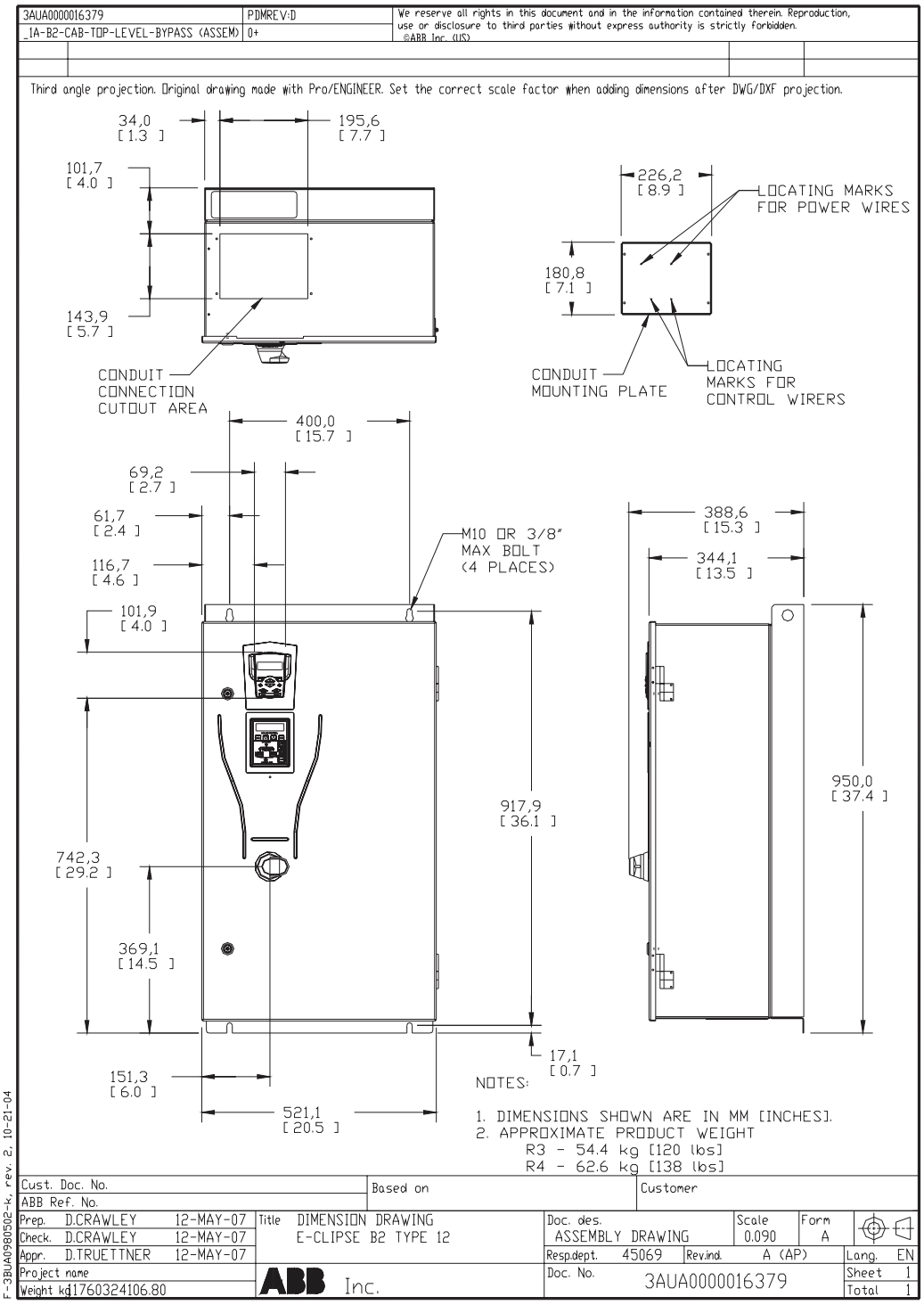
Control Terminals

The control wiring includes connections to an analog speed command signal and a start/stop relay contact for controlling the motor in the AUTO mode. There may also be connections to external run enable interlock contacts and a connection from the Motor Run contact to an external status indication circuit. For a detailed description of the control circuit functions and alternate Control Connection diagrams, refer to the *ACH550 with ABB E-Clipse bypass Users Manual.*

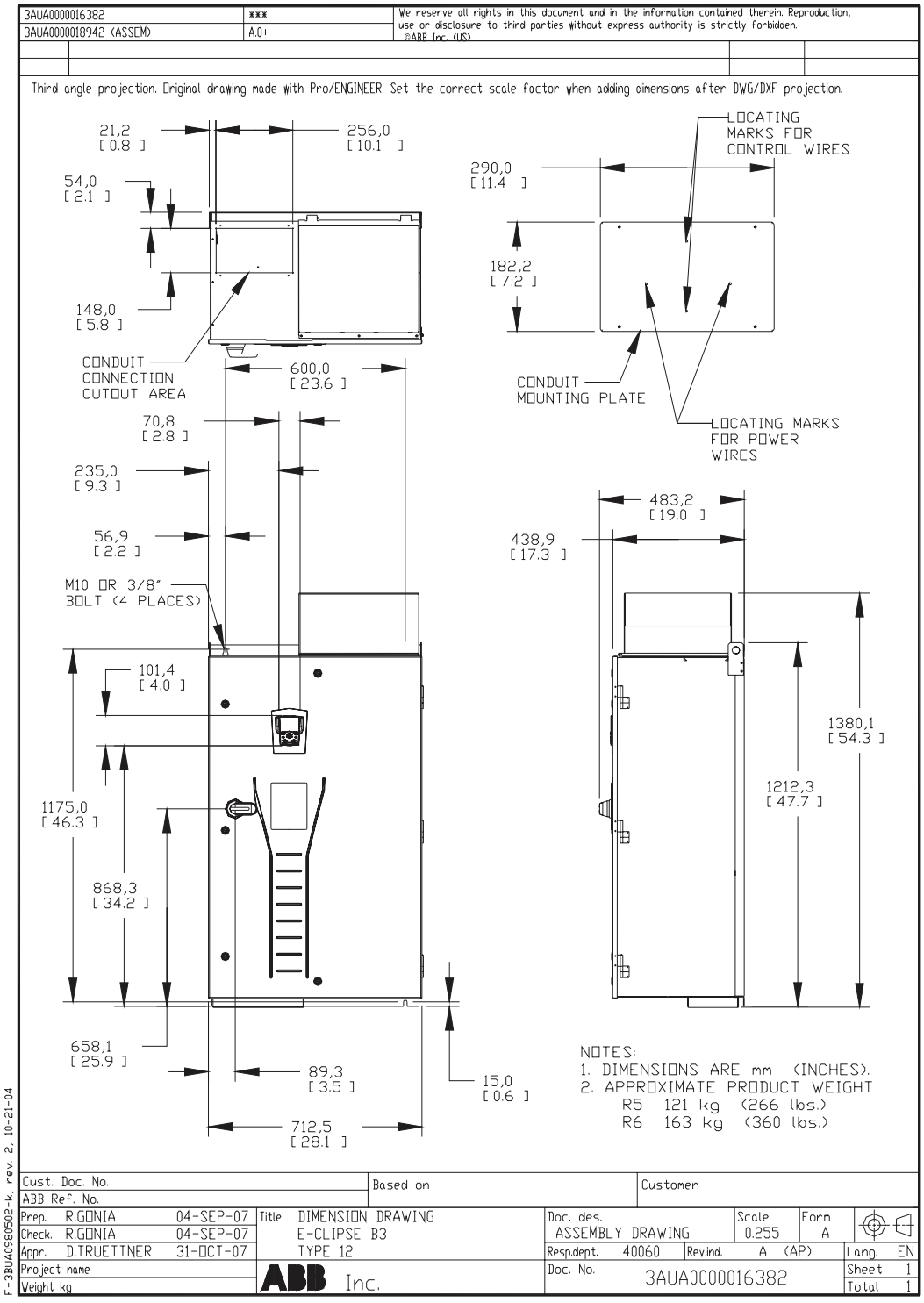


Basic Control Connections for Damper Actuator Control

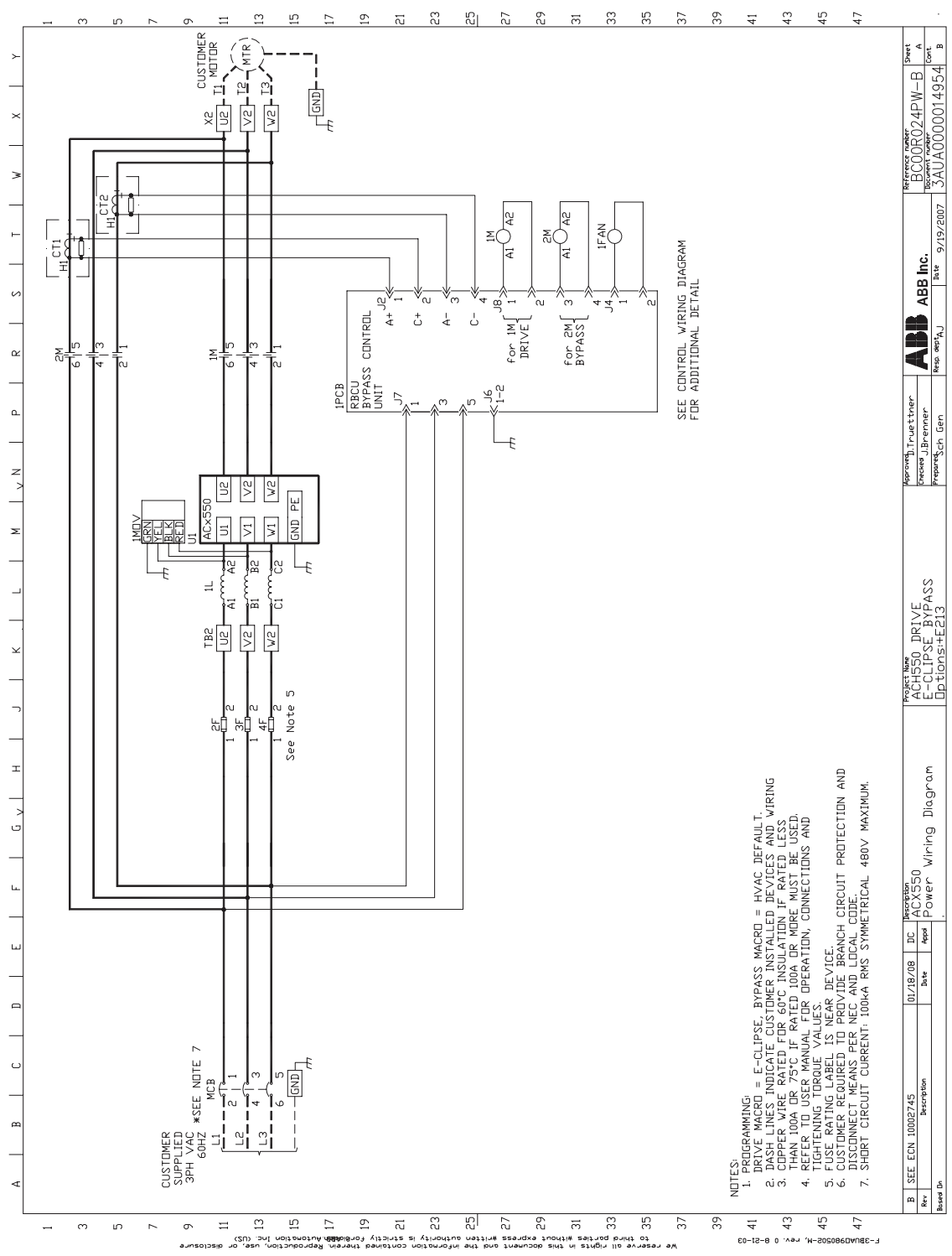
Dimension Drawing for 60 HP



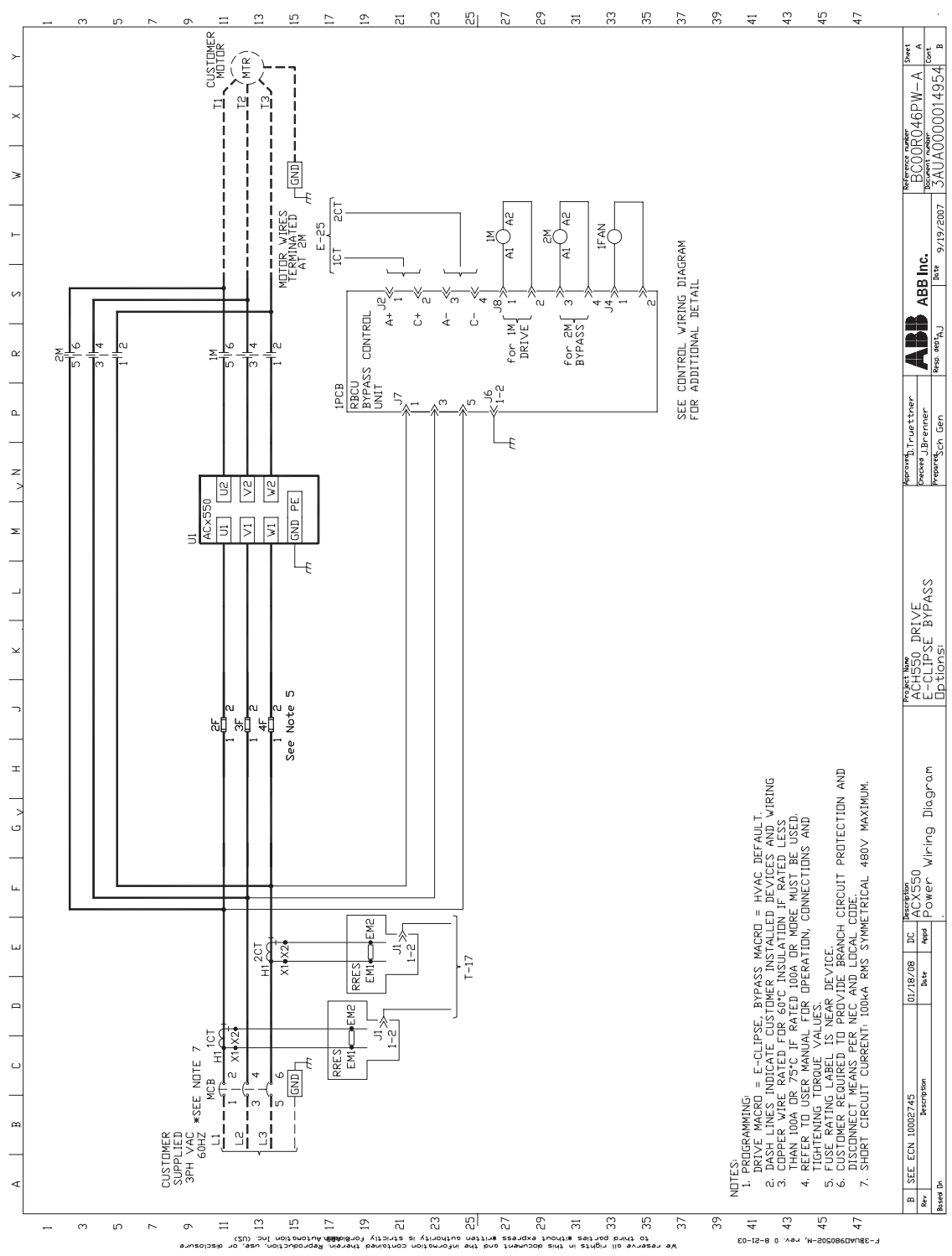
Dimension Drawing for 125 HP, 150 HP



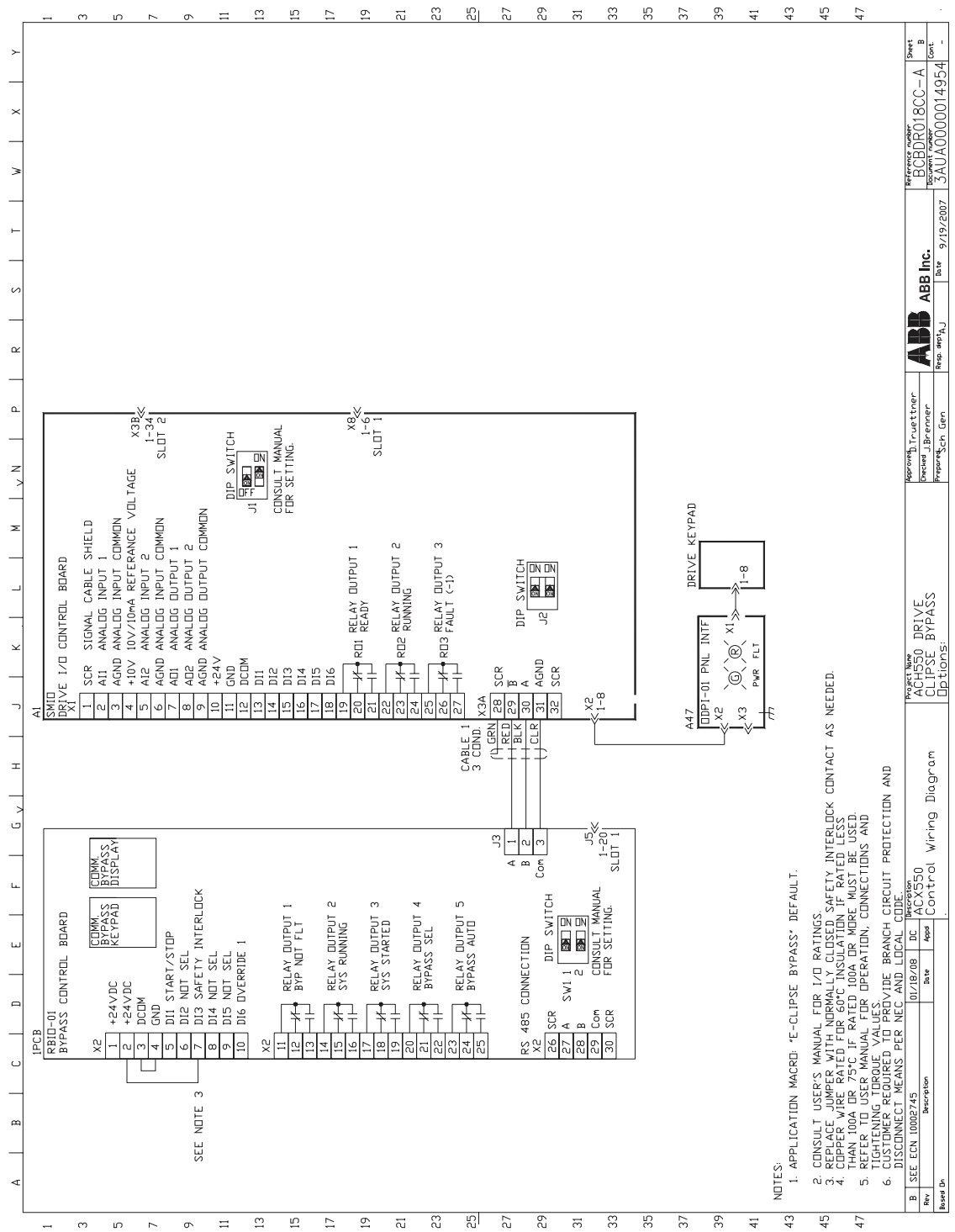
Power Drawing for 60 HP



Power Drawing for 125 HP, 150 HP



Connection Drawing for 60 HP, 125 HP, 150 HP



CORPORATE EQUIPMENT COMPANY

SALES AND SERVICE OF ENGINEERED PUMPING EQUIPMENT SINCE 1948

July 24, 2007

INSTALLATION, OPERATION & MAINTENANCE MANUAL

PROJECT: Cincinnati Bell Telephone
Chiller Upgrade

ENGINEER: Pedco E&A Services, Inc.

CONTRACTOR: Peck, Hannaford + Briggs, Inc.
P.O. S-89688-887

Equipment:

(2) Condenser Water Pumps

Peerless Pump model 10AE14A with base, coupling and 125 HP, 1800 RPM, premium efficiency motors.

(3) Chilled Water Pumps

Peerless Pump model 8AE15 with base, coupling and 150 HP, 1800 RPM, premium efficiency motors.

IOM Manual - Horizontal Pumps.

IOM Manual - Peerless AE Mechanical Seals.

REK/dlm
submittal
cintibell70724

607 REDNA TERRACE, NO. 100 CINCINNATI, OHIO 45215 513-771-6696 FAX: 771-0334

PEERLESS PUMP

Corporate Equipment Company

Cincinnati, Oh 45215
Ron Kastner Ext 113
Phone 513-771-6696
Fax 513-771-0334

Customer : Corporate Equipment Company
Peck Hannaford & Briggs
C/O Cincinnati Bell Telephone
Cincinnati, Oh
45201

Contact :

Project : Cincinnati Bell Chiller Upgrade
Quote No. : Cinti Bell PHB Order S89688-887 01 Page No : 10

Phone : 513-702-5427 Fax :
Date : Sunday, February 11, 2007

Item: Condenser Water Pumps
Model : Peerless - 10AE14A

Flow (US gpm)	Head (ft)	Eff. (%)	Power (hp)	Speed (RPM)
5583	70	84.5	120.3	1781
Liquid	**Temp. (°F)**	**Sp. Gravity**	**Visc. (cSt)**	**Dia. (inch)**
Water	68	1.000	1.007	10.95

Summary Quotation:

Item No	Description	Weight (lb)	Qty
1	10AE14A - CI/Brz Fit Horiz Mount, Mechanical Seal	2760	2
2	CI Casing with 125lb Suct /125lb Disch FF ANSI flanges	0	2
3	Hardware & Gasket for 125lb/125lb ANSI Flanged Casing	0	2
4	Bronze Impeller with Integral Rings	0	2
5	Bronze Casing Rings	0	4
6	Standard Grease Lube Bearings	0	2
7	RH 416 SS Shaft Double Row Outboard Bearing	0	2
8	Double Row Outboard/Sgl Row Inboard Brgs with Std Lip Seals	0	2
9	416 SS Shaft Sleeves (set of 2)	0	2
10	Std Mech Seals 225° F Max (set of 2)	0	2
11	Two Cyclone Separator Flush Piping Mounted	12	2
12	B 180 N-EUPEX, Flexible Coupling, Flender	61.6	2
13	Standard Fab Steel, Coupling Guard, Factory	16	2
14	Horiz Fab Non-Drip Rim Base, Mounting Parts, Factory	630	2
15	125Hp 1800R 405TS 460V 3P 60Hz FullVoltStart PremEff 1.15SF, Horiz Ft Mtd Mtr ODP F1, WEG	2414	2

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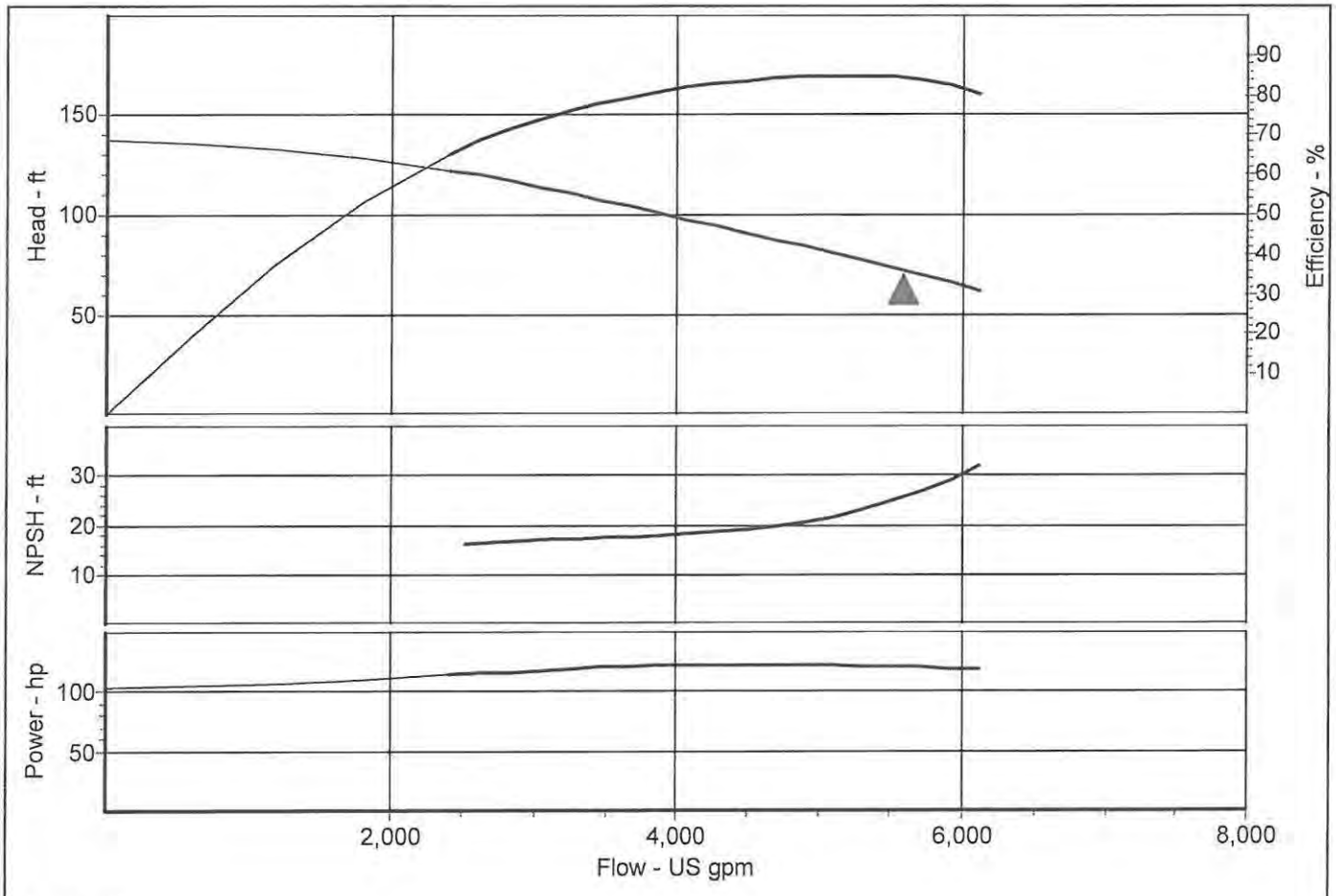
Date : Sunday, February 11, 2007

Pump Model:	**Peerless - 10AE14A**	Nom. Speed:	**1781**	RPM, 60 Hz Electric	Duty Flow :	**5583**	US gpm
Type:	**AE Horiz Mtg - Horizontal Split Case Single Stage**	Impeller Dia.:	**10.95**	inch	Duty Head :	**70**	ft
					Efficiency :	**84.5**	%
		Temperature:	**68**	°F	Power Required :	**120.3**	hp
		Viscosity:	**1.007**	cSt	NPSH Required :	**25.4**	ft
Curve No.:	**3132135**	Sp. Gravity:	**1.000**		Peak Power:	**122.4**	hp
Impeller No.	**2693193**	Fluid:	**Water**		Closed Valve Pressure	**138.1**	ft
Item :	**Condenser Water Pumps**						
Your Ref.:		Tolerance :	**Hyd Inst-Peerless Std**				



Comments:
Performance curve represents typical performance. See Standard Hydraulic Performance document in the selective printing area of RAPID for testing tolerances & contractual guarantees.

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Phone : 513-702-5427 **Fax :**
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Flow (US gpm)	Head (ft)	Efficiency (%)	Power Required (hp)	NPSH Required (ft)
2406.7	122.4	65.3	114.0	
2870.6	116.3	72.1	116.9	16.9
3334.5	109.3	77.1	119.4	17.4
3798.4	101.8	80.6	121.3	17.8
4262.3	94.2	82.9	122.3	18.5
4726.2	86.5	84.4	122.3	19.8
5190.1	78.9	85.1	121.5	22.3
5654.0	70.8	84.2	120.1	26.1
6117.8	61.6	80.4	118.4	31.9

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Flow (US gpm)	Head (ft)	Eff. (%)	Power (hp)	Speed (RPM)
5583	70	84.5	120.3	1781
Liquid	**Temp. (°F)**	**Sp. Gravity**	**Visc. (cSt)**	**Dia. (inch)**
Water	68	1.000	1.007	10.95

Technical Information:

Technical Information: **10AE14A**

Casing Suction Design	Double
Casing Volute Design	Double
Nominal Casing Thickness Inches	0.62
Corrosion Allow Inches	0.12
Max Suct Press PSI MechSeal 125# Suct less than or = to 150°F CI	150
Max Suct Press PSI MechSeal 250# Suct less than or = to 150°F CI	150
Max Suct Press PSI MechSeal 250# Suct less than or = to 150°F DI	150
Max Suct Press PSI Packed 125# Suct CI Csg	150
Max Suct Press PSI Packed 250# Suct CI Csg	150
Max Suct Press PSI Packed 250# Suct DI Csg	150
Max Work Press PSI MechSeal 125# Dischg less than or = to 150°F CI	175
Max Work Press PSI MechSeal 250# Dischg less than or = to 150°F CI	250
Max Work Press PSI MechSeal 250# Dischg less than or = to 150°F DI	Refer to factory
Max Work Press PSI Packed 125# Disch CI Csg	175
Max Work Press PSI Packed 250# Disch CI Csg	250
Max Work Press PSI Packed 250# Disch DI Csg	Not Available
Max Suct Press PSI Mech Seal 125# Suct 200°F CI	137
Max Suct Press PSI Mech Seal 250# Suct 200°F CI	137
Max Suct Press PSI Mech Seal 250# Suct 200°F DI	137
Max Suct Press PSI Packed 125# Suct 200°F CI	137
Max Suct Press PSI Packed 250# Suct 200°F CI	137
Max Suct Press PSI Packed 250# Suct 200°F DI	137
Max Work Press PSI Mech Seal 125# Disc 200°F CI	162

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Max Work Press PSI Mech Seal 250# Disc 200°F CI	232
Max Work Press PSI Mech Seal 250# Disc 200°F DI	Not Available
Max Work Press PSI Packed 125# Disch 200°F CI	162
Max Work Press PSI Packed 250# Disch 200°F CI	232
Max Work Press PSI Packed 250# Disch less than or = to 200°F DI	Not Available
Max Suct Press PSI Mech Seal 125# Suct less than or = to 225°F CI	125
Max Suct Press PSI Mech Seal 250# Suct less than or = to 225°F CI	125
Max Suct Press PSI Mech Seal 250# Suct less than or = to 225°F DI	Not Available
Max Suct Press PSI Packed 125# Suct less than or = to 250°F CI	125
Max Suct Press PSI Packed 250# Suct less than or = to 250°F CI	125
Max Suct Press PSI Pack 250# Suct 250° F DI	Not Available
Max Work Press PSI Mech Seal 125# Dischg less than or = to 225°F CI	130
Max Work Press PSI Mech Seal 250# Dischg less than or = to 225°F CI	225
Max Work Press PSI Mech Seal 250# Dischg less than or = to 225°F DI	Not Available
Max Work Press PSI Pack 125# Dischg less than or equal to 250°F CI	150
Max Work Press PSI Packed 250# Dischg less than or = to 250°F CI	215
Max Work Press PSI Packed 250# Dischg less than or = to 250°F DI	Not Available
Shaft Diameter Through Impeller Inches	2.5
Shaft Dia Through Coupling Inches	2.25
Cutwater Diameter Inches	15.08
Impeller Diameter at 90% of Cutwater Diameter	13.57
Impeller Diameter at 85% of Cutwater Diameter	12.82
Minimum Impeller Diameter Inches	Not Applicable
Minimum Impeller Average Diameter Inches	10
WR2 Lb-Ft2 Wet Bronze Impeller	16
Number of Impeller Vanes	8
Stuffing Box Shaft Sleeve Diameter Inches	2.75
Stuffing Box Bore Inches	4
Stuffing Box Depth Inches	4.12
Stuffing Box Face Nearest Obstruction Along Shaft In	2.44
Stuffing Box Square Packing Inches	0.625
Stuffing Box Packing Rows without Lantern Ring	6

Corporate Equipment Company

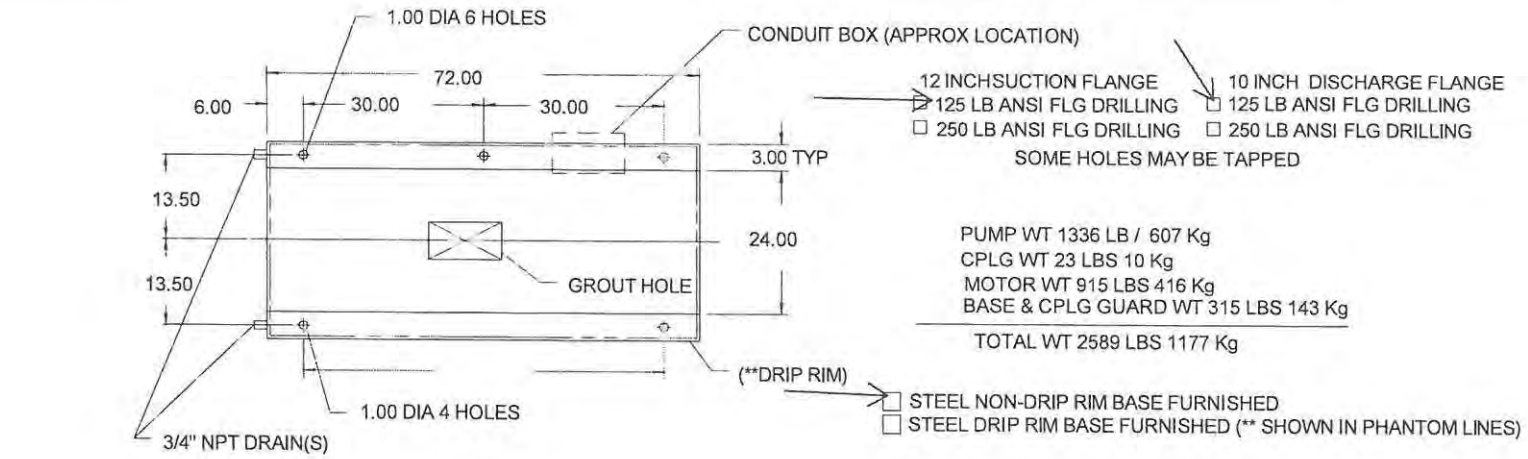
Cincinnati, Oh 45215
Ron Kastner Ext 113
Phone 513-771-6696
Fax 513-771-0334

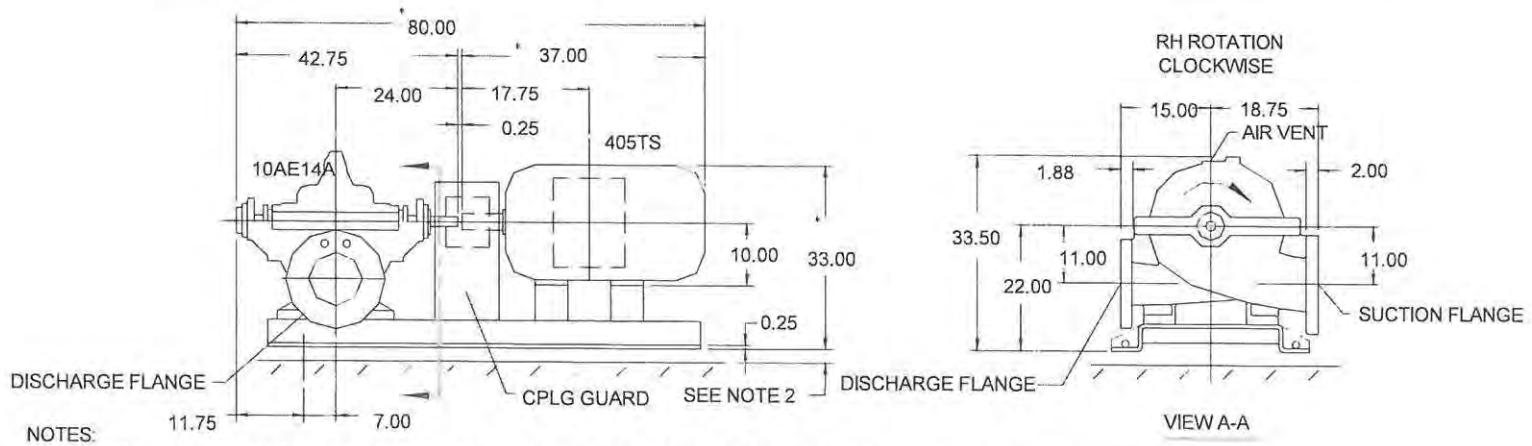
Customer : Corporate Equipment Company
Peck Hannaford & Briggs
C/O Cincinnati Bell Telephone
Cincinnati, Oh
45201

Contact :

Project : Cincinnati Bell Chiller Upgrade
Quote No. : Cinti Bell PHB Order S89688-887 01 **Page No :** 15
Phone : 513-702-5427 **Fax :**
Date : Sunday, February 11, 2007

Stuffing Box Packing Rows with Lantern Ring	5
Stuffing Box Gland Bolt Circle	7.5
Stuffing Box Gland Bolt Dia Inches	0.625
Radial Single Row Bearing Size	212
Thrust Single Row Bearing Size	310
Thrust Double Row Bearing Size Optional	5310
Priming Connection NPT	1
Discharge Drain NPT	1
Suction Drain NPT	0.5
First Critical Speed RPM	4052
Max Pump RPM Standard Construction	1800
Max Pump RPM Special Construction	2000
Rotor Series	5





NOTES:

1. UNIT INSTALLATION & FINAL CPLG ALIGNMENT MUST BE IN ACCORDANCE TO BULLETIN 2880549.
2. CUSTOMER MUST FILL BASE WITH GROUT ALLOWING .75 TO 1.50 INCH OF GROUT BETWEEN FOUNDATION AND BOTTOM OF BASE.

*MAXIMUM DIMENSIONS, MAY BE LESS WITH DIFFERENT MAKE MOTORS OR ENCLOSURES.

Dimensions in (inch)

Project :	Cincinnati Bell Chiller Upgrade	**Capacity:**	5583 (US gpm)	**Frame/Model:**	405TS
Customer:	Corporate Equipment Company	**Total Head:**	70 (ft)	**Elec. Spec.:**	3 Ph. 460 V. 60 Hz
Item No.:	Condenser Water Pumps	**Pump Speed:**	1781 (RPM)	**Service Factor:**	1.15
Quote No. :	Cinti Bell PHB Order S89688-887 01	**Impeller Dia.:**	10.95 (inch)	**Rotation:**	Clockwise
Pump Model:	Peerless - 10AE14A	**Power:**	125 (hp)	**Enclosure/Type:**	ODP

PEERLESS PUMP®

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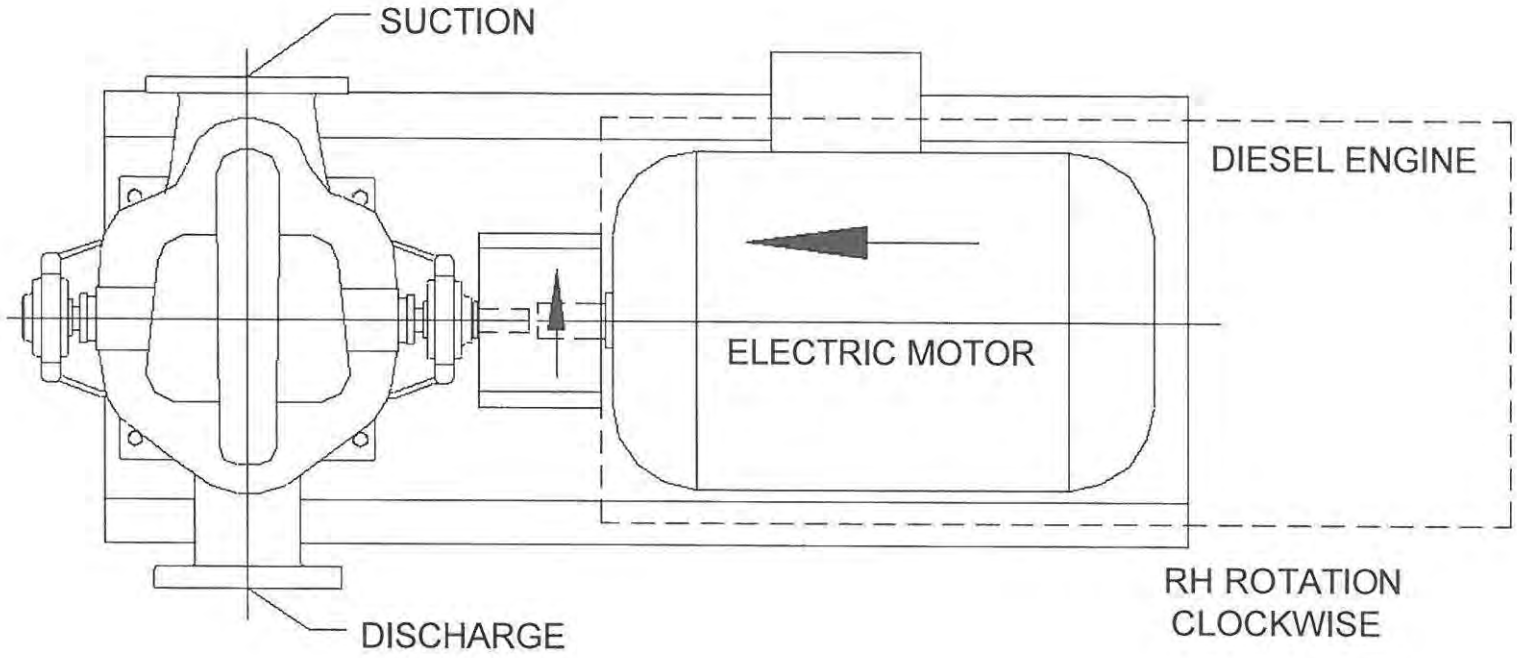
Date : Sunday, February 11, 2007

Page No : 16



10AE14A

Dimensions in (inch)

Project :	Cincinnati Bell Chiller Upgrade	**Capacity:**	5583 (US gpm)	**Frame/Model:**	405TS
Customer:	Corporate Equipment Company	**Total Head:**	70 (ft)	**Elec. Spec.:**	3 Ph. 460 V. 60 Hz
Item No.:	Condenser Water Pumps	**Pump Speed:**	1781 (RPM)	**Service Factor:**	1.15
Quote No. :	Cinti Bell PHB Order S89688-887 01	**Impeller Dia.:**	10.95 (inch)	**Rotation:**	Clockwise
Pump Model:	Peerless - 10AE14A	**Power:**	125 (hp)	**Enclosure/Type:**	ODP

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Fax 513-771-0334

Date : Sunday, February 11, 2007
Page No : 17

Peerless Pump Company. - Indianapolis, IN 46207-7026

ELECTRIC MOTOR DRIVER
Performance and Data Sheet

Manufacturer	WEG INVERTER DUTY MOTOR
Catalog No.	12518OT3GRB405TS
Type	12518OT3GRB4
Motor Hp	125
Synch Rpm	1800
Motor Frame	405TS
Low Voltage	0
High Voltage	460
Phase	3
Hertz	60
Motor Type	SCI
NEMA Design	B
Enclosure	ODP
Class Insulation	F
Service Factor	1.15
Type Starting	FULL VOLT
Type Motor Efficiency	PREM
Construction	Cast Iron
Full Load Rpm	1780
Full Load Efficiency %	95.4
Full Load Power Factor %	86
Low Voltage Full Load Amps	282
High Voltage Full Load Amps	141
Low Voltage Locked Rotor Amps	0
High Voltage Locked Rotor Amps	0
Maximum Altitude in Feet	3300
Rotation Facing Opposite Shaft End	Clockwise

The above data are not certified being extracted from manufacturer's published catalog data sheets.

WARRANTY

New equipment manufactured by Peerless Pump Company. (Seller) is warranted to be free from defects in material and workmanship under normal use and service for a period of one year from date of shipment, Seller's obligation under this warranty being limited to repairing or replacing at its option any part found to be so defective provided that such part is, upon request, returned to Seller's factory from which it was shipped, transportation prepaid.

This warranty does not cover parts damaged by decomposition from chemical action or wear caused by abrasive materials, nor does it cover damage resulting from misuse, accident, neglect, or from improper operation, maintenance, installation, modification or adjustment.

This warranty does not cover parts repaired outside Seller's factory without prior written approval. Seller makes no warranty as to starting equipment, electrical apparatus or other material not of its manufacture, since the same are usually covered by warranties of the respective manufacturers thereof.

In the event, notwithstanding the terms of this agreement, it is determined by a court of competent jurisdiction that an express warranty has been given by Seller to Purchaser with respect to the head, capacity or other like performance characteristics of said equipment, Seller's liability for breach of the same shall be limited to accepting return of such equipment F.O.B. plant of manufacture, refunding any amount paid thereon by Purchaser (less depreciation at the rate of 15% per year if Purchaser has used equipment for more than thirty (30) days) and canceling any balance still owing on the equipment.

Peerless Pump Company. in no event will be liable for indirect or consequential damages.

This warranty is expressly in lieu of any other warranties, expressed or implied, and seller specifically disclaims any implied warranty of merchantability or fitness for a particular purpose.

Peerless Pump Company
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PEERLESS PUMP

Corporate Equipment Company

Cincinnati, Oh 45215
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Fax 513-771-0334

Customer : Corporate Equipment Company
Peck Hannaford & Briggs
C/O Cincinnati Bell Telephone
Cincinnati, Oh
45201

Contact :

Project : Cincinnati Bell Chiller Upgrade
Quote No. : Cinti Bell PHB Order S89688-887 01 Page No : 1

Phone : 513-702-5427 Fax :
Date : Sunday, February 11, 2007

Item: Chilled Water Pumps
Model : Peerless - 8AE15

Flow (US gpm)	Head (ft)	Eff. (%)	Power (hp)	Speed (RPM)
2900	150	84.7	133.65	1782
Liquid	**Temp. (°F)**	**Sp. Gravity**	**Visc. (cSt)**	**Dia. (inch)**
Water	68	1.000	1.007	13.11

Summary Quotation:

Item No	Description	Weight (lb)	Qty
1	8AE15 - CI/Brz Fit Horiz Mount, Mechanical Seal	2625	3
2	CI Casing with 125lb Suct /125lb Disch FF ANSI flanges	0	3
3	Hardware & Gasket for 125lb/125lb ANSI Flanged Casing	0	3
4	Bronze Impeller with Integral Rings	0	3
5	Bronze Casing Rings	0	6
6	Standard Grease Lube Bearings	0	3
7	RH 416 SS Shaft Double Row Outboard Bearing	0	3
8	Double Row Outboard/Sgl Row Inboard Brgs with Std Lip Seals	0	3
9	416 SS Shaft Sleeves (set of 2)	0	3
10	Std Mech Seals 225° F Max (set of 2)	0	3
11	No Mechanical Seal Flush Piping	0	3
12	B 180 N-EUPEX, Flexible Coupling, Flender	92.4	3
13	Standard Fab Steel, Coupling Guard, Factory	24	3
14	Horiz Fab Non-Drip Rim Base, Mounting Parts, Factory	945	3
15	150Hp 1800R 444TS 460V 3P 60Hz FullVoltStart PremEff 1.15SF, Horiz Ft Mtd Mtr ODP F1, WEG	4827	3

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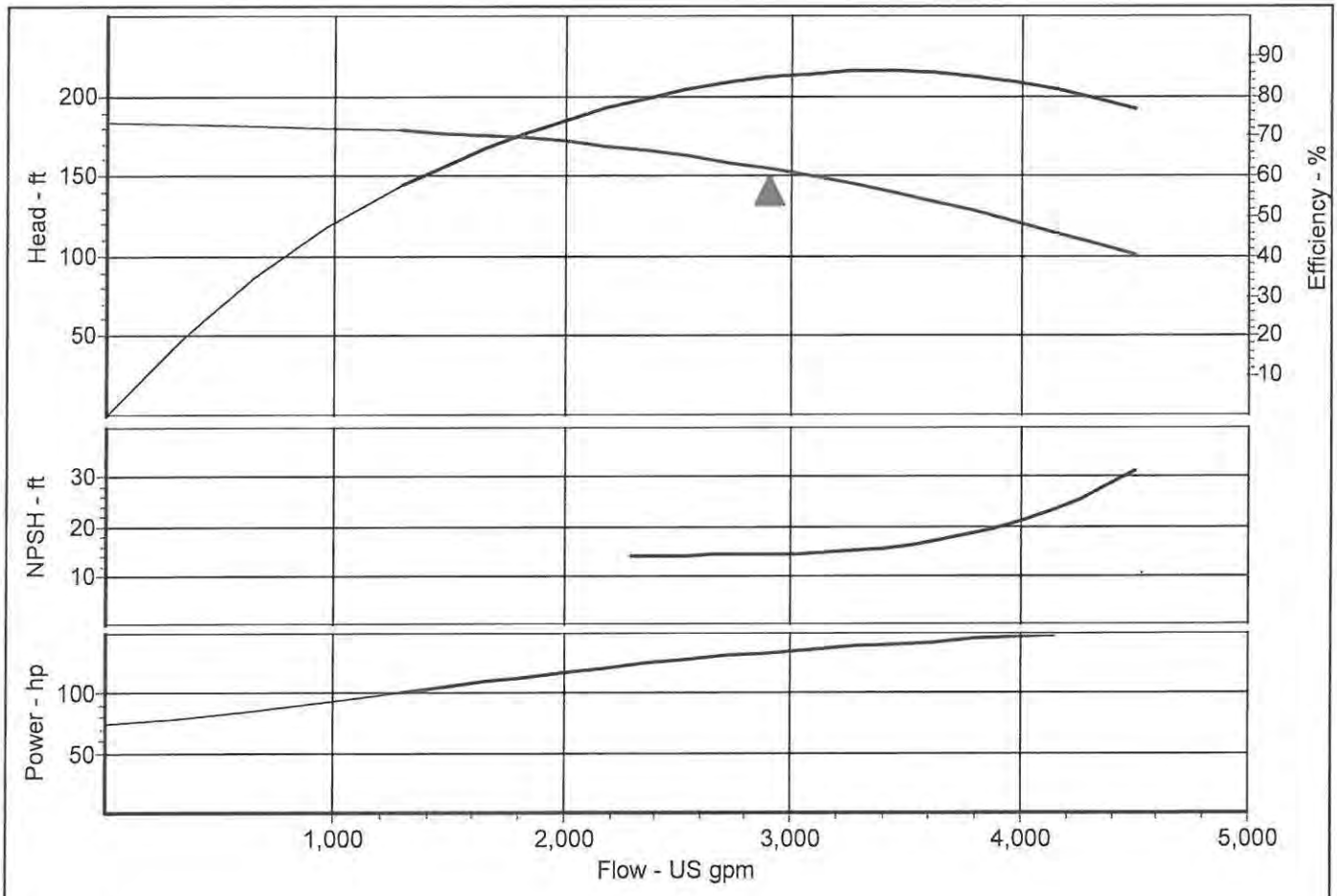
Contact :

Project : Cincinnati Bell Chiller Upgrade
Quote No. : Cinti Bell PHB Order S89688-887 01 **Page No. :** 2
Phone : 513-702-5427 **Fax :**
Date : Sunday, February 11, 2007

Pump Model:	**Peerless - 8AE15**	Nom. Speed:	**1782**	RPM, 60 Hz Electric	Duty Flow :	**2900**	US gpm
Type:	**AE Horiz Mtg - Horizontal Split Case Single Stage**	Impeller Dia.:	**13.11**	inch	Duty Head :	**150**	ft
					Efficiency :	**84.7**	%
		Temperature:	**68**	°F	Power Required :	**133.7**	hp
		Viscosity:	**1.007**	cSt	NPSH Required :	**14.3**	ft
Curve No.:	**3112026R**	Sp. Gravity:	**1.000**		Peak Power:	**149.6**	hp
Impeller No.	**2692769**	Fluid:	**Water**		Closed Valve Pressure	**183.2**	ft
Item :	**Chilled Water Pumps**						
Your Ref.:		Tolerance :	**Hyd Inst-Peerless Std**				



Comments:
Performance curve represents typical performance. See Standard Hydraulic Performance document in the selective printing area of RAPID for testing tolerances & contractual guarantees.

Corporate Equipment Company

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45201

Contact :

Project : Cincinnati Bell Chiller Upgrade
Quote No. : Cinti Bell PHB Order S89688-887 01 **Page No. :** 3

Phone : 513-702-5427 **Fax :**
Date : Sunday, February 11, 2007

Flow (US gpm)	Head (ft)	Efficiency (%)	Power Required (hp)	NPSH Required (ft)
1291.3	178.4	57.7	100.8	
1692.6	175.2	67.8	110.4	
2094.0	170.2	75.5	119.2	
2495.4	163.4	81.1	127.0	14.1
2896.7	154.6	84.6	133.6	14.3
3298.1	143.9	86.1	139.2	15.1
3699.4	131.3	85.3	143.8	17.6
4100.8	116.9	82.2	147.4	22.7
4502.2	100.6	76.4	149.6	31.1

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Cincinnati, Oh
45201

Contact :

Project : Cincinnati Bell Chiller Upgrade
Quote No. : Cinti Bell PHB Order S89688-887 01 Page No : 4

Phone : 513-702-5427 Fax :
Date : Sunday, February 11, 2007

Item: Chilled Water Pumps
Model : Peerless - 8AE15

Flow (US gpm)	Head (ft)	Eff. (%)	Power (hp)	Speed (RPM)
2900	150	84.7	133.65	1782
Liquid	**Temp. (°F)**	**Sp. Gravity**	**Visc. (cSt)**	**Dia. (inch)**
Water	68	1.000	1.007	13.11

Technical Information:

Technical Information: **8AE15**

Casing Suction Design	Double
Casing Volute Design	Single
Nominal Casing Thickness Inches	0.56
Corrosion Allow Inches	0.12
Max Suct Press PSI MechSeal 125# Suct less than or = to 150°F CI	150
Max Suct Press PSI MechSeal 250# Suct less than or = to 150°F CI	150
Max Suct Press PSI MechSeal 250# Suct less than or = to 150°F DI	150
Max Suct Press PSI Packed 125# Suct CI Csg	175
Max Suct Press PSI Packed 250# Suct CI Csg	175
Max Suct Press PSI Packed 250# Suct DI Csg	175
Max Work Press PSI MechSeal 125# Dischg less than or = to 150°F CI	175
Max Work Press PSI MechSeal 250# Dischg less than or = to 150°F CI	250
Max Work Press PSI MechSeal 250# Dischg less than or = to 150°F DI	Refer to factory
Max Work Press PSI Packed 125# Disch CI Csg	175
Max Work Press PSI Packed 250# Disch CI Csg	250
Max Work Press PSI Packed 250# Disch DI Csg	Not Available
Max Suct Press PSI Mech Seal 125# Suct 200°F CI	150
Max Suct Press PSI Mech Seal 250# Suct 200°F CI	150
Max Suct Press PSI Mech Seal 250# Suct 200°F DI	150
Max Suct Press PSI Packed 125# Suct 200°F CI	162
Max Suct Press PSI Packed 250# Suct 200°F CI	162
Max Suct Press PSI Packed 250# Suct 200°F DI	162
Max Work Press PSI Mech Seal 125# Disc 200°F CI	162

PEERLESS PUMP

Corporate Equipment Company

Cincinnati, Oh 45215
Ron Kastner Ext 113
Phone 513-771-6696
Fax 513-771-0334

Customer : Corporate Equipment Company
Peck Hannaford & Briggs
C/O Cincinnati Bell Telephone
Cincinnati, Oh
45201

Contact :

Project : Cincinnati Bell Chiller Upgrade
Quote No. : Cinti Bell PHB Order S89688-887 01 Page No : 5

Phone : 513-702-5427 Fax :
Date : Sunday, February 11, 2007

Max Work Press PSI Mech Seal 250# Disc 200°F CI	232
Max Work Press PSI Mech Seal 250# Disc 200°F DI	Not Available
Max Work Press PSI Packed 125# Disch 200°F CI	162
Max Work Press PSI Packed 250# Disch 200°F CI	232
Max Work Press PSI Packed 250# Disch less than or = to 200°F DI	Not Available
Max Suct Press PSI Mech Seal 125# Suct less than or = to 225°F CI	150
Max Suct Press PSI Mech Seal 250# Suct less than or = to 225°F CI	150
Max Suct Press PSI Mech Seal 250# Suct less than or = to 225°F DI	Not Available
Max Suct Press PSI Packed 125# Suct less than or = to 250°F CI	150
Max Suct Press PSI Packed 250# Suct less than or = to 250°F CI	150
Max Suct Press PSI Pack 250# Suct 250° F DI	Not Available
Max Work Press PSI Mech Seal 125# Dischg less than or = to 225°F CI	160
Max Work Press PSI Mech Seal 250# Dischg less than or = to 225°F CI	225
Max Work Press PSI Mech Seal 250# Dischg less than or = to 225°F DI	Not Available
Max Work Press PSI Pack 125# Dischg less than or equal to 250°F CI	150
Max Work Press PSI Packed 250# Dischg less than or = to 250°F CI	215
Max Work Press PSI Packed 250# Dischg less than or = to 250°F DI	Not Available
Shaft Diameter Through Impeller Inches	2.125
Shaft Dia Through Coupling Inches	1.875
Cutwater Diameter Inches	16.38
Impeller Diameter at 90% of Cutwater Diameter	14.74
Impeller Diameter at 85% of Cutwater Diameter	13.92
Minimum Impeller Diameter Inches	Not Applicable
Minimum Impeller Average Diameter Inches	10.25
WR2 Lb-Ft2 Wet Bronze Impeller	8.8
Number of Impeller Vanes	7
Stuffing Box Shaft Sleeve Diameter Inches	2.375
Stuffing Box Bore Inches	3.5
Stuffing Box Depth Inches	3.75
Stuffing Box Face Nearest Obstruction Along Shaft In	2.2
Stuffing Box Square Packing Inches	0.5625
Stuffing Box Packing Rows without Lantern Ring	6

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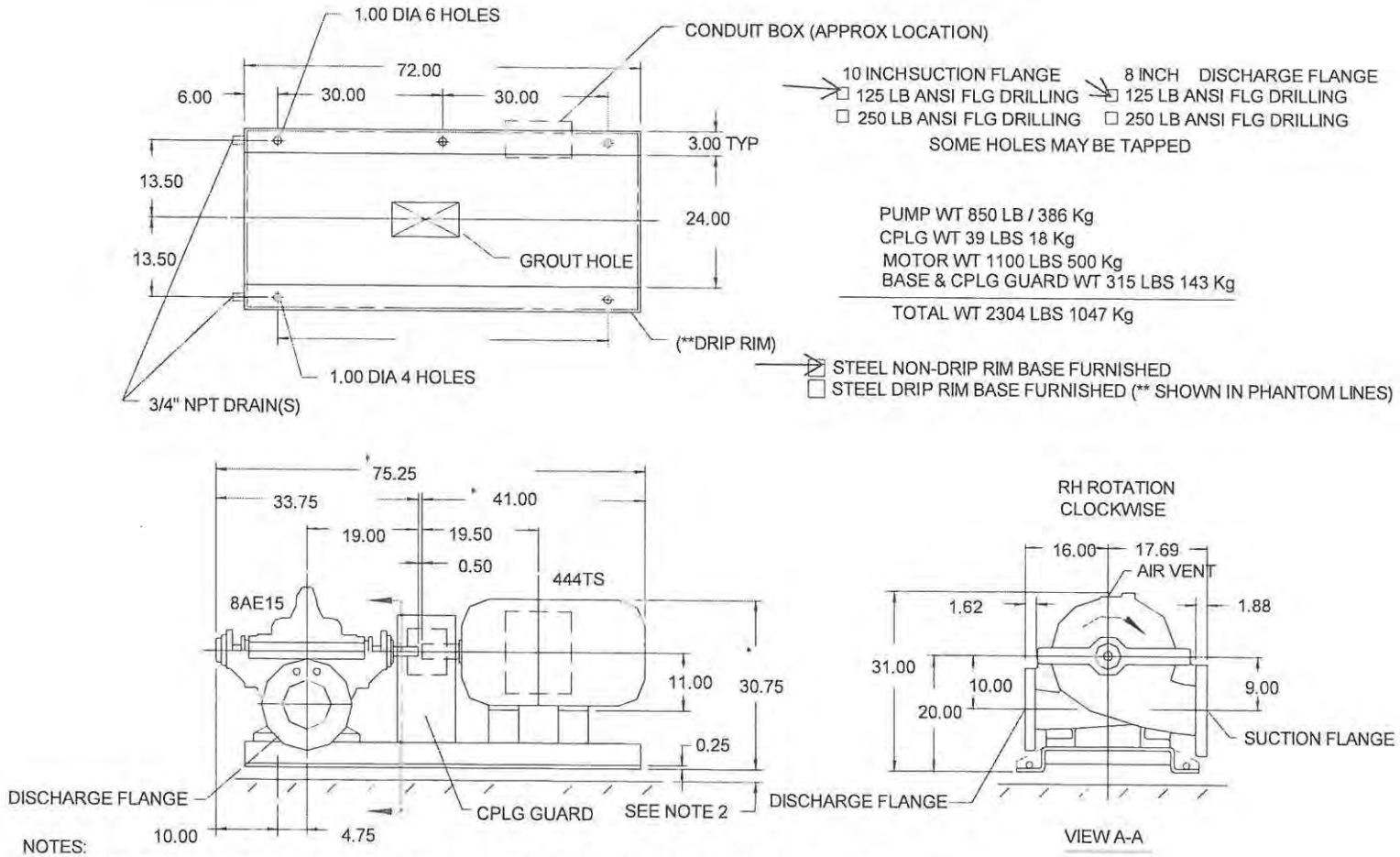
Quote No. : Cinti Bell PHB Order S89688-887 01 **Page No :** 6

Phone : 513-702-5427 **Fax :**
Date : Sunday, February 11, 2007

Stuffing Box Packing Rows with Lantern Ring	5
Stuffing Box Gland Bolt Circle	6.25
Stuffing Box Gland Bolt Dia Inches	0.625
Radial Single Row Bearing Size	210
Thrust Single Row Bearing Size	308
Thrust Double Row Bearing Size Optional	5308
Priming Connection NPT	1
Discharge Drain NPT	0.75
Suction Drain NPT	0.5
First Critical Speed RPM	6013
Max Pump RPM Standard Construction	1800
Max Pump RPM Special Construction	Not Available
Rotor Series	4



NOTES:

1. UNIT INSTALLATION & FINAL CPLG ALIGNMENT MUST BE IN ACCORDANCE TO BULLETIN 2880549.
2. CUSTOMER MUST FILL BASE WITH GROUT ALLOWING .75 TO 1.50 INCH OF GROUT BETWEEN FOUNDATION AND BOTTOM OF BASE.

*MAXIMUM DIMENSIONS, MAY BE LESS WITH DIFFERENT MAKE MOTORS OR ENCLOSURES.

Dimensions in (inch)

Project :	Cincinnati Bell Chiller Upgrade	**Capacity:**	2900 (US gpm)	**Frame/Model:**	444TS
Customer:	Corporate Equipment Company	**Total Head:**	150 (ft)	**Elec. Spec.:**	3 Ph. 460 V. 60 Hz
Item No.:	Chilled Water Pumps	**Pump Speed:**	1782 (RPM)	**Service Factor:**	1.15
Quote No. :	Cinti Bell PHB Order S89688-887 01	**Impeller Dia.:**	13.11 (inch)	**Rotation:**	Clockwise
Pump Model:	Peerless - 8AE15	**Power:**	150 (hp)	**Enclosure/Type:**	ODP

PEERLESS PUMP®

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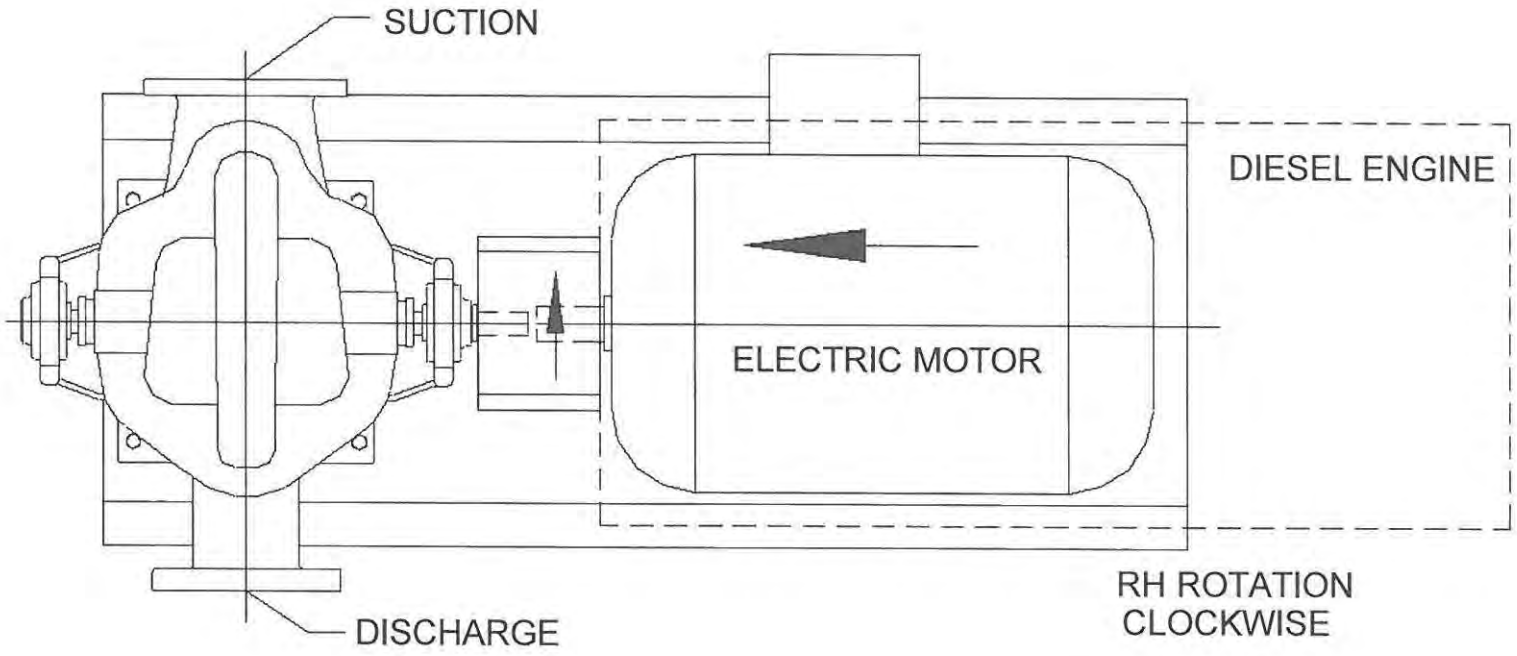
Fax 513-771-0334

Date : Sunday, February 11, 2007

Page No : 7



8AE15

Dimensions in (inch)

Project :	Cincinnati Bell Chiller Upgrade	**Capacity:**	2900 (US gpm)	**Frame/Model:**	444TS
Customer:	Corporate Equipment Company	**Total Head:**	150 (ft)	**Elec. Spec.:**	3 Ph. 460 V. 60 Hz
Item No.:	Chilled Water Pumps	**Pump Speed:**	1782 (RPM)	**Service Factor:**	1.15
Quote No. :	Cinti Bell PHB Order S89688-887 01	**Impeller Dia.:**	13.11 (inch)	**Rotation:**	Clockwise
Pump Model:	Peerless - 8AE15	**Power:**	150 (hp)	**Enclosure/Type:**	ODP

PEERLESS PUMP®

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Phone 513-771-6696
Fax 513-771-0334

Date : Sunday, February 11, 2007
Page No : 8

Peerless Pump Company. - Indianapolis, IN 46207-7026

ELECTRIC MOTOR DRIVER
Performance and Data Sheet

Manufacturer	WEG INVERTER DUTY MOTOR
Catalog No.	15018OT3GRB444TS
Type	15018OT3GRB4
Motor Hp	150
Synch Rpm	1800
Motor Frame	444TS
Low Voltage	0
High Voltage	460
Phase	3
Hertz	60
Motor Type	SCI
NEMA Design	B
Enclosure	ODP
Class Insulation	F
Service Factor	1.15
Type Starting	FULL VOLT
Type Motor Efficiency	PREM
Construction	Cast Iron
Full Load Rpm	1780
Full Load Efficiency %	95.8
Full Load Power Factor %	87
Low Voltage Full Load Amps	332
High Voltage Full Load Amps	166
Low Voltage Locked Rotor Amps	0
High Voltage Locked Rotor Amps	0
Maximum Altitude in Feet	3300
Rotation Facing Opposite Shaft End	Clockwise

The above data are not certified being extracted from manufacturer's published catalog data sheets.

ENERGY SAVINGS CALCULATIONS for ECM4

JAN 2012 V1			
Salesforce Opportunity Name	Cincinnati Bell Telephone - Domestic Water Pump VFDs		
Project Name	N/A		
Application #	11-464	Rev.	0
		State	OH

Notes:

1. Because of lack of information in the application, the following assumptions were made to calculate the energy savings for this application:
   a. Before Implementation:
      * Pumps operate according to the same schedule as for after implementation
      * Pumps operate at 100% of their design load
      * Pumps operate the consistently throughout the year, i.e., no significant monthly variations
   b. After Implementation:
      * Pumps total annual hrs of operation proportional to the total hrs in the 2 tabs in this file
      * Pump bhp is proportional to pump speed because much of the head is static head
      * VFD efficiency is 98%

Table 1

Pump Operating Hours w/VFD				
% Pump Speed w/VFD	Pumps Operating Hours			
	1	2	3	Totals
95 - 100% speed	586	568	23	1,177
90 - 95% speed	853	1,486	19	2,357
85 - 90% speed	36	149	435	620
80 - 85% speed	2	3	1,242	1,246
75 - 80% speed	1	0	229	230
<75% speed	4,151	3,422	3,681	11,253
Total	**5,628**	**5,628**	**5,628**	**16,883**

Table 2

Operating Hrs for Each Pump		
	Days/Month	Hrs/Month
Jan	0.0	0
Feb	0.0	0
Mar	0.0	0
Apr	0.0	0
May	31.0	744
Jun	30.0	720
Jul	31.0	744
Aug	31.0	744
Sep	30.0	720
Oct	31.0	744
Nov	30.0	720
Dec	20.5	492
Total	**234.5**	**5,628**

Table 3

Pump & Motor Power Usage	
pump bhp	13.5
motor efficiency	85.5%
motor input hp	15.8
motor kw wo/VFD	**11.8**
motor kw w/VFD	**12.0**

Table 4

Calculations of the kW-hr for May 1 - Dec 21			
		kw-hr/yr	
% HP Range w/VFD	% HP	Before Implem	After Implem
95 - 100%	97.5%	13,861	13,790
90 - 95%	92.5%	27,766	26,208
85 - 90%	87.5%	7,300	6,518
80 - 85%	82.5%	14,680	12,358
75 - 80%	77.5%	2,706	2,140
<75%	0.0%	0	0
Total		**66,313**	**61,014**

Table 5

Calculations of kw-hr/yr for the Entire Year			
	kw-hr/yr		
	Before Implem	After Implem	Savings
Total for the year	**103,216**	**94,968**	**8,248**

Cell: A20
Comment: bchiesa:
For the period May 1 to noon on Dec. 21 - see the "Dec21-May27 DWP 1,2,3" & the "May 21-1 DWP 1,2,3" tabs for 15-minute interval data for this period for each pump

Cell: G20
Comment: bchiesa:
For the period May 1 to noon on Dec. 21 - see the "Dec21-May27 DWP 1,2,3" & the "May 21-1 DWP 1,2,3" tabs for 15-minute interval data for this period for each pump.

Note: this table is a check on the correctness of the total number of hours for each pump in Table 1.

Cell: A29
Comment: bchiesa:
For the period May 1 to noon on Dec. 21

Cell: G34
Comment: bchiesa:
For the period May 1 to noon on Dec. 21

Cell: B35
Comment: bchiesa:
At full load - from the pump head and capacity at the design point on pg 3 of 6 & the pump head/capacity curve on pg. 5 of 6 of the "Dom Water Booster pump spec-CEC.pdf" file

Cell: B36
Comment: bchiesa:
Per pg. 4 of 6 of the "Dom Water Booster pump spec-CEC.pdf" file

Cell: A39
Comment: bchiesa:
At full load

Cell: B44
Comment: bchiesa:
Values used for calculations of kw-hr in each % HP range

Cell: B51
Comment: bchiesa:
Value of 0.0 used because the overwhelming majority of values in this range are zero.

Cell: C57
Comment: bchiesa:
Data from May 1 to Dec 21 is extrapolated to the entire year

Project Submittal for CBTS

Project Number:

Specification:

Engineering Contact:

Contractor:

Architect:

End Customer (User):

Submitted By: WRP Associates, LLC

Quotation Number: 15660362

Revision:

Date: November 14, 2011

Submittal Schedule

This schedule includes the products supplied as part of this submittal.

Schedule			Motor Data[1]			Drive Data			
Item	Qty	Tag / Equipment ID	HP	FLA	Voltage	Product ID	HP	Output Amps	Voltage
1	1	15 HP	15	21	460 VAC	ACH550-BCR-023A-4+B055	15	23	480 VAC

Notes: 1. AC Motor Data is per National Electrical Code Table 430.250 for typical motors used in most applications and is provided as typical data only. DC motor data is per typical industry standards. Actual motor data may vary.

Submittal Schedule Details for 15 HP

Item	Tag / Equipment ID	Product ID
1	15 HP	ACH550-BCR-023A-4+B055

Item Description
Input Voltage: 480 VAC **Rated Output Current:** 23 AMPS **Construction:** E-clipse-Bypass, Circuit Breaker **Enclosure:** NEMA 12 UL Type 12 **Nominal Horsepower:** 15 **Frame Size:** R2 **Input Disconnecting Means:** Circuit Breaker **Bypass:** E-Clipse Bypass **Input Impedance:** 5% **Short Circuit Current Rating:** 100 kA **Communication Protocols:** Johnson Controls N2, Siemens Buildings Technologies FLN (P1), Modbus RTU, BACnet **Other Options:**

Drive Input Fuse Ratings[1]	
(Note: Drive is UL approved without the need for input fuses. Fuse rating information provided for customer reference)	
Amps (600 V)	**Bussmann Type**
30	KTK-R-30

Wire Size Capacities of Power Terminals				
Circuit Breaker	**Disconnect Switch**	**Terminal Block**	**Overload Relay**	**Ground Lug**
#8 40 in-lbs	N/A N/A	#6 30 in-lbs	N/A N/A	#4 35 in-lbs

Dimensions and Weights				
Height in / mm	**Width in / mm**	**Depth in / mm**	**Weight lbs / kg**	**Dimension Drawing**
33.2 / 842	17.4 / 443	13.5 / 343	84 / 38.1	3AUA0000016376 Sheet 1

Heat Dissipation & Airflow Requirements			
Power Losses		**Airflow**	
Watts	**BTU/Hr**	**CFM**	**CM/Hr**
337	1150	52	88

Reference Drawings		
Power Wiring	**Connection Diagram**	**Dimension Detail**
BC00R012PW-A	BCBDR016CC-A	3AUA0000016376 Sheet 1

ACH550 Product Overview

Description

The ACH550 series is a microprocessor based Pulse Width Modulated (PWM) adjustable speed AC drive. The ACH550 drive takes advantage of sophisticated microprocessor control and advanced IGBT power switching technology to deliver high-performance control of AC motors for a wide range of HVAC applications.

With drives ranging from 1 to 550 HP, the ACH550 series features a universal full graphic interface that “speaks” to the operator in plain English phrases, greatly simplifying set-up, operation, and fault diagnosis. The ACH550 is also programmable in fourteen other languages.

Each ACH550 drive comes equipped with an extensive library of pre-programmed HVAC application macros which, at a touch of a button, allow rapid configuration of inputs, outputs, and performance parameters for specific HVAC applications to maximize convenience and minimize start-up time. The ACH550 series can handle the most demanding commercial applications in an efficient, dependable, and economic manner.

ACH550 Standard Features

- UL, cUL labeled and CE marked
- EMI/RFI Filter (1st Environment, Restricted Distribution)
- Start-Up Assistants
- Maintenance Assistants
- Diagnostic Assistants
- Real Time Clock
  - Includes Day, Date and Time
- Operator Panel Parameter Backup (read/write)
- Full Graphic and Multilingual Display for Operator Control, Parameter Set-Up and Operating Data Display:
  - Output Frequency (Hz)
  - Speed (RPM)
  - Motor Current
  - Calculated % Motor Torque
  - Calculated Motor Power (kW)
  - DC Bus Voltage
  - Output Voltage
  - Heatsink Temperature
  - Elapsed Time Meter (reset-able)
  - KWh (reset-able)
  - Input / Output Terminal Monitor
  - PID Actual Value (Feedback) & Error
  - Fault Text
  - Warning Text
  - Three (3) Scalable Process Variable Displays
  - User Definable Engineering Units
- Two (2) Programmable Analog Inputs
- Six (6) Programmable Digital Inputs
- Two (2) Programmable Analog Outputs
- Up to six (6) Programmable Relay Outputs (Three (3) Standard)
- Adjustable Filters on Analog Inputs and Outputs
- Mathematical Functions on Analog Reference Signals
- All Control Inputs Isolated from Ground and Power
- Four (4) Resident Serial Communication Protocols
  - Johnson Controls N2
  - Siemens Building Technologies FLN (P1)
  - Modbus RTU
  - BACnet (MS/TP)
- Input Speed Signals
  - Current 0 (4) to 20 mA
  - Voltage 0 (2) to 10 VDC
  - Increase/Decrease Reference Contacts (Floating Point)
  - Serial Communications
- Start/Stop
  - 2 Wire (Dry Contact Closure)
  - 3 Wire (Momentary Contact)
  - Application of Input Power
  - Application of Reference Signal (PID Sleep/Wake-Up)
  - Serial Communications
- Start Functions
  - Ramp
  - Flying Start
  - Premagnetization on Start
  - Automatic Torque Boost
  - Automatic Torque Boost with Flying Start
  - Auto Restart (Reset) – Customer Selectable and Adjustable
- Stop Functions
  - Ramp or Coast to Stop
  - Emergency Stop
  - DC Braking / Hold at Stop
  - Flux Braking
- Accel/Decel
  - Two (2) sets of Independently Ramps
  - Linear or Adjustable ‘S’ Curve Accel/Decel Ramps
- HVAC Specific Application Macros
- Separate Safeties (2) and Run Permissive Inputs
- Damper Control
- Override Input (Fire Mode)
- Timer Functions
  - Four (4) Daily Start/Stop Time Periods
  - Four (4) Weekly Start/Stop Time Periods
  - Four Timers for Collecting Time Periods and Overrides
- Seven (7) Preset Speeds
- Supervision Functions
- Adjustable Current Limit
- Electronic Reverse
- Automatic Extended Power Loss Ride Through (Selectable)
- Programmable Maximum Frequency to 500 Hz
- PID Control
  - Two (2) Integral Independent Programmable PID Setpoint Controllers (Process and External)
  - External Selection between Two (2) Sets of Process PID Controller Parameters
  - PID Sleep/Wake-Up
- Motor Control Features
  - Scalar (V/Hz) and Vector Modes of Motor Control
  - V/Hz Shapes
    - Linear
    - Squared
  - Energy Optimization
  - IR Compensation
  - Slip Compensation
  - Three (3) Critical Frequency Lockout Bands
- Preprogrammed Protection Circuits
  - Overcurrent
  - Short Circuit
  - Ground Fault
  - Overvoltage
  - Undervoltage
    - Input Phase Loss
  - Output Device (IGBT) Overtemperature
  - Adjustable Current Limit Regulator
  - UL508C approved Electronic Motor Overload (I^2T)
- Programmable Fault Functions for Protection Include
  - Loss of Analog Input
  - Panel Loss
  - External Fault
  - Motor Thermal Protection
  - Stall
  - Underload
  - Motor Phase Loss
  - Ground Fault
- 5% Input Impedance
  - Equivalent 5% Impedance with Internal Reactor(s)
  - Patented Swinging Choke Design for Superior Harmonic Mitigation (R1 to R4)

ACH550 Specifications

Input Connection

Input Voltage (U_1).....208/220/230/240 VAC 3-phase +/-10%
208/220/230/240 VAC 1-phase +/-10%
380/400/415/440/460/480 VAC 3-phase +/-10%
500/600 VAC 3-phase +/-10%
Frequency: .....48 - 63 Hz
Line Limitations: .....Max +/-3% of nominal phase to phase input voltage
Fundamental Power Factor (cos φ): .....0.98 at nominal load
Connection: .....U_1, V_1, W_1 (U_1, V_1, 1-phase)
Output (Motor) Connection
Output Voltage: .....0 to U_1, 3-phase symmetrical, U_2 at the field weakening point
Output Frequency: .....-500 to 500 Hz
Frequency Resolution: .....0.01 Hz
Continuous Output Current:
Variable Torque: .....1.0 * I_{2N} (Nominal rated output current, Variable Torque)
Short Term Overload Capacity:
Variable Torque:.....1.1 * I_{2N}, (1 min/10 min)
Peak Overload Capacity:
Variable Torque:.....1.35 * I_{2N}, (2 sec/1 min)
Base Motor Frequency Range:.....10 to 500 Hz
Switching Frequency: .....1, 4, 8 or 12 kHz
Acceleration Time: .....0.1 to 1800 s
Deceleration Time: .....0.1 to 1800 s
Efficiency: .....0.98 at nominal power level
Short Circuit Withstand Rating: .....100,000 AIC (UL) w/o fuses
Connection: .....U_2, V_2, W_2
Enclosure
Style:.....UL (NEMA) Type 1, Type 12, or Type 3R
UL Plenum Rated Type 1, Type 12
Agency Approval
Listing and Compliance:.....UL, cUL, CE

Ambient Conditions, Operation

Air Temperature:.....0^0 to 40^0C (32^0 to 104^0F), above 40^0C the maximum output current is de-rated 1% for every additional 1^0C (up to 50^0C (122^0F)) maximum limit.
Relative Humidity:.....5 to 95%, no condensation allowed, maximum relative humidity is 60% in the presence of corrosive gasses
Contamination Levels:
IEC:.....60721-3-1, 60721-3-2 and 60721-3-3
Chemical Gasses:.....3C1 and 3C2
Solid Particles:.....3S2
Installation Site Altitude:.....0 to 1000 m (3300 ft) above sea level. At sites over 1000 m (3300 ft) above sea level, the maximum power is de-rated 1% for every additional 100 m (330 ft). If the installation site is higher than 2000 m (6600 ft) above sea level, please contact your local ABB distributor or representative for further information
Vibration:.....Max 3.0 mm (0.12 in) 2 to 9 Hz, Max 10 m/s^2 (33 ft/s^2) 9 to 200 Hz sinusoidal

Ambient Conditions, Storage (in Protective Shipping Package)

Air Temperature:.....-40^0 to 70^0C (-40^0 to 158^0F)
Relative Humidity:.....Less than 95%, no condensation allowed
Vibration Tested to (IEC 60068-2-6):.....In accordance with ISTA 1A and 1B specifications
Bump Tested to (IEC 60068-2-29):.....Max 100 m/s^2 (330 ft/s^2) 11 ms (Tested 500 times each axis, each pole; 3000 times total)

Ambient Conditions, Transportation (in Protective Shipping Package)

Air Temperature:..... -40^0 to 70^0C (-40^0 to 158^0F)
Relative Humidity:.....Less than 95%, no condensation allowed
Atmospheric Pressure:.....60 to 106 kPa (8.7 to 15.4 PSI)
Vibration Tested to (IEC 60068-2-6):.....Max 3.0 mm (0.14 in) 2 to 9 Hz, Max 15 m/s^2 (49 ft/s^2) 9 to 200 Hz sinusoidal
Bump Tested to (IEC 60068-2-29):.....Max 100 m/s^2 (330 ft/s^2) 11 ms (Tested 500 times each axis, each pole; 3000 times total)
Shock Tested to (IEC 60068-2-27)
R1: 76 cm (30 in) R2: 61 cm (24 in) R3: 46 cm (18 in) R4: 31 cm (12 in) R5 & 6: 25 cm (10 in)

ACH550 Specifications (continued)

Cooling Information

Cooling Method:.....Integral fan(s)
Power Loss: .....Approximately 3% of rated power

Analog Inputs

Quantity.....Two (2) programmable
Voltage Reference:.....0 (2) to 10 V, 250kOhm, single ended
Current Reference:.....0 (4) to 20 mA, 100Ohm, single ended
Potentiometer:.....10 VDC, 10 mA (1K to 10KOhms)
Input Updating Time.....8 ms
Terminal Block Size.....2.3mm^2 / 14AWG

Reference Power Supply

Reference Voltage.....+10 VDC, 1% at 25^{0}C (77^{0}F)
Maximum Load.....10 mA
Applicable Potentiometer.....1 kOhm to 10 kOhm
Terminal Block Size.....2.3mm^2 / 14AWG

Analog Outputs

Quantity.....Two (2) programmable current outputs
Signal Level.....0 (4) to 20 mA
Accuracy.....+/- 1% full scale range at 25^{0}C (77^{0}F)
Maximum Load Impedance.....500 Ohms
Output Updating Time.....2 ms
Terminal Block Size.....2.3mm^2 / 14AWG

Digital Inputs

Quantity.....Six (6) programmable digital inputs
Isolation.....Isolated as one group
Signal Level.....24 VDC, (10V Logic 0)
Input Current.....15 mA at 24 VDC
Input Updating Time:.....4 ms
Terminal Block Size.....2.3mm^2 / 14AWG

Internal Power Supply

Primary Use.....Internal supply for digital inputs
Voltage:.....+24 VDC, max 250 mA
Maximum Current:.....250 mA
Protection:.....Short circuit protected

Relay Outputs

Quantity.....Three (3) programmable relay (Form C) outputs
Switching Capacity:.....8 A at 24 VDC or 250 VAC, 0.4 A at 120 VDC
Max Continuous Current:.....2A RMS
Contact Material:.....Silver Cadmium Oxide (AgCdO)
Isolation Test Voltage.....4 kVAC, 1 minute
Output Updating Time.....12 ms
Terminal Block Size.....2.3mm^2 / 14AWG

Protections

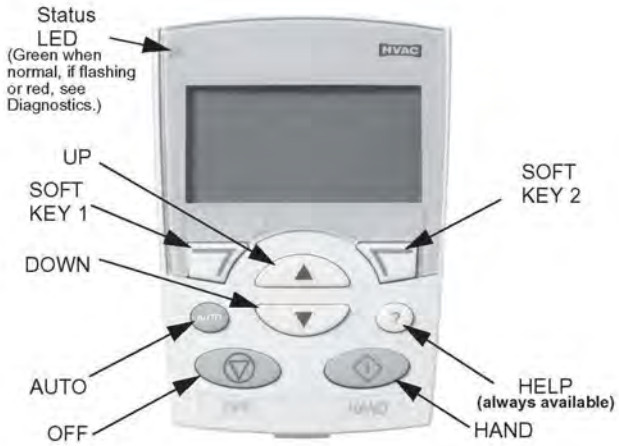
Single Phase.....Protected (input & output)
Overcurrent Trip Limit:.....3.5 x I_{2N} instantaneous
Adjustable Current Regulation Limit:.....1.1 x I_{2N} (RMS) max.
Overvoltage Trip Limit:.....1.30 x U_N
Undervoltage Trip Limit:.....0.65 x U_N
Overtemperature (Heatsink):.....+115°C (+239°F)
Auxiliary Voltage:.....Short Circuit Protected
Ground Fault:.....Protected
Short Circuit:.....Protected
Microprocessor fault:.....Protected
Motor Stall Protection:.....Protected
Motor Overtemperature Protection (I^2t):.....Protected
Input Power Loss of Phase:.....Protected
Loss of Reference:.....Protected
Short Circuit Current Rating:.....100,000 RMS symmetrical Amperes
Input Line Impedance:.....Swinging choke 5% equivalent R1-R6, 3% equivalent R8

U_1 = Input Voltage
U_2 = Output Voltage
P_N = Power – Normal Duty (HP)
U_N = Nominal Motor Voltage
f_N = Nominal Motor Frequency
I_{2N} = Nominal Motor Current – Normal Duty

Specifications are subject to change without notice. Please consult the factory when specifications are critical.

ACH550 Control Panel

The ACH550 Control Panel is a multifunction control panel with full graphic LCD display and multiple language capability. The control panel can be connected to and detached from the ACH550 at any time. The panel can be used to upload and copy parameters to other ACH550 drives.



Run Indication and Shaft Direction

Control Panel Display	Significance
Rotating arrow (clockwise or counterclockwise)	Drive is running and at set point Shaft direction is forward or reverse
Rotating arrow blinking	Drive is operating but not at setpoint
Stationary arrow	Drive is stopped

LED Indicators

The green LED indicates that the power is on and the drive is operating normally. The red LED indicates a fault. A blinking green LED indicates an alarm condition. A blinking red LED indicates a fault that requires power to be cycled off and on to reset the drive.

Fault Indications

The ACH550 Control Panel can display over 20 alarm and fault messages. The last fault and previous faults (1 to 9) are retained in memory. The last fault and previous faults (1 & 2) also record important diagnostic information to assist in troubleshooting. Most faults can be reset by pressing the RESET key (Soft Key 1).

Parameters

Application specific parameters are immediately accessible through a selection of start-up “Assistants”. A complete list of parameters is also available grouped by function in approximately 33 menu groups. One of the basic menu functions can be used to display the complete list of changed parameters.

Real Time Clock

The Operator Control Panel includes a real time clock which provides Day, Date and Time information, displayed in a choice of formats. The real time clock has a 10 year battery back up and provides time and date stamping of drive faults and other events. The clock is also used by the ACH550s internal timer functions, providing an integral time clock for start/stop control as well
as other control operations.

Control Modes

When the HAND key is pressed, the drive starts and pressing the UP/DOWN keys can modify the reference frequency. The HAND (keypad) control mode is indicated.

When the OFF key is pressed, the drive stops and the OFF control mode is indicated.

When the AUTO key is pressed, the AUTO control mode is indicated. The drive can be started and stopped using whichever remote start/stop command has been configured, a contact closure applied to the start/stop input, a serial communication command or a process feedback signal. In AUTO mode the drive speed is typically controlled by the external speed reference input or by the PID controller.

If the HAND key is pressed while the drive is running in the AUTO control mode, the drive continues to run without changing speed, but ceases to respond to external input or PID speed reference changes. (Bumpless transfer) Pressing the UP/DOWN keys can modify the reference frequency.

If the AUTO key is pressed while the drive is running in the HAND control mode and an external start command is present, the drive continues to run and follows the acceleration or deceleration control ramp to the speed set by the external input or PID speed reference. (Bumpless transfer)

Cable Connections

Terminal	Description	Note
U1, V1, W1	3~ power supply input	Use of 1~ supply requires 50% derate of output current and is applicable for 208 to 240 VAC operation only.
PE / GND	Protective Ground	Follow local rules for cable size.
U2, V2, W2	Power output to motor	
Uc+, Uc-	DC bus	
X1 1 to 18	Control Wiring	Low voltage control – Use shielded cable
X1 19 to 27	Control Wiring	Low voltage or 115VAC
X1 28 to 32	Serial Communications	Use shielded cable

Follow local codes for cable size. To avoid electromagnetic interference, use separate metallic conduits for input power wiring, motor wiring, control and communications wiring. Keep these four classes of wiring separated in situations where the wiring is not enclosed in metallic conduit. Also, keep 115VAC control wiring separated from low voltage control wiring and power wiring.

Use shielded cable for control wiring.

Ampacity is based on the use of 60 °C rated power cable up to 100 Amps (75 °C over 100 Amps).

Refer to the included tables for current ratings, fuse recommendations and maximum wire size capacities and tightening torques for the terminals. The ACH550 is suitable for use on a circuit capable of delivering not more than 100,000 RMS symmetrical amperes, 480 V maximum. The ACH550 has an electronic motor protection feature that complies with the requirements of the National Electric Code (NEC). When this feature is selected and properly adjusted. Additional overload protection is not required unless more than one motor is connected to the drive or unless additional protection is required by applicable safety regulations.

For CE installation requirements, see ABB publication CE-US-02 “CE Council Directives and Variable Speed Drives.” Contact your local ABB representative for specific IEC installation instructions.

ACH550 with ABB E-Clipse bypass – Overview

ABB E-Clipse bypass Standard Features

- Door Interlocked Disconnect or Circuit Breaker
- English Language Back-Lit LCD Display
- Operator Control Panel
- LED Status Pilot Lights
- Smoke Control
- Override Mode
- Serial Communications
- 5 Programmable Relay Outputs (Form C)
- 100% Functionality with Drive Removed
- Programmable Auto Transfer to Bypass
- Plain English Safety Annunciation
- UL & cUL Listed
- Seismic Zone 4 Certified (IBC 2006)
- UL Type 1, Type 12 or Type 3R Enclosure
- Programmable Class 10, 20, or 30 OL
- Automatic Restart
- 24 Month Parts and Labor Warranty (with Certified Start-up)
- Two Contactor Bypass
- System Status Display
- Bypass Diagnostics Display
- Drive Exclusive Fast-Acting Fuses
- Electronic Motor Overload Protection
- Damper Control - VFD and Bypass Modes
- 6 Digital Inputs (5 programmable)
- Single Phase Protection in VFD & Bypass Mode
- Bullet Proof Contactor Protection
- Serial Communications Pass Through I/O
- Proof-of-Flow Indication & Action
- Conformal Coated Circuit Boards
- +30%; -35% Input Voltage Tolerance
- Run Permissive Circuit
- Supervisory Control
- UL Listed I^2T Electronic Overload
- UL Listed and tested 100,000 Ampere SCCR (VCR and BCR Units)

The ACH550 with ABB E-Clipse bypass is an ACH550 HVAC Drive in an integrated UL Type 12 enclosure with a bypass motor starter. The ACH550 with ABB E-Clipse bypass provides an input disconnect switch or circuit breaker with door mounted and interlocked operator (padlockable in the OFF position), a bypass starter, electronic motor overload protection, a local programming and operator keypad with indicating lights, provisions for external control connections, and serial communications capability.

The ACH550 with ABB E-Clipse bypass includes two contactors. One contactor is the bypass contactor, used to connect the motor directly to the incoming power line in the event that the ACH550 is out of service. The other contactor is the ACH550 output contactor that disconnects the ACH550 from the motor when the motor is operating in the Bypass mode. The drive output contactor and the bypass contactor are electrically interlocked to prevent “back feeding”.

The ACH550 with ABB E-Clipse bypass is a microprocessor-controlled “intelligent” system which features programmable Class 20 or 30 overload curves, programmable underload (broken belt) and overload trip or indication. Also included as standard features are single-phase protection in bypass mode, programmable manual or automatic transfer to bypass, fireman’s override, smoke control, damper control, no contactor chatter on brown-out power conditions and serial communications. Should a drive problem occur, fast acting fuses exclusive to the ACH550 drive path disconnect the drive from the line prior to clearing upstream branch circuit protection, maintaining bypass capability.

Damper Control Circuit (Run Permissive)

The damper control circuit closes a dry contact upon a start command to open a damper such as an outdoor air damper, fire damper, isolation damper, etc. before the motor is allowed to operate in drive mode or bypass mode regardless of the source of the run command. When the damper is fully open, a normally open dry contact from the damper end-switch closes and allows the motor to operate. Up to four dedicated inputs are provided for safety interlocks such as firestats, smoke detectors, etc.

The safety interlock inputs may also be linked to plain English keypad diagnostic indications to be displayed on the LCD. The unit may be set-up to display any of the following diagnostics upon opening of a digital input: Vibration Switch; Firestat; Freezestat; Over Pressure; Vibration Trip; Smoke Alarm; Safety Open; Low Suction; Start Enable; Run Enable; Damper End Switch; Valve Open Proof; or Pre-Lube Cycle. When any of these contacts open, the motor stops (in drive or bypass mode) and the damper is commanded to close. Although it is not a recommend sequence of operation, this run permissive circuit may also be controlled via serial communications.

Smoke Control and Override Modes

The ACH550 with ABB E-Clipse bypass has two Override modes of operation for critical control situations. The Smoke Control Override accepts a normally open dry contact that forces the motor to run in bypass and ignores all keypad inputs. In Smoke Control Override mode, the system acknowledges high priority digital inputs such as overpressure safeties and damper end-switch run permissive proofs, and disregards other, low priority digital inputs. See the attached sample wiring diagram for further details. Smoke Control Override (Override 1) response is not field programmable. The unit will go into smoke Override mode whenever DI6 is closed.

The second mode, Override 2, is fully programmable. Override 2 default programming is designed for “Run to Destruction” operation. However, the end user can program the unit to acknowledge some external inputs while ignoring others, ignore all external inputs or acknowledge all external inputs. This mode is fully programmable to allow the user to program the response of the unit to match his local AHU.

Serial communications

All ABB E-Clipse bypass units have the following Embedded Fieldbus (EFB) protocols included as standard: Modbus RTU; Johnson Controls N2; Siemens Building Technologies FLN (P1); and BACnet (MS/TP).

The ACH550 with ABB E-Clipse bypass has the ability to monitor VFD/Bypass mode of operation, the status of the bypass H-O-A switch, bypass fault and override status over serial communication. In addition, the user can monitor and / or control over 45 points of bypass information via the communications protocols. Serial communication capabilities include - bypass run-stop control; the ability to force the unit to bypass; and the ability to control all relay outputs. The DDC system can monitor bypass feedback such as, current (in amps), kilowatt hours (resettable), operating hours (resettable), and bypass logic board temperature. The DDC system is also capable of monitoring the bypass relay output status, and all digital input status’. All bypass diagnostic warning and fault information is transmitted over the serial communications bus. Remote system (drive or bypass) fault reset is possible.

ABB E-Clipse bypass Operator Control

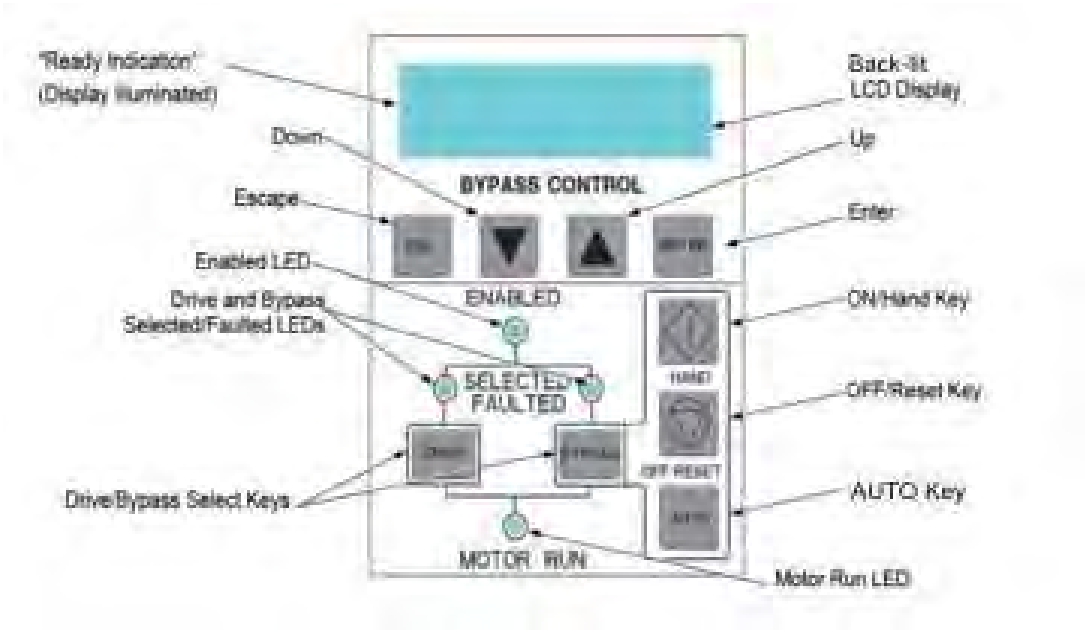
ACH550 Control Panel

The ACH550 Control Panel is a keypad with an LCD unit that provides status indication and operator controls for the ACH550 drive. In normal operation with the ABB E-Clipse bypass, the ACH550 should be placed in the *Auto* mode of operation by pressing the *Auto* key on the ACH550 Control Panel. Refer to the *ACH550 User's Manual* for additional information on the ACH550 Control Panel and other aspects of ACH550 operation.

Bypass Control Keypad

The ABB E-Clipse bypass has a separate keypad with an LCD unit that provides status indication and programming of the system. This keypad is also used for selecting the *Drive* or *Bypass* mode of operation and manually starting and stopping the motor in the *Bypass* mode. The bypass keypad has LED indicating lights that indicate the status of both the bypass and the drive as well as an LCD display that provides programming, status and warning/fault indications.

The illustration below shows the bypass control keypad and identifies the keys and LED indicating lights.



The functions of the various keys and LEDs are described in the following table.

Enabled LED	The *Enabled* LED is illuminated green under the following conditions: • Both the Safety Interlock(s) and Run Enable contacts are closed. • The Safety Interlock(s) contact are closed with no Start command present. The *Enable* LED flashes green if the Run Enable contact is open and when the Safety Interlock contact(s) are closed and a Start command is present. The Enable LED is illuminated red when the Safety Interlock contact(s) are open.
Drive Selected LED	The *Drive Selected* LED is illuminated green when the drive has been selected as the power source for the motor and no drive fault is present.
Bypass Selected LED	The *Bypass Selected* LED is illuminated green when the bypass has been selected as the power source for the motor and no bypass fault is present.
Motor Run LED	The *Motor Run* LED is illuminated green whenever the system is running. The *Motor Run* LED flashes green to indicate the system has been placed in an Override operating mode.
Drive Faulted LED	The *Drive Fault* LED is illuminated red when the bypass has lost its' communications link with the drive or when the motor or drive protection functions have shut down the drive.
Bypass Faulted LED	The *Bypass Faulted* LED is illuminated or flashes red when the motor or bypass protective functions have shut down the bypass.
Drive Key	The *Drive* Key selects the drive as the power source for the motor.
Bypass Key	The *Bypass* Key selects the bypass as the power source for the motor.
Auto Key	The *Auto* key selects the *Auto Start* contact or serial communications as the means for starting and stopping the motor in the bypass mode.
Off/Reset Key	The *Off*/*Reset* key may be used to manually stop the motor if the motor is running on bypass power. The *Off/Reset* Key also resets most bypass faults. It may take several minutes before the bypass can be reset after an overload trip. If a bypass fault condition is present, the second push of the *Off/Reset* key puts the bypass in the Off mode.
Hand Key	The *Hand* key can be used to manually start the motor when the bypass has been selected as the power source for the motor.
UP Key	Used to navigate through system programming steps.
Down Key	Used to navigate through system programming steps.

Control Modes

Drive mode

Under normal conditions the system is in the *Drive* mode. The ACH550 drive provides power to the motor and controls its speed. The source of the drive's start/stop and speed commands is determined by the *Auto* or *Hand* mode selection of the drive's keypad. Commands come from the control terminals or serial communications when the *Auto* mode has been selected or from the drive keypad when the *Hand* mode has been selected. The user can normally switch to the *Drive* mode by pressing the *Drive* key on the bypass keypad.

Bypass mode

In the *Bypass* mode, the motor is powered by AC line power through the bypass contactor. The source of the bypass'start/stop commands is determined by the *Auto* or *Hand* mode selection of the bypass' keypad. Commands come from the control terminals or serial communications when the *Auto* mode has been selected or from the bypass keypad when the *Hand* mode has been selected. The user can normally switch to the *Bypass* mode by pressing the *Bypass* key on the bypass keypad.

Smoke Control mode

In the *Smoke Control (Override 1)* mode, the motor is powered by AC line power through the bypass contactor. The source of the Smoke Control command is DI 6 and is unaffected by external stop commands. The VFD Keypad and the Bypass Keypad will not accept user commands when the system is in Smoke Control mode (the keypad user inputs are disabled). The user can switch to the *Smoke Control* mode by closing the *Smoke Control* input contact (DI 6). When the *Smoke Control* input contact is closed, the system is forced to bypass and runs the motor. The Motor Run LED flashes green when the system is in override. While in *Smoke Control*, the system only responds to certain inputs. Normally when the *Smoke Control* input contact is switched from closed to open, the system returns to the operating mode that existed prior to entering *Smoke Control* and can once again be controlled using the *Drive* and *Bypass* keys. The exception to this is when the *Bypass Override (Override 2)* input contact is closed, in which case the system switches to *Bypass Override* operation.

Bypass Override mode

In the *Bypass Override (Override 2)* mode, the motor is powered by AC line power through the bypass contactor. The source of the start command is internal and unaffected by external stop commands. The VFD Keypad and the Bypass Keypad will not accept user commands when the system is in Bypass Override mode (the keypad user inputs are disabled). The user can switch to the *Bypass Override* mode by closing the *Bypass Override* input contact (DI 5-if programmed). When the *Bypass Override* input contact is closed, the system is forced to bypass and does not respond to the *Drive* and *Bypass* keys. The Motor Run LED flashes green when the system is in override. While in *Bypass Override* the system responds to bypass overloads and programmed faults. The system may be custom programmed to acknowledge or disregard certain faults, safeties and enables. The unit is default programmed to ignore all external safeties and run enables. See Group 17 for programmability of the digital input and fault functions. Normally when the *Bypass Override* input contact is switched from closed to open, the system switches to the *Drive* mode and can be controlled using the *Drive* and *Bypass* keys. The exception to this is when the *Smoke Control (Override 1)* input contact is closed, in which case the system remains in *Smoke Control* operation.

Hand mode

When the system is in the *Bypass* mode, the operator can manually start the motor by pressing the *Hand* key. The motor will run and the *Hand* LED will be illuminated green. In order to run the motor, the *Safety Interlock* and *Run Enable* contacts must be closed (green *Enable* LED) and any bypass fault must be reset.

Auto mode

In the *Auto* mode the bypass start/stop command comes from the *Start/Stop* input terminal on the bypass control board or from serial communications – if programmed. The *Auto* mode is selected by pressing the *Auto* key on the bypass keypad. The *Auto* LED is illuminated green when the bypass is in the *Auto* mode. If the system is in the *Bypass* mode, the motor will run across the line if the *Auto* mode is selected, the *Start/Stop, Safety Interlock* and *Run Enable* contacts are closed and any bypass fault is reset.

Off Mode

If the motor is running in the *Bypass* mode, the operator can manually stop the motor by pressing the *OFF* key. The *Motor Running* LED will go out. The motor can be restarted by pressing the *Hand* key or the bypass can be returned to the *Auto* mode by pressing the *Auto* key. If the system is in the *Drive* mode, pressing the *OFF* key will take the bypass out of the *Auto* mode, but will not affect motor operation from the drive. If the system is switched to the *Bypass* mode, a motor that is running will stop.

Programmable Relay Contact Outputs

The ABB E-Clipse bypass has five programmable relay outputs as standard. The default programming descriptions for these relay outputs is described below.

Bypass Not Faulted

The *Bypass Not Faulted* relay is energized during normal operation. The *Bypass Not Faulted* relay is de-energized when a bypass fault has occurred.

System Running

The *System Running* relay is energized when the ABB E-Clipse bypass System is running. The *System Running* relay provides an output when the motor is running whether powered by the ACH550 drive or the bypass.

System Started

The *System Started* relay is energized when the ABB E-Clipse bypass system is started. Three conditions must be met in order for the relay to energize. 1) a *Start* command must be present, 2) the *Safety Interlock* input contact must be closed and 3) there can be no fault present in the system. The *Start* command can come from the bypass control board terminal block, the ACH550 keypad, the bypass keypad, or serial communications depending on the operational mode selected. The *System Started* relay is ideal for use in damper actuator circuits, opening the dampers only under those conditions where the system is preparing to run the motor. The *System Started* relay will de-energize, closing the dampers if the safeties open, the system faults, or when a *Stop* command is issued.

Bypass Selected

Relay output four is factory default programmed for Bypass Selected. The relay will be energized anytime the user has placed the system in Bypass mode.

Bypass Auto

Relay Output five is factory default programmed for *Bypass Auto*. The relay will be energized anytime the user has placed the bypass in the Auto mode.

The complete list of programmable relay output functions follows:

0 = NOT SEL	10 = DRV NOT FLT	20 = BYP UNDERLD
1 = SYS READY	11 = DRIVE ALARM	21 = PCB OVERTMP
2 = SYS RUNNING	12 = OVERRIDE	22 = SYS UNDERLD
3 = SYS STARTED	13 = BYPASS HAND	23 = SYSTEM FLT
4 = BYPASS SEL	14 = BYPASS OFF	24 = SYS FLT/ALM
5 = BYPASS RUN	15 = BYPASS AUTO	25 = SYS EXT CTL
6 = BYPASS FLT	16 = COM CTRL	26 = SYS OVERLD
7 = BYP NOT FLT	17 = SYS ALARM	27 = CONTACT FLT
8 = BYPASS ALRM	18 = BYPASS FLT/ALM	
9 = DRIVE FAULT	19 = BYP OVERLD	

Cable Connections

The following illustrations show the ACH550 with ABB E-Clipse bypass cable connection points for the various enclosure styles. The illustrations indicate the location of input and output power connections as well as equipment and motor grounding connection points.

ACH550 drives are configured for wiring access from the bottom only on Vertical ABB E-Clipse bypass units and from the top only on Standard ABB E-Clipse bypass units. At least three separate metallic conduits are required, one for input power, one for output power to the motor and one for control signals.

All ABB E-Clipse bypass units provided with a circuit breaker input - VCR and BCR configurations have a panel short circuit current rating of 100,000 RMS symmetrical Amperes. Units provided with a disconnect input - VDR and BDR configurations require separate external low peak fuses (supplied by others) to obtain the 100,000 KAIC SCCR.

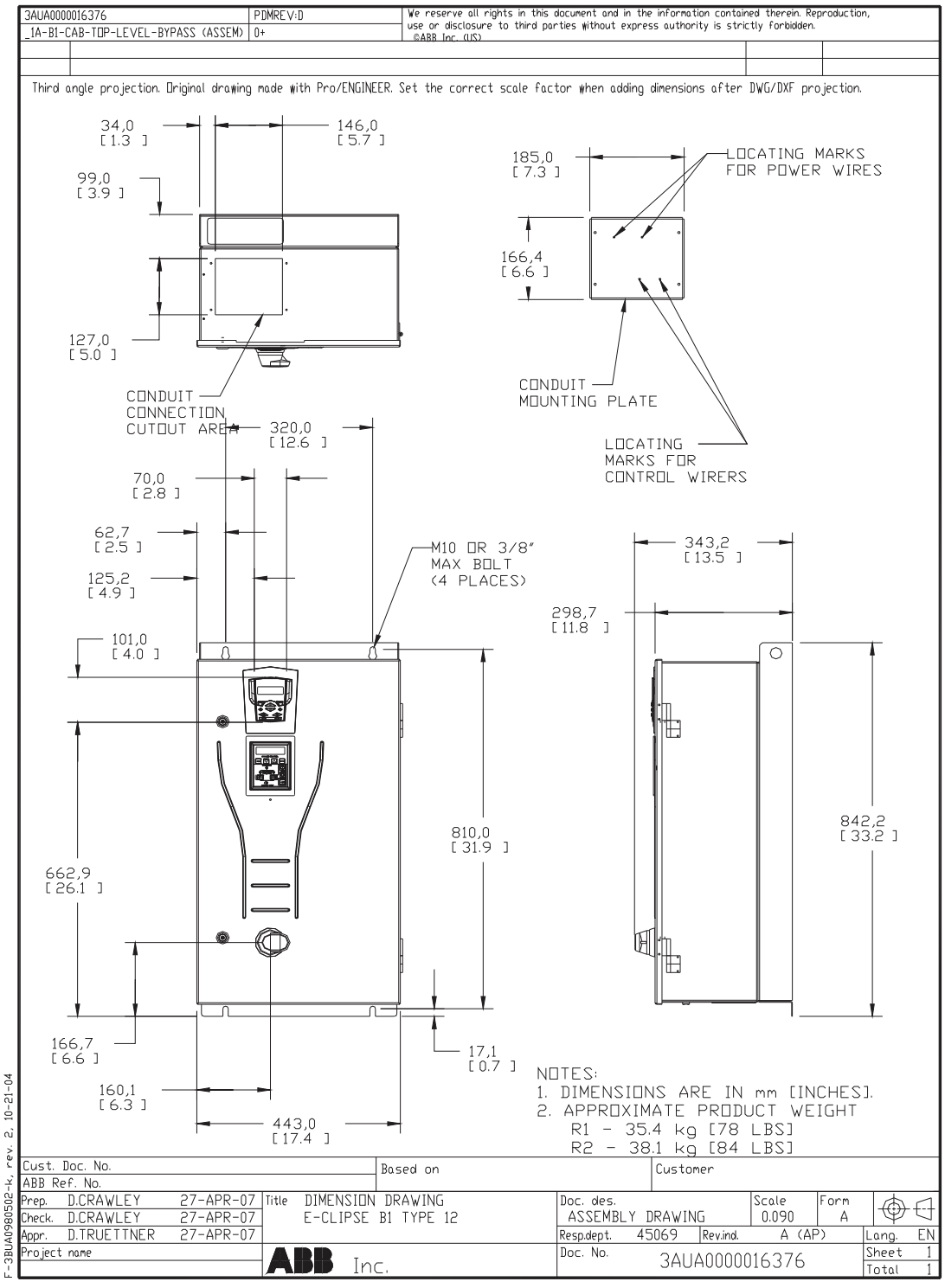
Terminal Sizes

Power and motor cable terminal sizes are shown in the *Submittal Schedule Details* and in the *Wire Size Capacities of Power Terminals* Table. The information provided is for connections to an input circuit breaker or disconnect switch, a motor terminal block, overload relay and ground lugs. The table also lists torque that should be applied when tightening the connections.

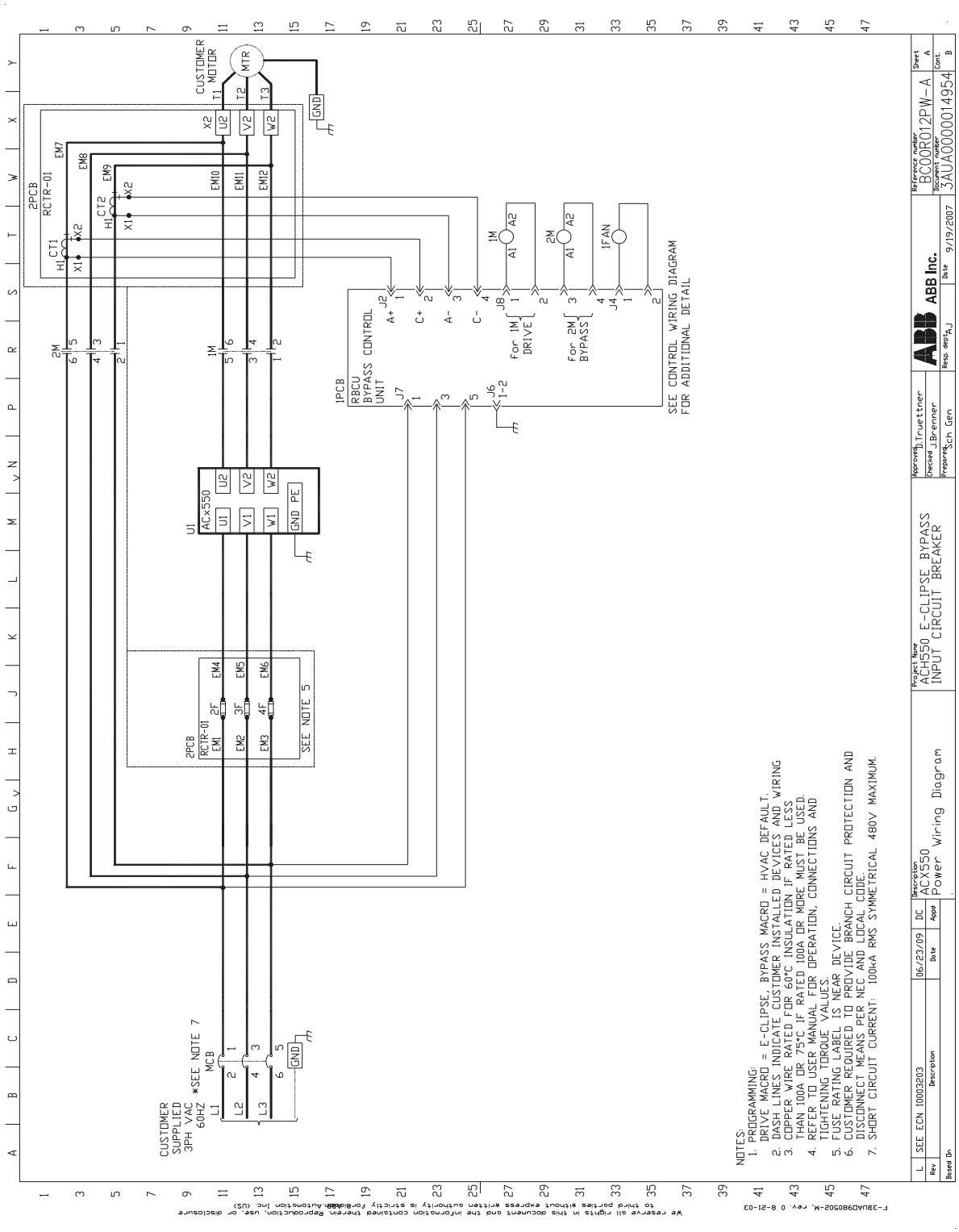
Protections

All ABB E-Clipse bypass units include the following protective features: single phase input and output; motor open phase; motor overload (UL Listed); stuck contactor; contactor coil open; undervoltage; motor underload (proof-of-flow / broken belt); serial communications loss; and overtemperature. All printed circuit boards are conformally coated as standard.

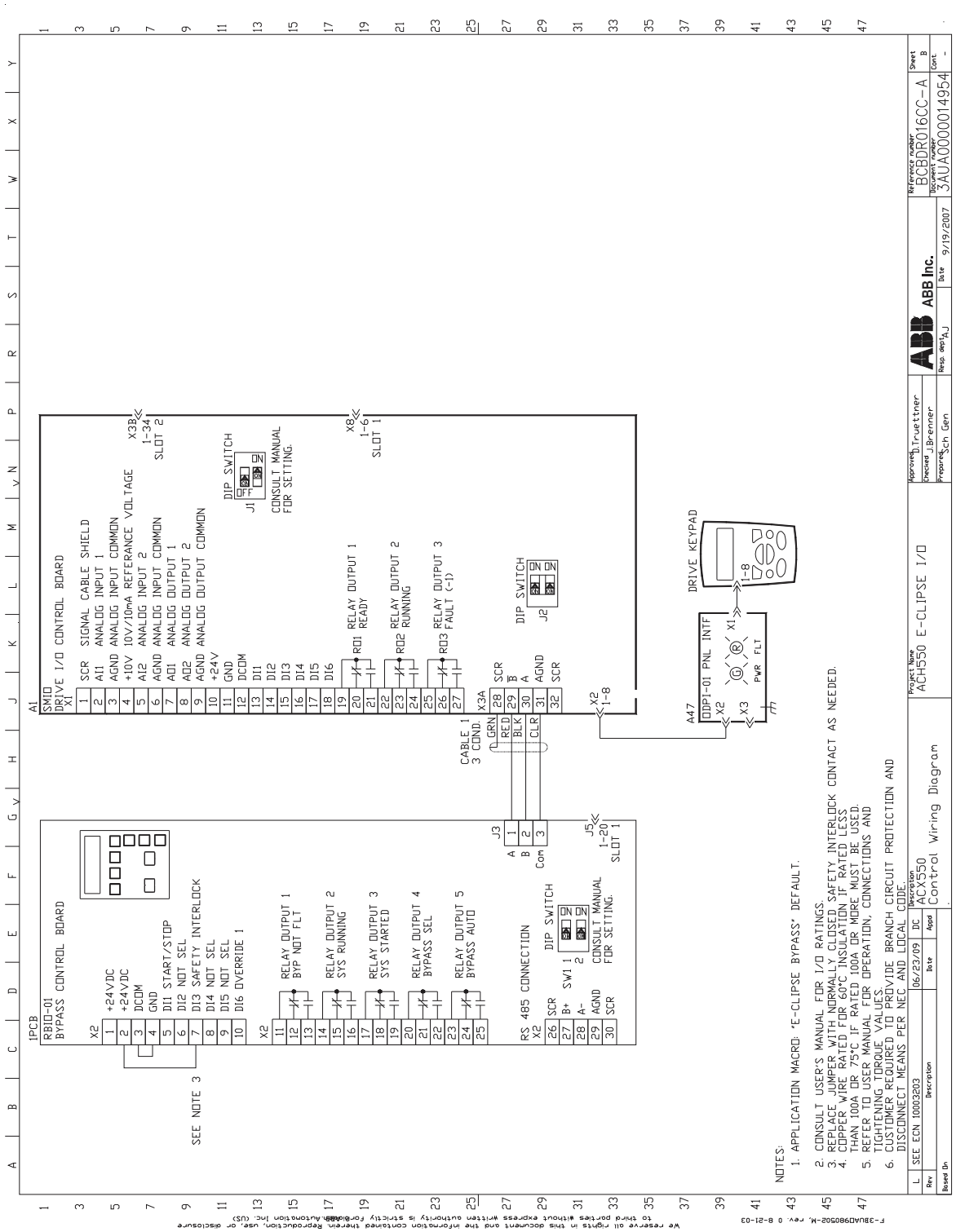
Dimension Drawing for 15 HP



Power Drawing for 15 HP



Connection Drawing for 15 HP



Systems, Inc.
SUBMITTAL DATA

REPRESENTED BY:
CORPORATE EQUIPMENT CO
607 REDNA TERRACE, #100
CINCINNATI, OHIO 45215
Phone 513-771-6696 Fax 513-771-0334

Date: APRIL 11, 2008 (REV 8/28/08)

PROJECT NAME: CINCINNATI BELL

DISTRIBUTOR: CORPORATE EQUIPMENT

SYSTEM MODEL: 3VC-VFD-G **TYPE:** TRIPLEX VARIABLE SPEED

SYSTEM DATA:

P-1	MODEL NO:	VCR32-4-2	150 GPM
P-2	MODEL NO:	VCR32-4-2	150 GPM
P-3	MODEL NO:	VCR32-4-2	150 GPM

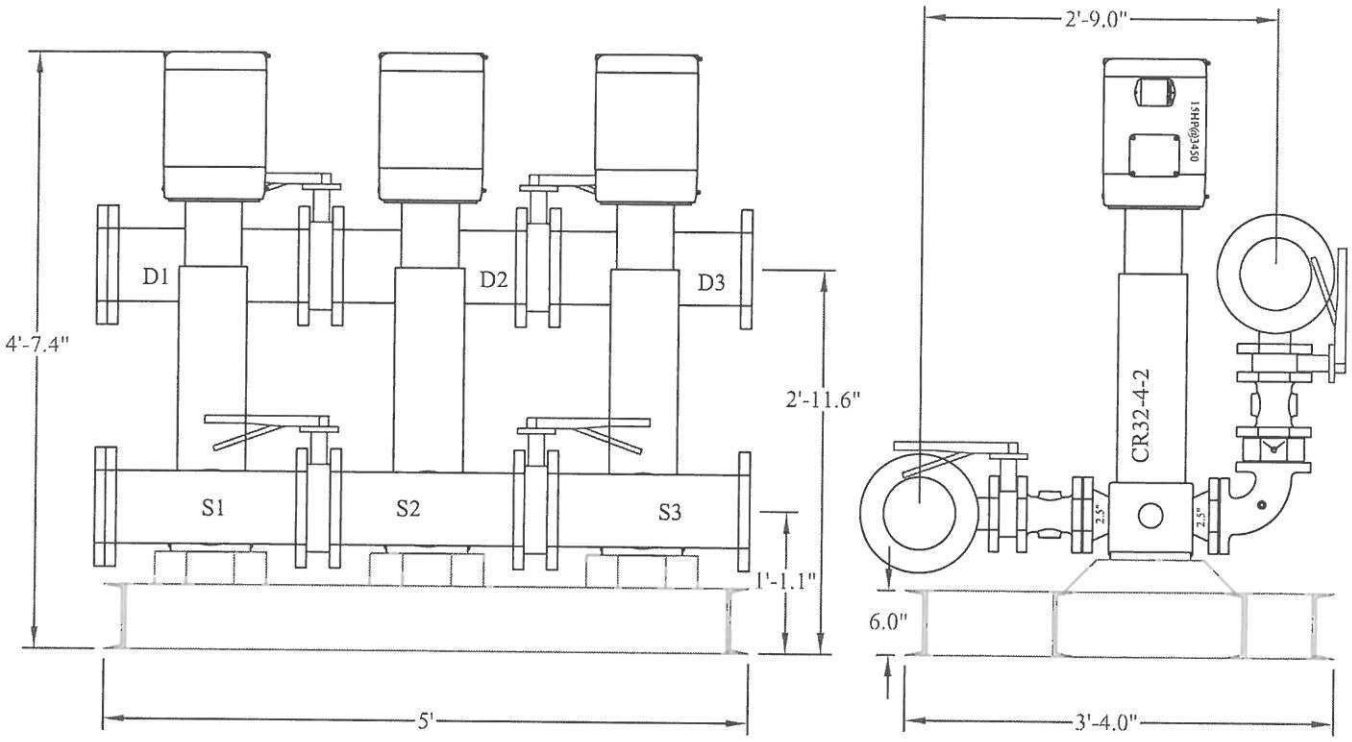
SYSTEM CAP. (GPM)	450 GPM	
PRESSURE (PSI):	108 PSI (250' TDH)	
MOTOR SPEED/HP:	3500 RPM	15+15+15 HP
POWER SUPPLY:	208/60/3	
ENCLOSURE:	ODP	
HEADER SIZE:	6X2.5	
HEADER MATERIAL:	WELDED 304 S/S PIPE	
PIPE ISOLATION:	SINGLE SPHERE RUBBER	
VIBRATION MOUNTS:	RUBBER IN SHEAR TYPE	

CONTROL PANEL: CONTROL PANEL AND DRIVES SUPPLIED AND INSTALLED BY OTHERS

NOTE: SYSTEM IS PROVIDED WITH (4) 6" ISOLATION VALVES IN THE SUCTION AND DISCHARGE HEADERS AS NOTED ON THE REVISED DRAWINGS, AS REQUESTED BY THE OWNER.

TANK: 26 GALLON, NON-CODE, 150 PSI W.P. BLADDER TANK, SUPPLIED FOR REMOTE MOUNTING BY THE INSTALLER. THE MAXIMUM PRESSURE AT THE REMOTE LOCATION NOT TO EXCEED 150 PSI.

CINCINNATI BELL
DOMESTIC BOOSTER SYSTEM



NOTE 1: SYSTEM IS SUPPLIED WITH DOUBLE ENDED HEADERS FOR FLOW IN EITHER DIRECTION. EACH HEADER IS SUPPLIED WITH 6" BUTTERFLY VALVE BETWEEN PUMPS.

NOTE 2: SYSTEM IS SUPPLIED WITH RUBBER IN SHEAR VIBRATION MOUNTS.

NOTE 3: SYSTEM IS SUPPLIED WITHOUT CONTROL PANEL OR VARIABLE FREQUENCY DRIVES, SUPPLIED BY OTHERS.

UL LISTED

VC SYSTEMS		
CINCINNATI BELL		
DRAWN BY: MRT	CHECKED BY: HGV	DATE: AUGUST 20, 2008
CORPORATE EQUIPMENT		

PUMP SCHEDULE

PUMP	MANUFACTURER	MODEL NO.	GPM	HEAD	HP	SPEED	POWER
P-1	VC SYSTEMS	VCR32-4-2	150	250'	15	3500	???-60-3
P-2	VC SYSTEMS	VCR32-4-2	150	250'	15	3500	???-60-3
P-3	VC SYSTEMS	VCR32-4-2	150	250'	15	3500	???-60-3

GRUNDFOS

Company name:	VC SYSTEMS
Created by:	H VICKERY
Phone:	-
Fax:	-
Date:	-

Project:	CINCINNATI BELL	**Client:**	CORPORATE EQ CO
Reference number:	-	**Client number:**	-
		Contact:	STEVE ASHPAW

Position	*Count*	*Description*	*Unit price*
	1	**CR 32-4-2 A-G-A-E KUBE** Product No.: 96419530 Vertical, non-self-priming, multistage, in-line, centrifugal pump for installation in pipe systems and mounting on a foundation. **The pump has the following characteristics:** - Impellers and intermediate chambers are made of Stainless steel DIN W.-Nr. 1.4301 DIN W.-Nr.. - Pump head and base are made of Cast iron. - The shaft seal has assembly length according to DIN 24960. - Power transmission is via cast iron split coupling. - Pipework connection is via ANSI flanges. The motor is a 3-phase AC motor. **Liquid:** Liquid temperature range: 32 .. 248 °F Liquid temp: 35.6 °F Density: 62.4 lb/ft³ **Technical:** Speed for pump data: 3444 rpm Rated flow: 140.9 US gpm Rated head: 260 ft Shaft seal: KUBE Approvals on motor nameplate: UL Recognized Component, CSA Curve tolerance: ISO 9906 Annex A **Materials:** Pump housing: Cast iron EN-JS1050 DIN W.-Nr. 80-55-06 ASTM Impeller: Stainless steel 1.4301 DIN W.-Nr. 304 AISI **Installation:** Maximum ambient temperature: 104 °F Max pressure at stated temperature: 232 / 250 psi/°F Flange standard: ANSI Pipe connection: 2 1/2" Pressure stage: 125 Lb. Flange size for motor: 254TC **Electrical data:**	On request

GRUNDFOS

Company name:	VC SYSTEMS
Created by:	H VICKERY
Phone:	-
Fax:	-
Date:	-

Project:	CINCINNATI BELL	**Client:**	CORPORATE EQ CO
Reference number:	-	**Client number:**	-
		Contact:	STEVE ASHPAW

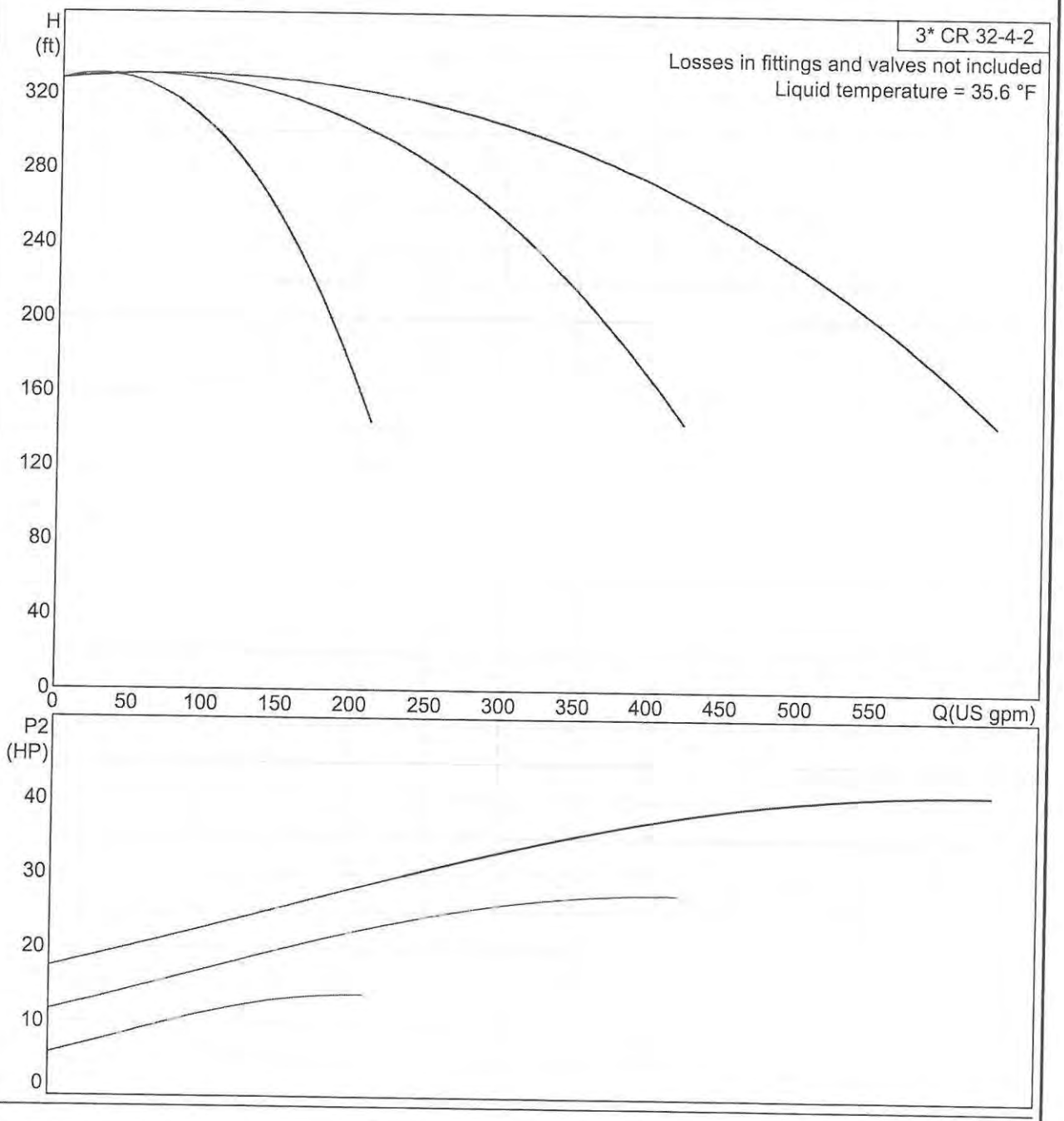
Position	*Count*	*Description*		*Unit price*
		Motor type:	Baldor, ODP	
		Rated power - P2:	15 HP	
		Main frequency:	60 Hz	
		Rated voltage:	3 x 208-230 / 460 V	
		Service factor:	1,15	
		Rated current:	38-36 / 18 A	
		Starting current:	289.7-262 / 131 A	
		Cos phi - power factor:	0,92	
		Rated speed:	3450 rpm	
		Motor efficiency at full load:	85,5 %	
		Insulation class (IEC 85):	F	
		Others:		
		Gross weight:	441 lb	
		Shipping volume:	32.8 ft³	

GRUNDFOS

Company name:	VC SYSTEMS
Created by:	H VICKERY
Phone:	-
Fax:	-
Date:	-

Project:	CINCINNATI BELL	**Client:**	CORPORATE EQ CO
Reference number:	-	**Client number:**	-
		Contact:	STEVE ASHPAW

96419530 CR 32-4-2

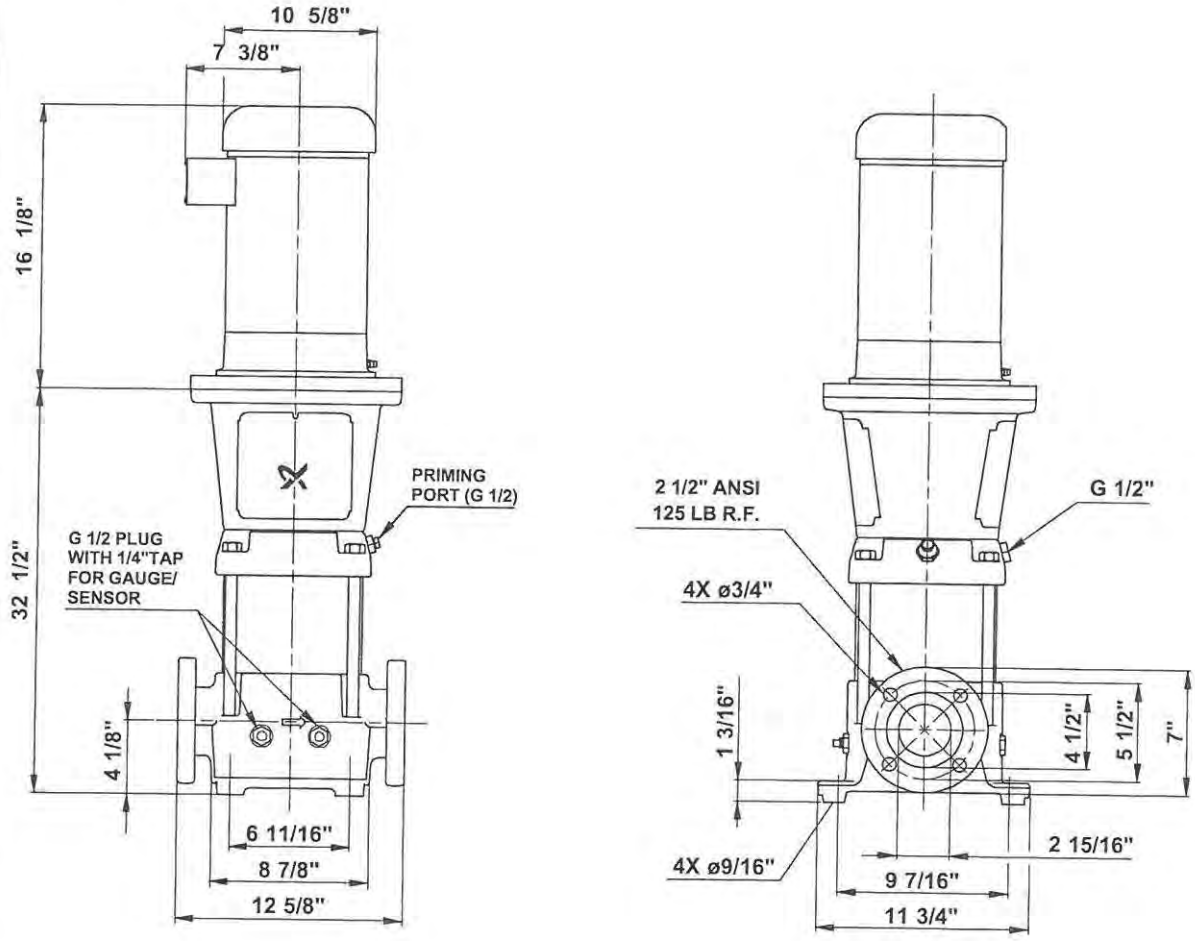


GRUNDFOS

Company name:	VC SYSTEMS
Created by:	H VICKERY
Phone:	-
Fax:	-
Date:	-

Project:	CINCINNATI BELL	**Client:**	CORPORATE EQ CO
Reference number:	-	**Client number:**	-
		Contact:	STEVE ASHPAW

96419530 CR 32-4-2



Note! All units are in [mm] unless others are stated.
Disclaimer: This simplified dimensional drawing does not show all details.

WRP Associates, LLC

Invoice

5668 Wooster Pike
Cincinnati, OH 45227
Phone: 513-271-4977

Date	Invoice #
12/15/2008	678

PAID
01/09/2009

Bill To

Glenwood Electric
2107 Lawn Ave.
Cincinnati, OH 45212

P.O. No.	Terms	Project
C7429	Net 30	CBTS

Quantity	Description	Rate	Amount
8	ABB Model ACH550-BCR-045A-4+B055, 30 HP VFD's	4,500.00	36,000.00
1	ABB Model ACH550-BCR-072A-4+B055, 50 HP VFD	6,350.00	6,350.00

WRP-B427

Thank you for your business.

Phone #

513-271-4977

Total $42,350.00

WRP Associates, LLC

Invoice

5668 Wooster Pike
Cincinnati, OH 45227
Phone: 513-271-4977

Date	Invoice #
2/9/2009	739

PAID
03/23/2009

Bill To

Glenwood Electric
2107 Lawn Ave.
Cincinnati, OH 45212

P.O. No.	Terms	Project
C7429	Net 30	CBTS

Quantity	Description	Rate	Amount
1	ABB Model ACH550-BCR-023A-4+B055	2,990.00	2,990.00

WRP-C022

Thank you for your business.

Phone #

513-271-4977

Total $2,990.00

WRP Associates, LLC

Invoice

5668 Wooster Pike
Cincinnati, OH 45227
Phone: 513-271-4977

Date	Invoice #
8/15/2008	494

PAID
09/25/2008

Bill To

Glenwood Electric
12250 Chandler Drive
Walton, KY 41094

P.O. No.	Terms	Project
C7404	Net 30	

Quantity	Description	Rate	Amount
3	ABB Model ACH550-BCR-023A-4+B055, 15 HP Drives	3,025.00	9,075.00

Shipped To:
Cincinnati Bell
Attn: Mike March/Glenwood
221 E. Fourth St.
Cincinnati, OH 45201

WRP-B277

Thank you for your business.

Phone #

513-271-4977

Total $9,075.00

The VFD 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.

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	Kevin Daniel, Building Manager (as agent for Cincinnati Bell)
Company	Cincinnati Bell Telephone

Equipment Vendor / Project Engineer Contact Information

Name	Fred Betts
Company	Pedco

Location of Proposed VFD Project

Site Name	Cincinnati Bell W 7th St.
Electric Account Number(s)	3480-0674-01
Site Address	209-229 West 7th Street, Cincinnati Ohio, 45202

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.

Use one worksheet for each type of motor or fan that is being evaluated for a VFD

App No.					
Rev.					

Driven Equipment	**Name**	Cooling Towers	**Type** Fan
Quantity		2	
Brake HP (BHP) at Full Load (see note 1)		58.8	
Nameplate HP		60.0	

Current Equipment Operation without VFD - Input values for ONE driven equipment and its motor.

% of Full Load BHP of Driven Equipment		BHP of Driven Equipment @ Actual Load (BHP)	Motor output HP as % of Nameplate HP	Motor Efficiency @ Motor Output HP (%)		Motor Electrical Power Draw (kw)	Annual hours that motor runs (see note 2)	Monthly hours that each motor runs (see note 3)												Yearly Total (hr)
								Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
100	%	58.8	98%	95	%	46.17	4,416	744		744		744		720		744		720		4,416
	%	0.0	0%		%	#DIV/0!														0
	%	0.0	0%		%	#DIV/0!														0
	%	0.0	0%		%	#DIV/0!														0
Not Running		0.0	0%	NA	%	0.00														0
						Totals	**4,416**	**744**	**0**	**744**	**0**	**744**	**0**	**720**	**0**	**744**	**0**	**720**	**0**	**4,416**

Proposed Equipment Operation with VFD - Input values for ONE driven equipment and its motor.

Efficiency of VFD	98	%

% of Full Load BHP of Driven Equipment		BHP of Driven Equipment @ Actual Load (BHP)	Motor output HP as % of Motor Nameplate	Motor Efficiency @ Motor Output HP (%)		Motor Electrical Power Draw (kw)	Annual hours that motor runs (see note 2)	Monthly hours that each motor runs (see note 3)												Yearly Total (hr)
								Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
100	%	58.8	98%	95	%	47.12		280		280		19		675		720		10		1984
90	%	52.9	88%	95	%	42.40		225		225		150		69				35		704
80	%	47.0	78%	95	%	37.69		125		125		250						155		655
70	%	41.2	69%	95	%	32.98		60		60		225						200		545
60	%	35.3	59%	95	%	28.27		54		54		100						250		458
50	%	29.4	49%	95	%	23.56												70		70
40	%	23.5	39%		%	#DIV/0!														0
30	%	17.6	29%		%	#DIV/0!														0
20	%	11.8	20%		%	#DIV/0!														0
10	%	5.9	10%		%	#DIV/0!														0
Not Running		0.0	0%	NA	%	0.00	8,760	0	672	0	720	0	720	0	744	0	744	0	744	4,344
						Totals	**8,760**	**0**	**672**	**0**	**720**	**0**	**720**	**0**	**744**	**0**	**744**	**0**	**744**	**4,344**

Detailed Project Description Attached? Yes (Required)

1 Brake HP (BHP) at Full Load
The "full load" operating condition is the condition at which the driven equipment operates for the base condition (i.e., without the VFD)

2 Annual hours that motor runs
If the % operating loads do not vary between months, then enter the total annual hours that the motor will run at full load, partial load and hours not operating.

3 Monthly hours that each motor runs
If the % operating loads vary between months (due to weather conditions or seasonal load), fill in the expected hours that the motor will run each month at full load, partial load and hours not operating.

App No.	0
Rev.	0

Operating Hours (see note 4)

	Weekday		Saturday		Sunday		Weeks of Use in Year (see note 5)	Total Annual Hours of Use
24 x 7	Start Hour	End Hour	Start Hour	End Hour	Start Hour	End Hour		
Yes	*12:00 AM*	*11:59 PM*	*12:00 AM*	*11:59 PM*	*12:00 PM*	*11:59 PM*	*26*	*4,344*

Energy Savings

	Existing (no VFD)	Proposed (VFD)	Savings	Describe how energy numbers were calculated
Annual Electric Energy	269,376 kWh	233,317 kWh	36,059 kWh	
Electric Demand (kilowatts)	0 kW	0 kW	0 kW	
Calculations attached	Yes	Yes		63.94kVa*95PF*0.01=60.743kw*4416=kwh. Used % full load against hours at %fu

Simple Payback

Average electric rate ($/kWh) on the applicable accounts (see note 6)					$0.10
Estimated annual electric savings					$3,606
Other annual savings in addition to electric savings, such as operations, maintenance, other fuels					$0.00
Incremental cost to implement the project (equipment & installation) (see note 7)					$10,906.00
Copy of vendor proposal is attached (see note 8)					Yes
Simple Electric Payback in years (see note 9)	3.024487645		**Total Payback in years**		3.024487645

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. * TWO TOWERS RUN 8760 HRS/YR. ALL FOUR TOWERS RUN 2888 HRS OF THE YEAR DURING

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: Towers are rotated monthly so each unit operates 6 months out of the year

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 payback on the project is less than 1 year, then the project is not eligible for a custom incentive. Please check that the electric rate is accurate based on history.

The VFD 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.

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

Name	Kevin Daniel, Building Manager (as agent for Cincinnati Bell)
Company	Cincinnati Bell Telephone

Equipment Vendor / Project Engineer Contact Information

Name	Fred Betts
Company	Pedco

Location of Proposed VFD Project

Site Name	Cincinnati Bell W 7th St.
Electric Account Number(s)	3480-0674-01
Site Address	209-229 West 7th Street, Cincinnati Ohio, 45202

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.

Use one worksheet for each type of motor or fan that is being evaluated for a VFD

Driven Equipment	**Name**	Cooling Towers	**Type**	Fan	**App No.**
Quantity		2			**Rev.**
Brake HP (BHP) at Full Load (see note 1)		58.8			
Nameplate HP		60.0			

Current Equipment Operation without VFD - Input values for ONE driven equipment and its motor.

% of Full Load BHP of Driven Equipment		BHP of Driven Equipment @ Actual Load (BHP)	Motor output HP as % of Nameplate HP	Motor Efficiency @ Motor Output HP (%)		Motor Electrical Power Draw (kw)	Annual hours that motor runs (see note 2)	Monthly hours that each motor runs (see note 3)											Yearly Total (hr)
								Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
100	%	58.8	98%	95	%	46.17	4,344	0	672		720		720		744		744		744	4,344
	%	0.0	0%		%	#DIV/0!														0
	%	0.0	0%		%	#DIV/0!														0
	%	0.0	0%		%	#DIV/0!														0
Not Running		0.0	0%	NA	%	0.00														0
						Totals	**4,344**	**0**	**672**	**0**	**720**	**0**	**720**	**0**	**744**	**0**	**744**	**0**	**744**	**4,344**

Proposed Equipment Operation with VFD - Input values for ONE driven equipment and its motor.

Efficiency of VFD	98	%

% of Full Load BHP of Driven Equipment		BHP of Driven Equipment @ Actual Load (BHP)	Motor output HP as % of Motor Nameplate	Motor Efficiency @ Motor Output HP (%)		Motor Electrical Power Draw (kw)	Annual hours that motor runs (see note 2)	Monthly hours that each motor runs (see note 3)											Yearly Total (hr)
								Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
100	%	58.8	98%	95	%	47.12			200		50		450		700		744		5	2149
90	%	52.9	88%	95	%	42.40			200		85		250		44				25	604
80	%	47.0	78%	95	%	37.69			100		200		20						75	395
70	%	41.2	69%	95	%	32.98			77		225								200	502
60	%	35.3	59%	95	%	28.27			75		150								200	425
50	%	29.4	49%	95	%	23.56			20		10								239	269
40	%	23.5	39%		%	#DIV/0!														0
30	%	17.6	29%		%	#DIV/0!														0
20	%	11.8	20%		%	#DIV/0!														0
10	%	5.9	10%		%	#DIV/0!														0
Not Running		0.0	0%	NA	%	0.00	8,760	744	0	744	0	744	0	744	0	720	0	720	0	4,416
						Totals	**8,760**	**744**	**0**	**744**	**0**	**744**	**0**	**744**	**0**	**720**	**0**	**720**	**0**	**4,416**

Detailed Project Description Attached? Yes (Required)

1 Brake HP (BHP) at Full Load
The "full load" operating condition is the condition at which the driven equipment operates for the base condition (i.e., without the VFD)

2 Annual hours that motor runs
If the % operating loads do not vary between months, then enter the total annual hours that the motor will run at full load, partial load and hours not operating.

3 Monthly hours that each motor runs
If the % operating loads vary between months (due to weather conditions or seasonal load), fill in the expected hours that the motor will run each month at full load, partial load and hours not operating.

App No.	0
Rev.	0

Operating Hours (see note 4)

	Weekday		Saturday		Sunday		Weeks of Use in Year (see note 5)	Total Annual Hours of Use
24 x 7	Start Hour	End Hour	Start Hour	End Hour	Start Hour	End Hour		
Yes	*12:00 AM*	*11:59 PM*	*12:00 AM*	*11:59 PM*	*12:00 PM*	*11:59 PM*	*26*	*4,416*

Energy Savings

	Existing (no VFD)	Proposed (VFD)	Savings	Describe how energy numbers were calculated
Annual Electric Energy	264,984 kWh	228,118 kWh	36,866 kWh	
Electric Demand (kilowatts)	0 kW	0 kW	0 kW	
Calculations attached	Yes	Yes		63.94kVa*95PF*0.01=60.743kw*4344=kwh. Used % full load against hours at %fu

Simple Payback

Average electric rate ($/kWh) on the applicable accounts (see note 6)					$0.10
Estimated annual electric savings					$3,687
Other annual savings in addition to electric savings, such as operations, maintenance, other fuels					$0.00
Incremental cost to implement the project (equipment & installation) (see note 7)					$10,906.00
Copy of vendor proposal is attached (see note 8)					Yes
Simple Electric Payback in years (see note 9)	2.958281343		**Total Payback in years**		2.958281343

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: Equipment is rotated monthly so each tower runs 6 months per year.

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 payback on the project is less than 1 year, then the project is not eligible for a custom incentive. Please check that the electric rate is accurate based on history.

2841-01

EVAPCO, INC.
P.O. Box 1300
Westminster, Maryland 21158, USA

Telephone (410) 756-2600
FAX (410) 756-6450

February 09, 2007

Mr. Jerry Lindsay
Peck, Hannaford & Briggs
4673 Spring Grove Avenue
Cincinnati, OH 45230

RE: Purchase Order No. S89689-887
EVAPCO Order No. 7-308025-308026
(2) USS 224-918 Cooling Towers
Project: Cincinnati Bell Telephone 7th Street Chiller Proje

Dear Mr. Lindsay:

Please find the enclosed certified submittal data for the above referenced order. This data is provided "for record" only. This order has been released for production. Any changes may have a schedule and/or financial impact.

This order is being manufactured at our Greenup factory using the highest quality materials and will be assembled in accordance with EVAPCO's strict quality control guidelines. All EVAPCO® products undergo a mechanical test prior to shipment to ensure proper field performance.

This order is in our production schedule for shipment on or before 3/12/2007. If you experience any delays in the project, which would affect your shipments requirements, please contact your local EVAPCO representative, Trane Company - Cincinnati, as soon as possible.

Thank you for your selecting EVAPCO as your supplier. We appreciate your business and look forward to working with you in the future.

RECEIVED

Sincerely,

EVAPCO, INC.

Daniel S. Kelly

Daniel S. Kelly
Senior Product Manager

ENCLOSURE(S)
cc: Trane Company - Cincinnati - Bill Schriner

February 15, 2007

EVAPCO® SUBMITTAL PACKAGE

PROJECT CINCINNATI BELL TELEPHONE 7TH STREET UNIT (2) USS 224-918 COOLING TOWERS

CUSTOMER PECK, HANNAFORD & BRIGGS P.O. S89689-887

EVAPCO SERIAL NO. 7-308025-308026 ENGINEER PEDCO

SUBMITTAL DATA ENCLOSED

DESCRIPTION	DOCUMENT NUMBER
PERFORMANCE AND MECHANICAL SPECIFICATIONS	USS12ST-ST
UNIT CERTIFIED DRAWING	T2241848-ERB-24
STEEL SUPPORT CONFIGURATION	SLAI2418DC
MOTOR DAVIT ARR. BELT DRIVE UNITS	MBAITTOO-ERA
LADDER DRAWING	T22418ERALD
VIBRATION SWITCH (SINGLE SPEED)	V1AU0000-ED
GUARANTEE OF THERMAL PERFORMANCE	AOS2636

EVAPCO...TAKING QUALITY AND SERVICE TO A HIGHER LEVEL!

Date 2/9/2007

PERFORMANCE AND MECHANICAL SPECIFICATIONS

EVAPCO® USS COOLING TOWERS

PROJECT	Cincinnati Bell Telephone 7th Street Chiller Proje		
CUSTOMER	Peck, Hannaford & Briggs		
ENGINEER	Pedco		
UNIT:	(2) USS 224-918 Cooling Towers		
CUSTOMER P.O.	S89689-887	EVAPCO SERIAL NO.	7-308025-308026
CAPACITY	Each Unit 4650 GPM	95 °F IN / 85 °F OUT	78 °F E.W.B.
FAN MOTOR:	Each Unit (2) 60 (Inverter Duty) HP	ELEC. SPEC.	460/3/60
INLET PRESSURE:	3.7 PSIG	DRIVES SIZED FOR 0" ESP.	

UNIT TYPE	Factory assembled, induced draft, counterflow cooling tower.
CONSTRUCTION	All cold water basin components including vertical supports and air inlet louver frames are constructed of Type 316 Stainless Steel. Type 316 Stainless Steel casing, channels and angle supports. Fan cowl is constructed of stainless steel.
MAKE UP FLOAT VALVE ASSEMBLY*	Brass float valve with adjustable plastic float.
PAN STRAINER*	All stainless steel construction with large area removable perforated screens.
ACCESS	Hinge mounted door in the upper casing for fan drive and water distribution system access. Removable louver panels on all four sides of the unit for pan and sump access.
FAN SHAFT	Solid shaft of ground and polished steel. Exposed surface coated with rust preventative.
FAN SHAFT BEARINGS	Heavy-duty, self-aligning ball type bearings with extended lubrication lines to grease fittings located on access door frame. Bearings are designed for a minimum L-10 life of 75,000 hours.
FANS	Fans are axial propeller type constructed of aluminum alloy and statically balanced. The fan is installed in a closely fitted cowl with venturi air inlet. Fan screens are stainless steel and have stainless steel frames bolted to the fan cowl.
FAN MOTOR	Totally enclosed ball bearing type electric motor(s) suitable for moist air service. Motor(s) are 1.15 service factor design.
FAN DRIVE	The fan drive is a multi-groove, solid back, reinforced neoprene V-belt type with taper lock sheaves designed for 150% of the motor nameplate horsepower. Fan and motor sheaves are constructed of aluminum alloy.

FILL	Polyvinyl Chloride (PVC) of cross-fluted design. PVC sheets are bonded together for strength and durability. Fill is self-extinguishing for fire resistance, has a flame spread of 5 under A.S.T.M. designation E-84-81a, and is resistant to rot, decay and biological attack.
WATER DISTRIBUTION SYSTEM	Precision molded ABS spray nozzles with a large orifice to eliminate clogging. Spray header and branches are Schedule 40 Polyvinyl Chloride (PVC) for corrosion resistance with stainless steel connection to attach external piping.
ELIMINATORS	The eliminators are constructed entirely of Polyvinyl Chloride (PVC) in easily handled sections. Design incorporates three changes in air direction and limits the water carryover to a maximum of 0.001% of the circulating water rate.
AIR INLET LOUVERS	The air inlet louvers are constructed from UV inhibited polyvinyl chloride (PVC) and incorporate a framed interlocking design that allows for easy removal of louvers for access to the entire basin area for maintenance. The louvers have a minimum of two changes in air direction and are of a non-planar design to prevent splash-out, block direct sunlight and debris from entering the basin. (Patent Pending)

*OMITTED ON UNITS FOR REMOTE SUMP OPERATION	All SST	12 FT WIDE BELT DRIVE	USS12ST-ST

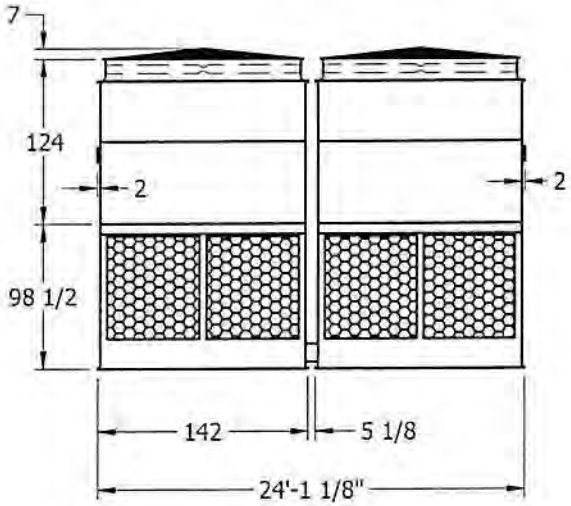
SPECIAL REMARKS:

- Unit(s) to be supplied with Inverter Duty fan motor(s).
- Remote Sump Trash Screen(s).
- Flume Plate.
- Unit(s) provided with ladder(s).
- (1) Motor Davit and Base per fan motor.
- Unit provided with Vibration Cutout Switch(es), mounted (wiring and sensitivity adjustment by others).
- Unit(s) is arranged for remote sump operation. Suction hood, strainers and make-up valve(s) are not provided for this application.
- Unit to ship loosely bolted, less sealer tape.

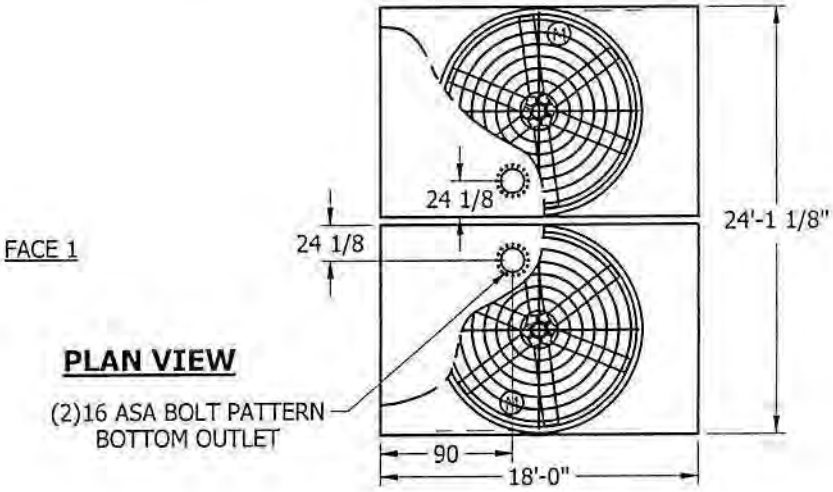
EVAPCO, INC.

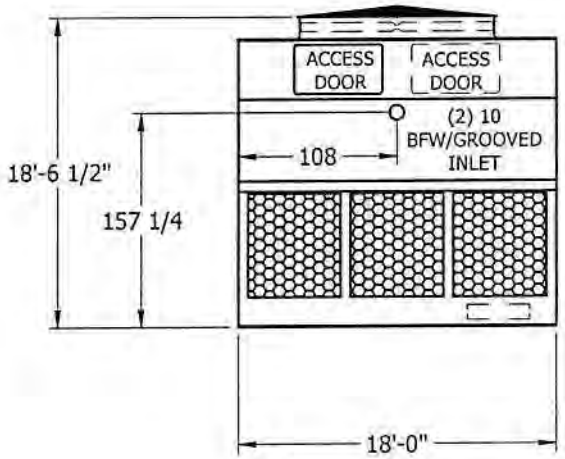
UNIT	MODEL #	SCALE	DWG. #	REV.	DATE	SERIAL #
COOLING TOWER	USS 224-918	NTS	T2241848-ERB-24	-	2/9/07	7-308025-26

NOTES:
1. (M)- FAN MOTOR LOCATION
2. HEAVIEST SECTION IS UPPER SECTION
3. MPT DENOTES MALE PIPE THREAD
   FPT DENOTES FEMALE PIPE THREAD
   BFW DENOTES BEVELED FOR WELDING
4. + UNIT WEIGHT DOES NOT INCLUDE ACCESSORIES (SEE SEPARATE DRAWINGS FOR ACCESSORIES)
5. 3/4" DIA. MOUNTING HOLES. REFER TO RECOMMENDED STEEL SUPPORT DRAWING



FACE 1



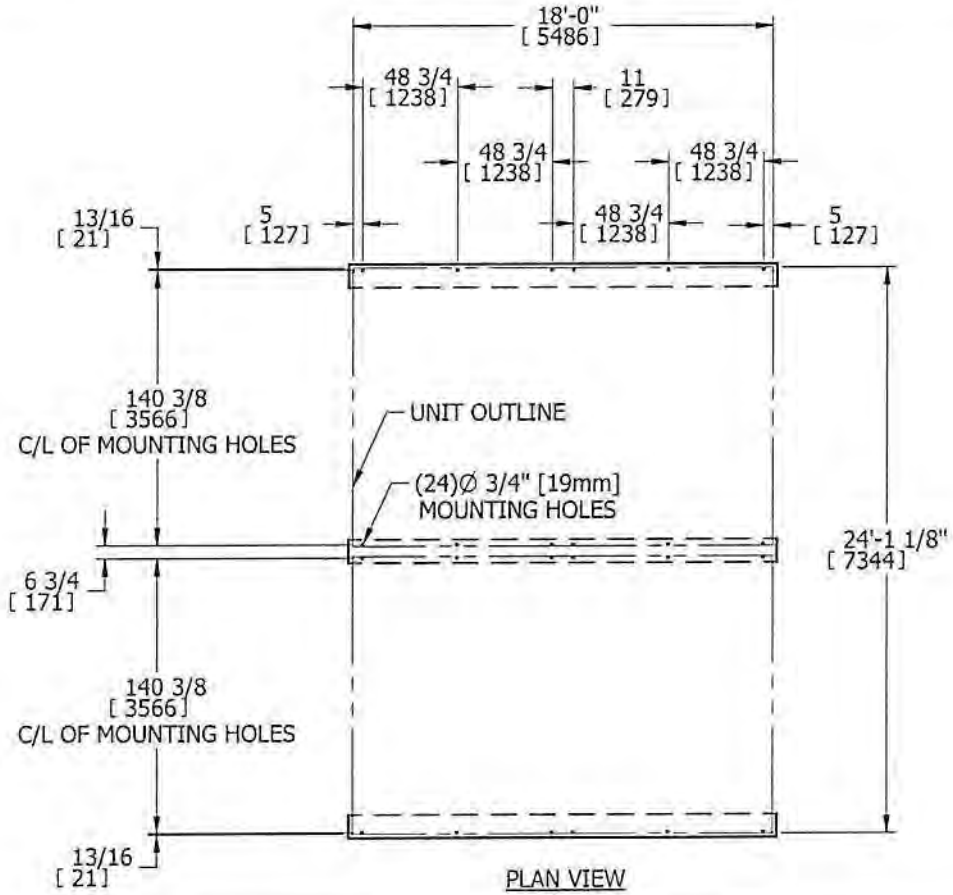


FACE 2

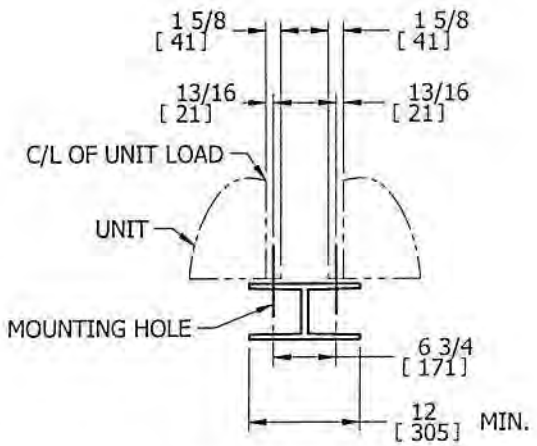
SHIPPING WEIGHT	25180 lbs.+	OPERATING WEIGHT	32740 lbs.	HEAVIEST SECTION WEIGHT	8870 lbs.	NO. OF SHIPPING SECTIONS	4

EVAPCO, INC.

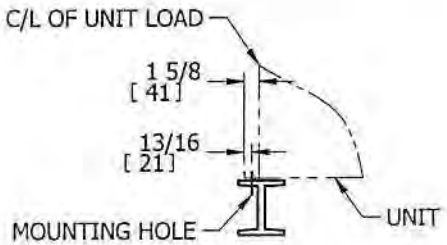
TITLE	UNIT:	DWG. #
STEEL SUPPORT CONFIGURATION	24x18 INDUCED DRAFT UNITS	SLAI2418-DC



PLAN VIEW



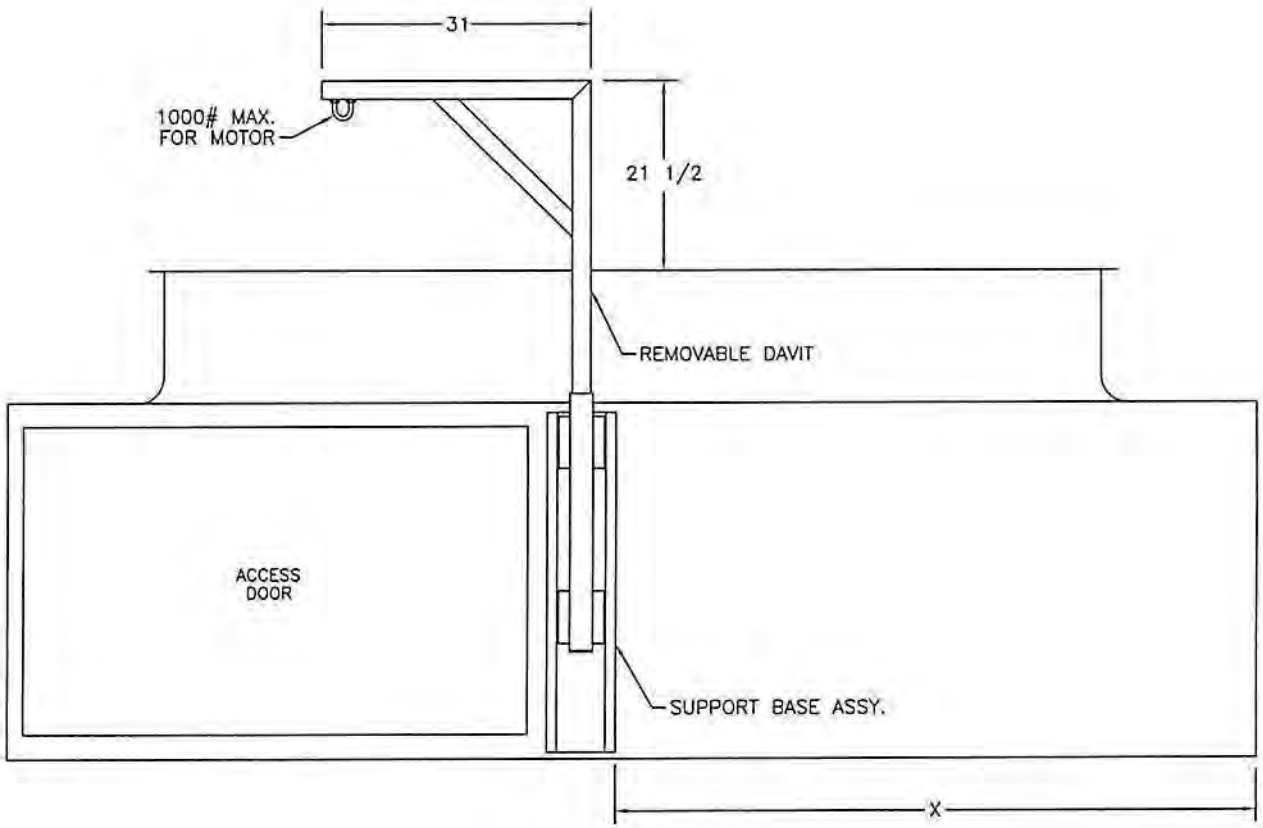
CENTER ARRANGEMENT



TYPICAL END VIEW

NOTES:

1. BEAMS SHOULD BE SIZED IN ACCORDANCE WITH ACCEPTED STRUCTURAL PRACTICES. MAXIMUM DEFLECTION OF BEAM UNDER UNIT TO BE 1/360 OF UNIT LENGTH NOT TO EXCEED 1/2" [13mm].
2. DEFLECTION MAY BE CALCULATED BY USING 55% OF THE OPERATING WEIGHT AS A UNIFORM LOAD ON EACH BEAM. SEE CERTIFIED PRINT FOR OPERATING WEIGHT.
3. SUPPORT BEAMS AND ANCHOR HARDWARE ARE TO BE FURNISHED BY OTHERS. ANCHOR HARDWARE TO BE 5/8" [16mm].
4. BEAMS MUST BE LOCATED UNDER THE FULL LENGTH OF THE PAN SECTION.
5. SUPPORTING BEAM SURFACE MUST BE LEVEL. DO NOT LEVEL THE UNIT BY PLACING SHIMS BETWEEN THE UNIT MOUNTING FLANGE AND THE SUPPORTING BEAM.
6. ANCHORING ARRANGEMENT SHOWN HAS A MAXIMUM WIND RATING OF 30 PSF [1.44KPa] ON CASED VERTICAL SURFACES.
7. THE FACTORY RECOMMENDED STEEL SUPPORT CONFIGURATION IS SHOWN. CONSULT THE FACTORY FOR ALTERNATE SUPPORT CONFIGURATIONS.
8. UNIT SHOULD BE POSITIONED ON STEEL SUCH THAT THE ANCHORING HARDWARE FULLY PENETRATES THE BEAM'S FLANGE AND CLEARS THE BEAM'S WEB.
9. ALL 24 X 18 MODELS ARE MULTIPLE CELL UNITS. OPERATING WEIGHT OF EACH CELL IS FOUND BY DIVIDING TOTAL OPERATING WEIGHT BY THE NUMBER OF CELLS.
10. WHEN VIBRATION ISOLATION IS REQUIRED FOR MULTIPLE CELL UNITS, THE VIBRATION ISOLATORS (BY OTHERS) MUST BE LOCATED UNDER THE SUPPORTING STEEL BEAMS AND NOT BETWEEN THE SUPPORTING STEEL BEAMS AND THE UNIT.
11. THE CENTER BEAM SHOULD HAVE A MINIMUM WIDTH OF 12" [305mm].



UNIT	X
12X	67 3/4
24X	104 1/2

SIDE VIEW

ALL AT/USS/UB 12X/24X INDUCED DRAFT UNITS

NOTES:
1. DAVIT IS DESIGNED FOR RAISING OR LOWERING EVAPCO FAN MOTORS AND GEAR REDUCERS ONLY. DO NOT USE FOR ANY OTHER PURPOSE.
2. MAXIMUM DESIGN LOAD OF DAVIT IS 1000lbs. LOADING ON DAVIT SHOULD BE DONE INDEPENDENTLY, AND LIFTING MORE THAN ONE OBJECT AT ONCE MAY RESULT IN FAILURE OF DAVIT.
3. DAVIT IS DESIGNED TO PIVOT FREELY IN THE SUPPORT BASE ASSY.AND CAN BE REMOVED FOR STORAGE.
4. EACH FAN SECTION CONTAINS (1) SUPPORT BASE ASSY. AND (1)REMOVABLE DAVIT SUPPLIED BY EVAPCO.
5. THE SUPPORT BASE ASSY. WILL BE SHIPPED LOOSE.

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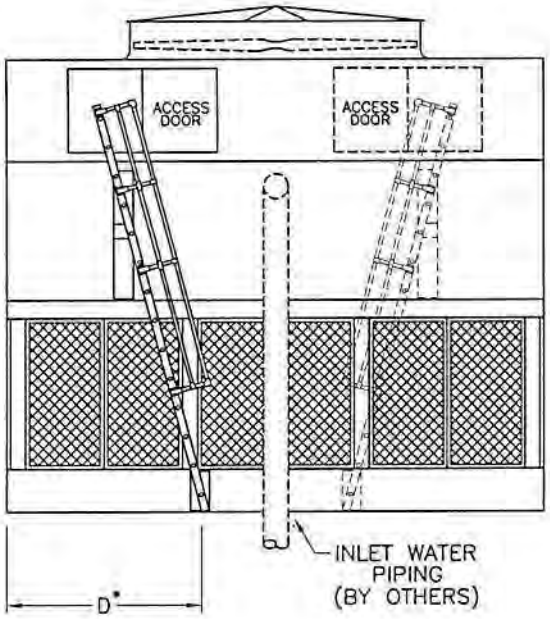
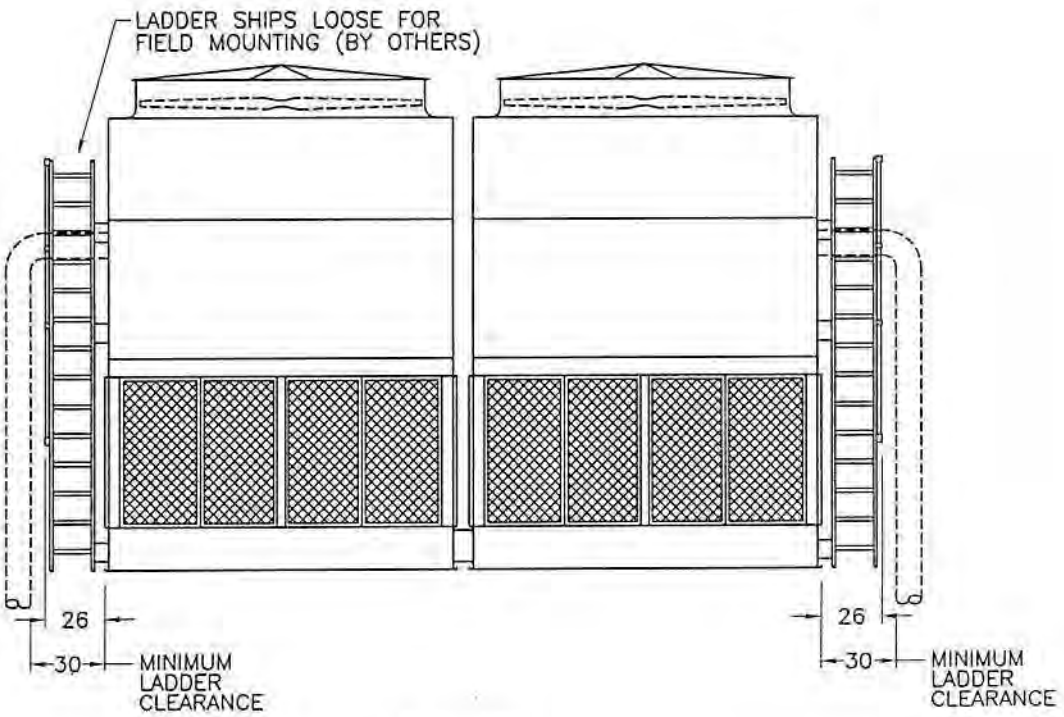
MOTOR DAVIT ARR.
BELT DRIVE UNITS

MBAITTOO–ERA



SIDE VIEW



END VIEW

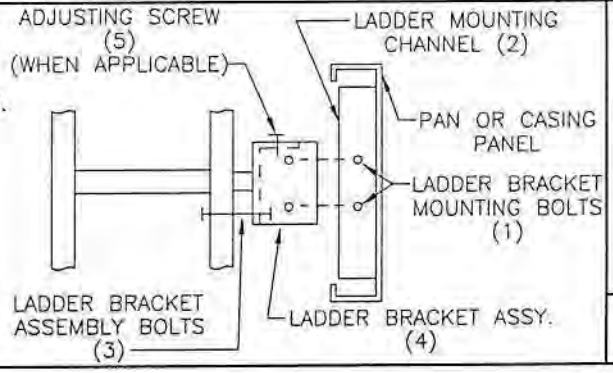
- Ⓜ –FAN MOTOR LOCATION
- * THE BOTTOM OF THE LADDER IS AT THE BASE OF THE UNIT. IF THE UNIT IS ELEVATED THEN A LADDER EXTENSION SHOULD BE CONSIDERED. (CONSULT FACTORY). LADDER EXTENSIONS OF UP TO 3 FEET CAN BE ADDED WITHOUT ANY ADDITIONAL SUPPORT. FOR A LADDER EXTENSION LONGER THAN 3 FEET ADDITIONAL SUPPORT MUST BE PROVIDED BY OTHERS.
- LOOKING AT SIDE VIEW, LADDER ON OPPOSITE SIDE IS ROTATED 180° AND DIAGONAL FROM SHOWN LADDER.

RIG LADDERS BEFORE PIPING UNIT

TOWERS	D(IN)
AT/USS 224-018/118/318	93 1/8
AT/USS 224-218/418 618/718	95 5/8
AT/USS 224-518/818/918	99 3/4

CUSTOMER INSTALLATION NOTES:

a. REMOVE LADDER BRACKET MOUNTING BOLTS (1) FROM LADDER MOUNTING CHANNELS (2) ON PAN AND CASING SECTIONS.
b. LOOSEN, BUT DO NOT REMOVE, LADDER BRACKET AND ASSY. BOLTS (3).
c. TO ASSEMBLE, SLIDE LADDER BRACKET ASSY. (4) OVER LADDER MOUNTING CHANNELS (2) LOCATED ON PAN AND CASING (DO NOT REMOVE LADDER BRACKET ASSY. (4) FROM LADDER.)
d. ALIGN HOLES AND REINSTALL LADDER BRACKET MOUNTING BOLTS (1) THROUGH LADDER BRACKET ASSY. (4) AND LADDER MOUNTING CHANNELS (2).
e. TIGHTEN ALL BOLTS.
f. TIGHTEN ADJUSTING SCREW (5) IN THE ADJUSTABLE MOUNTING BRACKETS WHEN APPLICABLE.



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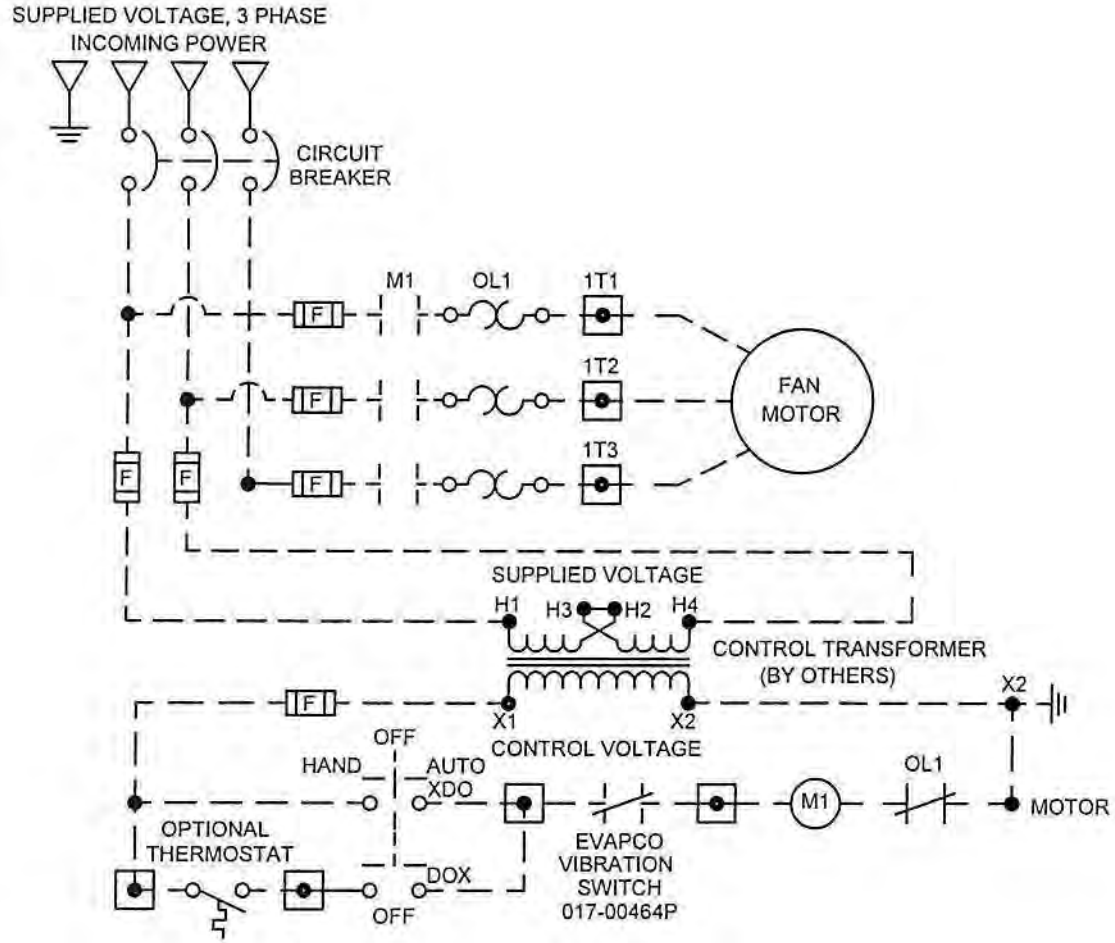
LADDER INSTALLATION PACKAGE

T22418ERA–LD

EVAPCO, INC.

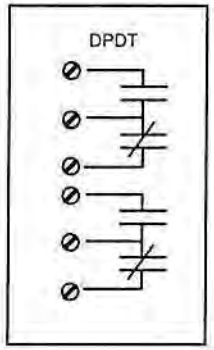
TITLE	DESCRIPTION:	DWG. #
VIBRATION SWITCH	SINGLE SPEED	V1AU0000-ED



SWITCH CONTACT RATING:

15 AMPS, 125, OR 480 Vac; 1/8 HP, 125 Vac; 1/4 HP, 250 Vac; 1/2 AMP, 125 Vdc; 1/4 AMP, 250 Vdc.

WIRING DIAGRAM:



NOTES:

1. DASHED LINES INDICATE WIRING(BY OTHERS)

ADJUSTMENT

ADJUST THE SWITCH SO THAT DURING FULL SPEED START-UP AND UNDER NORMAL CONDITIONS, THE CONTACTS DO NOT TRIP. FIRST, WITH THE MOTOR ON AT FULL SPEED, TURN THE ADJUSTMENT SCREW COUNTER-CLOCKWISE (MORE SENSITIVE DIRECTION) UNTIL THE SWITCH TRIPS. NEXT, TURN ON THE ADJUSTMENT SCREW CLOCKWISE 1/8 TURN (LESS SENSITIVE DIRECTION). RESET THE SWITCH BY DEPRESSING THE PUSH-BUTTON RESET LOCATED ON TOP OF THE SWITCH. START THE MOTOR ON FULL SPEED. IF THE MOTOR TRIPS THE SWITCH, THEN TURN THE ADJUSTMENT SCREW CLOCKWISE AN ADDITIONAL 1/8 TURN. RESET THE SWITCH AND START THE MOTOR AGAIN. REPEAT THE ABOVE PROCEDURE UNTIL THE MOTOR CONTINUES TO RUN.

Guarantee of Thermal Performance by EVAPCO

EVAPCO® unequivocally guarantees the thermal performance of its equipment as shown on the certified drawings, when the equipment is installed in accordance with good engineering practice. If after installation and start-up there is any question regarding thermal performance of the equipment, at the owner's request EVAPCO will send its engineers to the jobsite to conduct a performance test. This test may be observed by the owner and the consulting engineer or by their authorized representatives. If the results of the evaluation show the equipment to be deficient, EVAPCO will make the necessary repairs or alterations to correct the deficiency at no cost to the owner. If the equipment is found to be performing in accordance with its certified drawing, the owner is expected to reimburse the company for its costs associated with this performance test.

evapco

EVAPCO, INC. INCORPORATED MCMLXXVI MARYLAND

AOS2636

WRP Associates, LLC

Invoice

5668 Wooster Pike
Cincinnati, OH 45227
Phone: 513-271-4977

Date	Invoice #
6/11/2008	395

PAID
07/24/2008

Bill To

Glenwood Electric
12250 Chandler Drive
Walton, KY 41094

P.O. No.	Terms	Project
C7350	Net 30	

Quantity	Description	Rate	Amount
4	ABB Model ACH550-BCR-078A-4+B055 60 HP Drives	7,406.00	29,624.00
2	ABB Model ACH550-BCR-157A-4+B055 125 HP Drives	11,473.00	22,946.00
2	ABB Model ACH550-BCR-180A-4+B055 150 HP Drives	13,222.00	26,444.00

Shipped To:
Glenwood Electric
C/O Cincinnati Bell Telephone
229 West 7th St.
Cincinnati, OH 45202

WRP-B195

Thank you for your business.

Phone #

513-271-4977

Total $79,014.00

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 1-513-419-5572.

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 an/or billing history for other utilities as required):

Account Number	Annual Usage	Account Number	Annual Usage
3480-0674-01	76,828,077		

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 ☐
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 ☐
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 513-419-5572

Mercantile Self Direct
Nonresidential Custom Rebate Application
PART 1

1. Contact Information (Required)

Duke Energy Customer Contact Information									
Company Name	Cincinnati Bell Telephone								
Address	209 West 7th Street, Mail Location 121-1200								
Project Contact	Kevin Daniel								
City	Cincinnati	State	Ohio	Zip Code	45202				
Title	Building Operations Manager, Real Estate Dept.								
Office Phone	513-397-5412	Mobile Phone	513-604-6959	Fax	513-397-0842				
E-mail Address	kevin.daniel@cinbell.com AND grace.lobono@cinbell.com								

Equipment Vendor / Contractor / Architect / Engineer Contact Information									
Company Name	Johnson Controls, Glenwood Electric								
Address	209 W7th St								
City	Cincinnati	State	OH	Zip Code	45202				
Project Contact	Kevin Daniel								
Title	Building Manager								
Office Phone	513-397-5412	Mobile Phone	613-604-6959	Fax	513-397-0842				
E-mail Address	kevin.daniel@cinbell.com AND grace.lobono@cinbell.com								
Describe Role	Responsible to oversee all facility capital improvements and maintenance								

Payment Information					
Payee Legal Company Name (as shown on Federal income tax return):	Cincinnati Bell Telephone				
Mailing Address	209 W 7th St. ML 121-1200				
City	Cincinnati Bell	State	OH	Zip Code	45202
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:	20-2003820				
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____/___/_____ (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.

Variable Speed Drives were installed on our Condenser Water Pumps, Cooling Towers, Chilled Water Pumps, and the Domestic Water Pumps, providing efficiency to the Chiller Plant.

C. When did you start and complete implementation?

Start date 1/ 2008 (mm/yyyy) End date 12/2008 (mm/yyyy)

D. Are you also applying for Self-Direct Prescriptive incentives and, if so, which one(s)[1]?

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.

Documentation and Trend Data for all pumps and drives is submitted with the applications.

[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) Kevin Daniel, 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).

Duke Energy Ohio, Inc Customer Signature

Print Name Kevin Daniel

Date 12-15-11

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.*