EMS
Energy Management Solutions, Inc.

*Using **Our** Energy to Save **Yours***

Energy Conservation and Incentive Summary

Customer: GE Aviation

Project: NUP Custom VFD's

Hours of Operation: 8,760 hrs/yr

Scope of Work: GE Aviation has decided to put in a new utility plant on their facility that consists of multiple motors throughout the plant. As part of the project, VFD's were installed on all of the motors to be more energy efficient and to save on utility costs. Due to the size of these motors (150-400HP), these need to be run as a custom project.

See attached spreadsheets for further details and breakdown of savings. Savings are based on motors operating at 70% load.

- Assumed Hours of Operation:
  - 8,760 hrs/yr
- Total Savings
  - 8,624,107 kWh
- Cost Savings (8,624,107 kWh @ $0.06/kWh)
  - $517,446/yr
- Total Cost
  - $787,500.00
- Simple Payback
  - 1.52 yrs
- Estimated Rebate
  - Mercantile 50% - $354,120.98

GE Aviation NUP - Custom VFDs

Designation	Server	VFD Type	Model	Drive HP	Qty VFD's	Total HP	Annual Op Hours	Project Cost	Date Installed and Operable	kWh Savings	kW Savings	Total Rebate	Payback @$0.06/kWh
VFD-451-CHP-6-1	CHP-451-6	Chilled Water Pump	GE DRIVE 6HFPH31254400320	400	3	1,200	8760	$ 420,000	10/1/2017	4,596,943	524.80	$ 377,521	
VFD-451-CHP-7-1	CHP-451-7	Chilled Water Pump	GE DRIVE 6HFPH31254400320						10/1/2017			$ -	
VFD-451-CHP-8-1	CHP-451-8	Chilled Water Pump	GE DRIVE 6HFPH31254400320						10/1/2017			$ -	
VFD-451-CWP-1-1	CWP-451-1	Condenser Water Pump	GE CORE DRIVE 6KFP43250X9XXCB1	250	3	750	8760	$ 262,500	10/1/2017	2,873,089	328.00	$ 235,951	
VFD-451-CWP-1-2	CWP-451-2	Condenser Water Pump	GE CORE DRIVE 6KFP43250X9XXCB1						10/1/2017			$ -	
VFD-451-CWP-1-3	CWP-451-3	Condenser Water Pump	GE CORE DRIVE 6KFP43250X9XXCB1						10/1/2017			$ -	
VFD-451-HWP-4-1	HWP-451-4	Hot Water Pump	GE CORE DRIVE 6KFP43150X9XXCB1	150	2	300	8760	$ 105,000	10/1/2017	1,154,075	131.70	$ 94,770	
VFD-451-HWP-5-1	HWP-451-5	Hot Water Pump	GE CORE DRIVE 6KFP43150X9XXCB1						10/1/2017			$ -	
Total:						2,250		$ 787,500		8,624,107	984.50	$ 708,242	1.52

Mercantile 50% $ 354,120.98

ENERGY EFFICIENT MEASURES
VARIABLE FREQUENCY DRIVE

EMS
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ENERGY SAVINGS INPUT DATA

Customer Name:	**GE Aviation**
Customer Location:	**Ohio**
Date:	**4/24/2018**
Improvement Description:	**GE Aviation put (3) GE Drives 6HFPH31254400320 onto their chilled water pumps (CHP-451-6, CHP-451-7, CHP-451-8).**

Motor Size	400.00	H.P.	Proposed Control Type:	VFD			
Number of Motors	3	# Proposed					
Total Motor Size	1,200.00	H.P.	Motor Efficiency	95.4%		VFD Efficiency =	98%
Current Motor Type	New		Electric Demand Rate =	$0.00	kW	Hours of Operation =	8,760
Existing Control	None - Pump		Electricity Rate =	$0.060	kWh	Operating Months =	12
Load Profile	Standard						

		Percent of Full Input Power							
System Rated Flow	Operating Time	Existing	Proposed VFD	Full-Load Power kW	Existing Motor Input Power	Proposed Motor Input Power	kW Power Savings	Hours Per Year	kWh/Yr. Energy Savings
0%	0%	100%	27%	0.0	0.0	0.0	0.0	0	0
20%	0%	100%	14%	938.4	938.4	137.2	801.2	0	0
25%	0%	100%	13%	938.4	938.4	126.9	811.5	0	0
30%	0%	100%	13%	938.4	938.4	125.0	813.4	0	0
35%	0%	100%	14%	938.4	938.4	131.6	806.8	0	0
40%	0%	100%	15%	938.4	938.4	146.5	791.8	0	0
45%	0%	100%	18%	938.4	938.4	170.0	768.4	0	0
50%	0%	100%	21%	938.4	938.4	201.8	736.5	0	0
55%	0%	100%	25%	938.4	938.4	242.1	696.3	0	0
60%	0%	100%	30%	938.4	938.4	290.8	647.5	0	0
65%	0%	100%	36%	938.4	938.4	348.0	590.4	0	0
70%	100%	100%	43%	938.4	938.4	413.6	524.8	8,760	4,596,943
75%	0%	100%	51%	938.4	938.4	487.6	450.7	0	0
80%	0%	100%	60%	938.4	938.4	570.1	368.3	0	0
85%	0%	100%	69%	938.4	938.4	661.0	277.4	0	0
90%	0%	100%	79%	938.4	938.4	760.3	178.0	0	0
95%	0%	100%	91%	938.4	938.4	868.1	70.2	0	0
100%	0%	100%	103%	938.4	938.4	984.3	(46.0)	0	0
	100%							Total	4,596,943

ECONOMIC EVALUATION:

Estimated Installed Drive Cost	$360,000.00
kWh Saved	4,596,943
kW Saved	524.8
Savings $	$275,816.58
Rebate	$377,516.07
Payback	1.3

Rebate Rate

$0.065	/kWh
$150	/kW

Disclaimer: All values are estimates based on information provided at the time. These values are not to be taken as fact and proof of installation is needed for rebates to be issued.

Prepared by: Mark Goudreault
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Phone Number: 952-797-3025

ENERGY EFFICIENT MEASURES
VARIABLE FREQUENCY DRIVE

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Using OUR Energy to Save YOURS

ENERGY SAVINGS INPUT DATA

Customer Name:	**GE Aviation**
Customer Location:	**Ohio**
Date:	**4/24/2018**
Improvement Description:	**GE Aviation put (3) GE Core Drives 6KFP43250X9XXCB1 onto their condensed water pumps (CWP-451-1, CWP-451-2, CWP-451-3).**

Motor Size	750.00	H.P.	Proposed Control Type:	VFD			
Number of Motors	1	# Proposed					
Total Motor Size	750.00	H.P.	Motor Efficiency	95.4%		VFD Efficiency =	98%
Current Motor Type	New		Electric Demand Rate =	$0.00	kW	Hours of Operation =	8,760
Existing Control	None - Pump		Electricity Rate =	$0.065	kWh	Operating Months =	12
Load Profile	Standard						

System Rated Flow	Operating Time	Percent of Full Input Power: Existing	Percent of Full Input Power: Proposed VFD	Full-Load Power kW	Existing Motor Input Power	Proposed Motor Input Power	kW Power Savings	Hours Per Year	kWh/Yr. Energy Savings
0%	0%	100%	27%	0.0	0.0	0.0	0.0	0	0
20%	0%	100%	14%	586.5	586.5	85.8	500.7	0	0
25%	0%	100%	13%	586.5	586.5	79.3	507.2	0	0
30%	0%	100%	13%	586.5	586.5	78.1	508.4	0	0
35%	0%	100%	14%	586.5	586.5	82.2	504.3	0	0
40%	0%	100%	15%	586.5	586.5	91.6	494.9	0	0
45%	0%	100%	18%	586.5	586.5	106.2	480.3	0	0
50%	0%	100%	21%	586.5	586.5	126.1	460.3	0	0
55%	0%	100%	25%	586.5	586.5	151.3	435.2	0	0
60%	0%	100%	30%	586.5	586.5	181.8	404.7	0	0
65%	0%	100%	36%	586.5	586.5	217.5	369.0	0	0
70%	100%	100%	43%	586.5	586.5	258.5	328.0	8,760	2,873,089
75%	0%	100%	51%	586.5	586.5	304.8	281.7	0	0
80%	0%	100%	60%	586.5	586.5	356.3	230.2	0	0
85%	0%	100%	69%	586.5	586.5	413.1	173.4	0	0
90%	0%	100%	79%	586.5	586.5	475.2	111.3	0	0
95%	0%	100%	91%	586.5	586.5	542.6	43.9	0	0
100%	0%	100%	103%	586.5	586.5	615.2	(28.7)	0	0
	100%							Total	2,873,089

ECONOMIC EVALUATION:

Estimated Installed Drive Cost	$225,000.00
kWh Saved	2,873,089
kW Saved	328.0
Savings $	$172,385.36
Rebate	$235,947.55
Payback	1.3

Rebate Rate

$0.065	/kWh
$150	/kW

Disclaimer: All values are estimates based on information provided at the time. These values are not to be taken as fact and proof of installation is needed for rebates to be issued.

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ENERGY EFFICIENT MEASURES
VARIABLE FREQUENCY DRIVE

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ENERGY SAVINGS INPUT DATA

Customer Name:	**GE Aviation**
Customer Location:	**Ohio**
Date:	**4/24/2018**
Improvement Description:	**GE Aviation put (2) GE Core Drives 6KFP43150X9XXCB1 onto their hot water pumps (HWP-451-4, HWP-451-5).**

Motor Size	150.00	H.P.	Proposed Control Type:	VFD			
Number of Motors	2	# Proposed					
Total Motor Size	300.00	H.P.	Motor Efficiency	95.0%	VFD Efficiency =	98%	
Current Motor Type	New		Electric Demand Rate =	$0.00	kW	Hours of Operation =	8,760
Existing Control	None - Pump		Electricity Rate =	$0.060	kWh	Operating Months =	12
Load Profile	Standard						

		Percent of Full Input Power							
System Rated Flow	Operating Time	Existing	Proposed VFD	Full-Load Power kW	Existing Motor Input Power	Proposed Motor Input Power	kW Power Savings	Hours Per Year	kWh/Yr. Energy Savings
0%	0%	100%	27%	0.0	0.0	0.0	0.0	0	0
20%	0%	100%	14%	235.6	235.6	34.4	201.1	0	0
25%	0%	100%	13%	235.6	235.6	31.9	203.7	0	0
30%	0%	100%	13%	235.6	235.6	31.4	204.2	0	0
35%	0%	100%	14%	235.6	235.6	33.0	202.6	0	0
40%	0%	100%	15%	235.6	235.6	36.8	198.8	0	0
45%	0%	100%	18%	235.6	235.6	42.7	192.9	0	0
50%	0%	100%	21%	235.6	235.6	50.7	184.9	0	0
55%	0%	100%	25%	235.6	235.6	60.8	174.8	0	0
60%	0%	100%	30%	235.6	235.6	73.0	162.6	0	0
65%	0%	100%	36%	235.6	235.6	87.4	148.2	0	0
70%	100%	100%	43%	235.6	235.6	103.8	131.7	8,760	1,154,075
75%	0%	100%	51%	235.6	235.6	122.4	113.2	0	0
80%	0%	100%	60%	235.6	235.6	143.1	92.5	0	0
85%	0%	100%	69%	235.6	235.6	165.9	69.6	0	0
90%	0%	100%	79%	235.6	235.6	190.9	44.7	0	0
95%	0%	100%	91%	235.6	235.6	217.9	17.6	0	0
100%	0%	100%	103%	235.6	235.6	247.1	(11.5)	0	0
	100%							Total	1,154,075

ECONOMIC EVALUATION:

Estimated Installed Drive Cost	$90,000.00
kWh Saved	1,154,075
kW Saved	131.7
Savings $	$69,244.48
Rebate	$94,776.40
Payback	1.3

Rebate Rate

$0.065	/kWh
$150	/kW

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Phone Number: 952-797-3025

General Electric International Inc
4200 Wildwood Pkwy
Atlanta, GA 30339 USA

BRANCH ADDRESS: 4200 Wildwood Pkwy, Atlanta,GA 30339 US

SHIP TO: GE AIRCRAFT ENGINE
*GEN ELEC CO
CINCINNATI OH 45215

BILL TO: IBS ADMINISTRATOR IBS ADMINISTRATOR
GE AIRCRAFT ENGINE
*GEN ELEC CO
CINCINNATI OH 45215

ORIGINAL INVOICE

INVOICE NUMBER	INVOICE DATE	PAGE
1078959	26-JUL-16	1 of 1

DUE DATE	PAYMENT TERMS
26-JUL-16	DUE ON RECEIPT

SEND PAYMENT SHOWING INVOICE NO. & INVOICE DATE TO

BY MAIL: GE INTERNATIONAL INC
P.O. BOX # 281997
ATLANTA GA 30384-1997

BY WIRE: DEUTSCHE BANK TRUST COMP
ACC# 50280397
ABA# 021001033
NEWYORK, NY
Swift Code: BKTRUS33

Seller VAT ID

GE Tax ID# 13-1962940

Customer VAT ID:

We now accept: Master Card, Visa and American Express. Call Phone# listed below for processing

CURRENCY : USD

CUSTOMER ORDER NUMBER	GE REFERENCE NUMBER	GE CUSTOMER NUMBER	BILLING PERIOD
2931890HZCAW	30039120	F00000	26-JUL-16

LINE	SVC.DATE	PRODUCT/SERVICE PROVIDED	TAX/VAT%	QUANTITY	UOM	UNIT PRICE	EXTENDED AMOUNT
1		NUP Plant VFDs, JUN 2016		1		65,465.00	65,465.00

Signature and Stamp

TAX SUMMARY BY RATE

TAX NAME/RATE	NET AMOUNT	TAX/VAT%	TAX/VAT AMOUNT	TOT AMOUNT
TOTAL				

State tax statutes require that a copy of tax-exempt certificate be maintained in our records,otherwise we must collect tax on sales invoiced. If applicable, please return a copy of your valid tax-exempt certificates to the following address, to ensure accurate invoicing: General Electric, PO Box 2639, LILBURN, GA 30048. Fax (949) 252-7340

UNIT TOTAL	TAX TOTAL	SHIP HNDL TOTAL	INVOICE TOTAL
65,465.00	0.00	0.00	65,465.00

General Electric International Inc
4200 Wildwood Pkwy
Atlanta, GA 30339 USA

BRANCH ADDRESS: 4200 Wildwood Pkwy, Atlanta, GA 30339 US

SHIP TO: GE AIRCRAFT ENGINE
*GEN ELEC CO
CINCINNATI OH 45215

BILL TO: IBS ADMINISTRATOR IBS ADMINISTRATOR
GE AIRCRAFT ENGINE
*GEN ELEC CO
CINCINNATI OH 45215

ORIGINAL INVOICE

INVOICE NUMBER	INVOICE DATE	PAGE
1079425	24-AUG-16	1 of 1

DUE DATE	PAYMENT TERMS
24-AUG-16	DUE ON RECEIPT

SEND PAYMENT SHOWING INVOICE NO. & INVOICE DATE TO

BY MAIL: GE INTERNATIONAL INC
P.O. BOX # 281997
ATLANTA GA 30384-1997

BY WIRE: DEUTSCHE BANK TRUST COMP
ACC# 50280397
ABA# 021001033
NEWYORK, NY
Swift Code: BKTRUS33

Seller VAT ID

GE Tax ID# 13-1962940

Customer VAT ID:

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CURRENCY : USD

CUSTOMER ORDER NUMBER	GE REFERENCE NUMBER	GE CUSTOMER NUMBER	BILLING PERIOD
2931906HZCDW	30039121	F00000	24-AUG-16

LINE	SVC.DATE	PRODUCT/SERVICE PROVIDED	TAX/VAT%	QUANTITY	UOM	UNIT PRICE	EXTENDED AMOUNT
1		Defer NUP Plant VFDs, AUG 2016		1		3,371.40	3,371.40

Signature and Stamp

TAX SUMMARY BY RATE

TAX NAME/RATE	NET AMOUNT	TAX/VAT%	TAX/VAT AMOUNT	TOT AMOUNT
TOTAL				

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UNIT TOTAL	TAX TOTAL	SHIP HNDL TOTAL	INVOICE TOTAL
3,371.40	0.00	0.00	3,371.40

General Electric International Inc
4200 Wildwood Pkwy
Atlanta, GA 30339 USA

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ORIGINAL INVOICE

INVOICE NUMBER	INVOICE DATE	PAGE
1079424	24-AUG-16	1 of 1

DUE DATE	PAYMENT TERMS
24-AUG-16	DUE ON RECEIPT

SEND PAYMENT SHOWING INVOICE NO. & INVOICE DATE TO

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P.O. BOX # 281997
ATLANTA GA 30384-1997

BY WIRE: DEUTSCHE BANK TRUST COMP
ACC# 50280397
ABA# 021001033
NEWYORK, NY
Swift Code: BKTRUS33

Seller VAT ID

GE Tax ID# 13-1962940

Customer VAT ID:

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CURRENCY : USD

CUSTOMER ORDER NUMBER	GE REFERENCE NUMBER	GE CUSTOMER NUMBER	BILLING PERIOD
2931890HZCAW	30039120	F00000	24-AUG-16

LINE	SVC DATE	PRODUCT/SERVICE PROVIDED	TAX/VAT%	QUANTITY	UOM	UNIT PRICE	EXTENDED AMOUNT
1		NUP Plant VFDs, AUG 2016		1		19,104.60	19,104.60

Signature and Stamp

TAX SUMMARY BY RATE

TAX NAME/RATE	NET AMOUNT	TAX/VAT%	TAX/VAT AMOUNT	TOT AMOUNT
TOTAL				

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UNIT TOTAL	TAX TOTAL	SHIPHNDL TOTAL	INVOICE TOTAL
19,104.60	0.00	0.00	19,104.60

General Electric International Inc
4200 Wildwood Pkwy
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ORIGINAL INVOICE

INVOICE NUMBER	INVOICE DATE	PAGE
1079897	20-SEP-16	1 of 1

DUE DATE	PAYMENT TERMS
20-SEP-16	DUE ON RECEIPT

SEND PAYMENT SHOWING INVOICE NO. & INVOICE DATE TO

BY MAIL: GE INTERNATIONAL INC
P.O. BOX # 281997
ATLANTA GA 30384-1997

BY WIRE: DEUTSCHE BANK TRUST COMP
ACC# 50280397
ABA# 021001033
NEWYORK, NY
Swift Code: BKTRUS33

Seller VAT ID

GE Tax ID# 13-1962940

Customer VAT ID:

We now accept: Master Card, Visa and American Express. Call Phone# listed below for processing

CURRENCY : USD

CUSTOMER ORDER NUMBER	GE REFERENCE NUMBER	GE CUSTOMER NUMBER	BILLING PERIOD
2931906HZCDW	30039121	F00000	20-SEP-16

LINE	SVC DATE	PRODUCT/SERVICE PROVIDED	TAX/VAT%	QUANTITY	UOM	UNIT PRICE	EXTENDED AMOUNT
1		Defer NUP Plant VFDs, SEP 2016		1		17,830.20	17,830.20

Signature and Stamp

TAX SUMMARY BY RATE

TAX NAME/RATE	NET AMOUNT	TAX/VAT%	TAX/VAT AMOUNT	TOT AMOUNT
TOTAL				

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UNIT TOTAL	TAX TOTAL	SHIP HNDL TOTAL	INVOICE TOTAL
17,830.20	0.00	0.00	17,830.20

General Electric International Inc
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ORIGINAL INVOICE

INVOICE NUMBER	INVOICE DATE	PAGE
1078972	26-JUL-16	1 of 1

DUE DATE	PAYMENT TERMS
26-JUL-16	DUE ON RECEIPT

SEND PAYMENT SHOWING INVOICE NO. & INVOICE DATE TO

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Customer VAT ID:

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CURRENCY: USD

CUSTOMER ORDER NUMBER	GE REFERENCE NUMBER	GE CUSTOMER NUMBER	BILLING PERIOD
2931906HZCDW	30039121	F00000	26-JUL-16

LINE	SVC.DATE	PRODUCT/SERVICE PROVIDED	TAX/VAT%	QUANTITY	UOM	UNIT PRICE	EXTENDED AMOUNT
1		Defer NUP Plant VFDs, JUN 2016		1		9,819.75	9,819.75

Signature and Stamp

TAX SUMMARY BY RATE

TAX NAME/RATE	NET AMOUNT	TAX/VAT%	TAX/VAT AMOUNT	TOT AMOUNT
TOTAL				

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General Electric, PO Box 2639, LILBURN, GA 30048. Fax (949) 252-7340

UNIT TOTAL	TAX TOTAL	SHIP HNDL TOTAL	INVOICE TOTAL
9,819.75	0.00	0.00	9,819.75

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4200 Wildwood Pkwy
Atlanta, GA 30339 USA

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GE AIRCRAFT ENGINE
*GEN ELEC CO
CINCINNATI OH 45215

ORIGINAL INVOICE

INVOICE NUMBER	INVOICE DATE	PAGE
1079896	20-SEP-16	1 of 1

DUE DATE	PAYMENT TERMS
20-SEP-16	DUE ON RECEIPT

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ATLANTA GA 30384-1997

BY WIRE: DEUTSCHE BANK TRUST COMP
ACC# 50280397
ABA# 021001033
NEWYORK, NY
Swift Code: BKTRUS33

Seller VAT ID

GE Tax ID# 13-1962940

Customer VAT ID:

We now accept: Master Card, Visa and American Express. Call Phone# listed below for processing

CURRENCY : USD

CUSTOMER ORDER NUMBER	GE REFERENCE NUMBER	GE CUSTOMER NUMBER	BILLING PERIOD
2931890HZCAW	30039120	F00000	20-SEP-16

LINE	SVC.DATE	PRODUCT/SERVICE PROVIDED	TAX/VAT%	QUANTITY	UOM	UNIT PRICE	EXTENDED AMOUNT
1		NUP Plant VFDs, SEP 2016		1		101,037.80	101,037.80

Signature and Stamp

TAX SUMMARY BY RATE

TAX NAME/RATE	NET AMOUNT	TAX/VAT%	TAX/VAT AMOUNT	TOT AMOUNT
TOTAL				

State tax statutes require that a copy of tax-exempt certificate be maintained in our records,otherwise we must collect tax on sales invoiced. If applicable, please return a copy of your valid tax-exempt certificates to the following address, to ensure accurate invoicing: General Electric, PO Box 2639, LILBURN, GA 30048. Fax (949) 252-7340

UNIT TOTAL	TAX TOTAL	SHIP HNDL TOTAL	INVOICE TOTAL
101,037.80	0.00	0.00	101,037.80

APPLICATION AND CERTIFICATE FOR PAYMENT

TO (OWNER): CH2MHILL ENGINEERS, INC
One Neumann Way MD D9
Cincinnati, OH 45215

PROJECT: GE Evendale North Utility Plant MEP
Evendale, OH 45215

APPLICATION NO: 21609-14
PERIOD TO: 9-30-17

Distribution to:
☐ OWNER
☐ ARCHITECT
☐ CONTRACTOR
☐
☐

FROM (CONTRACTOR): MONARCH CONSTRUCTION COMPANY
PO BOX 631100
CINCINNATI OH 45263-1100

ARCHITECT'S PROJECT NO:
CONTRACT NO: EBF1945-SC-010
CONTRACT DATE:

CONTRACT FOR: General Construction

CONTRACTOR'S APPLICATION FOR PAYMENT

Application is made for Payment, as shown below, in connection with the Contract.

Continuation Sheet, AIA Document G703, is attached.

CHANGE ORDER SUMMARY		ADDITIONS	DEDUCTIONS
Change Orders approved in previous months by Owner			
	TOTAL	7,527,459.25	18,279.00
Approved this month			
Number	Date Approved		
42	Sep-17	3,934.00	
43	Sep-17	1,169.00	
	Totals	7,532,562.25	18,279.00
Net change by Change Orders		7,514,283.25	

1. ORIGINAL CONTRACT SUM		$ 5,842,390.00
2. Net change by Change Orders		$ 7,514,283.25
3. CONTRACT SUM TO DATE (Line 1 +/- 2)		$ 13,356,673.25
4. TOTAL COMPLETED & STORED TO DATE (Column G on G703)		$ 13,356,673.25
5. RETAINAGE:		
a. Retainage 10%	$ 1,335,667.33	
b. Retainage for stored material	$ -	
c. Amount withheld		$ -
Total Retainage (Line 5a + 5b or Total in Column I of G703)		$ 1,335,667.33
6. TOTAL EARNED LESS RETAINAGE (Line 4 less Line 5 Total)		$ 12,021,006.92
7. LESS PREVIOUS CERTIFICATES FOR PAYMENT (Line 6 from prior Certificate)		$ 12,016,413.22
8. CURRENT PAYMENT DUE		$ 4,592.70
9. BALANCE TO FINISH, PLUS RETAINAGE (Line 3 less Line 6)		$ 1,335,667.33

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 the 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: MONARCH CONSTRUCTION COMPANY

By: Wendy Taylor Date: 9/29/17
Wendy Taylor, Controller

State of: Ohio County of Hamilton
Subscribed and sworn to before me this 29th day of August, 2017.
Notary Public: LINDSEY BUTLER
Notary Public, State of Ohio
My Commission Expires 06-26-2022
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 the 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.)

ARCHITECT:

By: Date:

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

A	B	C	D	E	F	G		H	I
Item No.	Description of Work	Scheduled Value	WORK COMPLETED		Other (Not in D or E)	Total Completed to Date (Describe Below) (D+E+F)	(G ÷ C) %	Balance to Finish	Retainage Ten %
			From Previous Application (D + E)	This Period					
	General Conditions								
1	Mobilization/Demobilization	12,000.00	12,000.00			12,000.00	100%		1,200.00
2	General Conditions	172,000.00	172,000.00			172,000.00	100%		17,200.00
3	MEP PM & Badging								
4	Safety and Security Requirements	28,000.00	28,000.00			28,000.00	100%		2,800.00
5	SWPPP	1,200.00	1,200.00			1,200.00	100%		120.00
6	Insurance	28,000.00	28,000.00			28,000.00	100%		2,800.00
7	Builders Risk Insurance	8,000.00	8,000.00			8,000.00	100%		800.00
8	Project Closeout								
9	Equipment Trucking								
10	3D BIM Coordination	356,000.00	356,000.00			356,000.00	100%		35,600.00
	HVAC								
11	Ductwork	406,180.00	406,180.00			406,180.00	100%		40,618.00
12	Owner Furnished Equipment Installation								
13	HVAC Controls/Devices	600,000.00	600,000.00			600,000.00	100%		60,000.00
14	Testing/Inspection								
	CWS/Temporary HW & CW Tie-in								
15	CW Piping Above RO Space								
16	Piping	1,329,000.00	1,329,000.00			1,329,000.00	100%		132,900.00
17	CHW Piping to AHU's								
18	Insulation								
19	Pipe Supports	200,000.00	200,000.00			200,000.00	100%		20,000.00
20	Equipment Installation	284,000.00	284,000.00			284,000.00	100%		28,400.00
21	CT Support Steel	200,000.00	200,000.00			200,000.00	100%		20,000.00
22	Testing/Inspections								
	Hot Water System								
23	Piping								
24	Insulation								
25	Pipe Supports	69,000.00	69,000.00			69,000.00	100%		6,900.00
26	Testing/Inspection								
27	RO System								
	Not In Scope								

Description of Item G: _____

A	B	C	D	E	F	G		H	I
Item No.	Description of Work	Scheduled Value	WORK COMPLETED		Other (Not in D or E)	Total Completed to Date (Describe Below) (D+E+F)	(G ÷ C) %	Balance to Finish	Retainage Ten %
			From Previous Application (D + E)	This Period					
	Air Compressor System								
28	Not in Scope								
29	Natural Gas								
30	Piping	217,650.00	217,650.00			217,650.00	100%		21,765.00
31	Pipe Supports	16,100.00	16,100.00			16,100.00	100%		1,610.00
32	Inline Devices/Controls								
33	Testing/Inspection								
	Domestic HW/CW Systems								
34	Piping								
35	Insulation								
36	Equipment Installation								
37	Relocate Backflow Preventer								
38	Testing/Inspection								
	Sanitary/Oil Waster/Storm								
39	Sanitary/OW Piping								
40	Sewer Ejector Pump Equipment	54,000.00	54,000.00			54,000.00	100%		5,400.00
41	Oil Separator	29,000.00	29,000.00			29,000.00	100%		2,900.00
42	Testing/Inspection								
	Electrical								
43	Medium Voltage Feeder Cables	100,000.00	100,000.00			100,000.00	100%		10,000.00
44	Equipment Installation	413,100.00	413,100.00			413,100.00	100%		41,310.00
45	Power Distribution	263,000.00	263,000.00			263,000.00	100%		26,300.00
46	Cable Tray	279,000.00	279,000.00			279,000.00	100%		27,900.00
47	Lighting								
48	Substation Grounding								
49	Security								
50	Fire Alarm/EWS								
51	PMCS Controls								
52	Conduit and Wiring for HVAC and Process Controls								

Description of Item G: _____

A	B	C	D	E	F	G		H	I
Item No.	Description of Work	Scheduled Value	WORK COMPLETED		Other (Not in D or E)	Total Completed to Date (Describe Below) (D+E+F)	(G ÷ C) %	Balance to Finish	Retainage Ten %
			From Previous Application (D + E)	This Period					
	Architectural								
53	Control Room Fitout								
54	Patching Roof Penetrations Labor to Install Interior CMU Walls, Paint, Install D/F/H per Previously Issued Bid Alternate #13 Clarification Document,								
55	dated 7-1-16	200,000.00	200,000.00			200,000.00	100%		20,000.00
56	Other	25,900.00	25,900.00			25,900.00	100%		2,590.00
	RO Distribution Scope								
57	Demo	67,000.00	67,000.00			67,000.00	100%		6,700.00
	Taxes								
58	Taxes	204,750.00	204,750.00			204,750.00	100%		20,475.00
	Others								
59	Fire Protection (Base)	149,000.00	149,000.00			149,000.00	100%		14,900.00
60	CWT Alternate Material Stainless	33,927.00	33,927.00			33,927.00	100%		3,392.70
61	Additional Valves on NPCW and CWW Service	8,644.00	8,644.00			8,644.00	100%		864.40
62	Stormwater Ditch Demo	14,066.00	14,066.00			14,066.00	100%		1,406.60
63	Gravel at UF/RO Tank Pad	2,145.00	2,145.00			2,145.00	100%		214.50
64	Slab modifications at Substation to Accommodate Low Voltage Switchgear	18,393.00	18,393.00			18,393.00	100%		1,839.30
65	Added Cable Tray Unistrut Support at North Utility Rack	45,349.00	45,349.00			45,349.00	100%		4,534.90
66	Supplemental Cable Tray Material	8,086.00	8,086.00			8,086.00	100%		808.60
67	Others								
68	C.O. 10 Rework Doors Per Bulletin #3	11,451.00	11,451.00			11,451.00	100%		1,145.10
	General Conditions								
69	Mobilization/Demobilization	18,000.00	18,000.00			18,000.00	100%		1,800.00
70	General Conditions	502,000.00	502,000.00			502,000.00	100%		50,200.00
71	MEP PM & Badging								
72	Safety and Security Requirements	42,000.00	42,000.00			42,000.00	100%		4,200.00
73	SWPPP	1,800.00	1,800.00			1,800.00	100%		180.00
74	Insurance	42,000.00	42,000.00			42,000.00	100%		4,200.00
75	Builders Risk Insurance	12,000.00	12,000.00			12,000.00	100%		1,200.00
76	Project Closeout	15,000.00	15,000.00			15,000.00	100%		1,500.00

Description of Item G: _____

A Item No.	B Description of Work	C Scheduled Value	D WORK COMPLETED From Previous Application (D + E)	E This Period	F Other (Not in D or E)	G Total Completed to Date (Describe Below) (D+E+F)	(G ÷ C) %	H Balance to Finish	I Retainage Ten %
77	Equipment Trucking	20,000.00	20,000.00			20,000.00	100%		2,000.00
78	3D BIM Coordination								
	HVAC								
79	Ductwork	181,820.00	181,820.00			181,820.00	100%		18,182.00
80	Owner Furnished Equipment Installation	95,000.00	95,000.00			95,000.00	100%		9,500.00
81	HVAC Controls/Devices	222,000.00	222,000.00			222,000.00	100%		22,200.00
82	Testing/Inspection	3,000.00	3,000.00			3,000.00	100%		300.00
	CWS/Temporary HW & CW Tie-In								
83	CW Piping Above RO Space								
84	Piping	1,842,158.00	1,842,158.00			1,842,158.00	100%		184,215.80
85	CHW Piping to AHU's	209,200.00	209,200.00			209,200.00	100%		20,920.00
86	Insulation	133,500.00	133,500.00			133,500.00	100%		13,350.00
87	Pipe Supports	11,300.00	11,300.00			11,300.00	100%		1,130.00
88	Equipment Installation	406,000.00	406,000.00			406,000.00	100%		40,600.00
89	CT Support Steel								
90	Testing/Inspections	49,000.00	49,000.00			49,000.00	100%		4,900.00
	Hot Water System								
91	Piping	811,000.00	811,000.00			811,000.00	100%		81,100.00
92	Insulation	218,500.00	218,500.00			218,500.00	100%		21,850.00
93	Pipe Supports	3,700.00	3,700.00			3,700.00	100%		370.00
94	Testing/Inspection	23,000.00	23,000.00			23,000.00	100%		2,300.00
	RO System								
95	Not In Scope								
	Air Compressor System								
96	Not In Scope								
	Natural Gas								
97	Piping	11,450.00	11,450.00			11,450.00	100%		1,145.00
98	Pipe Supports								
99	Inline Devices/Controls								
100	Testing/Inspection	8,800.00	8,800.00			8,800.00	100%		880.00

Description of Item G: _____

A	B	C	D	E	F	G		H	I
Item No.	Description of Work	Scheduled Value	WORK COMPLETED		Other (Not in D or E)	Total Completed to Date (Describe Below) (D+E+F)	(G ÷ C) %	Balance to Finish	Retainage Ten %
			From Previous Application (D + E)	This Period					
	Domestic HW/CW Systems								
101	Piping	338,000.00	338,000.00			338,000.00	100%		33,800.00
102	Insulation	86,000.00	86,000.00			86,000.00	100%		8,600.00
103	Equipment Installation								
104	Relocate Backflow Preventer	25,300.00	25,300.00			25,300.00	100%		2,530.00
105	Testing/Inspection	12,000.00	12,000.00			12,000.00	100%		1,200.00
	Sanitary/Oil Waster/Storm								
106	Sanitary/CW Piping	244,000.00	244,000.00			244,000.00	100%		24,400.00
107	Sewer Ejector Pump Equipment								
108	Oil Seperator								
109	Testing/Inspections	5,700.00	5,700.00			5,700.00	100%		570.00
	Electrical								
111	Medium Voltage Feeder Cables	129,000.00	129,000.00			129,000.00	100%		12,900.00
112	Equipment Installation								
113	Power Distribution	569,000.00	569,000.00			569,000.00	100%		56,900.00
114	Cable Tray	30,000.00	30,000.00			30,000.00	100%		3,000.00
115	Lighting	211,000.00	211,000.00			211,000.00	100%		21,100.00
116	Substation Grounding	44,300.00	44,300.00			44,300.00	100%		4,430.00
117	Security	120,400.00	120,400.00			120,400.00	100%		12,040.00
118	Fire Alarm/EWS	213,700.00	213,700.00			213,700.00	100%		21,370.00
119	PMCS Controls	65,400.00	65,400.00			65,400.00	100%		6,540.00
120	Conduit and Wiring for HVAC and Process Controls	180,000.00	180,000.00			180,000.00	100%		18,000.00
	Architectural								
121	Control Room Fitout	23,000.00	23,000.00			23,000.00	100%		2,300.00
122	Patching Roof Penetrations	15,500.00	15,500.00			15,500.00	100%		1,550.00
123	Labor to Install Interior CMU Walls, Paint, Install D/F/H per Previously Issued Bid Alternate #13 Clarification Document, dated 7-1-16	105,000.00	105,000.00			105,000.00	100%		10,500.00
124	Other	4,000.00	4,000.00			4,000.00	100%		400.00
	RO Distribution Scope								
125	Demo								
126	Taxes								
127	Taxes	110,250.00	110,250.00			110,250.00	100%		11,025.00
Totals									

Description of Item G: _____

A Item No.	B Description of Work	C Scheduled Value	D WORK COMPLETED From Previous Application (D + E)	E WORK COMPLETED This Period	F Other (Not in D or E)	G Total Completed to Date (Describe Below) (D+E+F)	(G ÷ C) %	H Balance to Finish	I Retainage Ten %
128	CAR 3 Steel at Box	2,024.00	2,024.00			2,024.00	100%		202.40
129	CAR 4 PHB Tie In	10,400.00	10,400.00			10,400.00	100%		1,040.00
130	CAR 5 Heating #1	16,631.00	16,631.00			16,631.00	100%		1,663.10
131	CAR 6 CMU Rescope	63,139.00	63,139.00			63,139.00	100%		6,313.90
132	CAR 7 Temp Power UPS	569.00	569.00			569.00	100%		56.90
133	CAR 8 Louver Blanks	2,408.00	2,408.00			2,408.00	100%		240.80
134	CAR 9 Elevator Generator	6,881.00	6,881.00			6,881.00	100%		688.10
135	CAR 10 Transformer Lugs	578.00	578.00			578.00	100%		57.80
136	CAR 11 Added Break Metal	2,763.00	2,763.00			2,763.00	100%		276.30
137	CAR 12 Added Roof Pavers	4,976.00	4,976.00			4,976.00	100%		497.60
138	CAR 13 Mezz Panels and Transformers	23,806.00	23,806.00			23,806.00	100%		2,380.60
139	CAR 14 Pump Terminal Boxes	2,565.00	2,565.00			2,565.00	100%		256.50
140	CAR 15 Fire Dept Connection	8,996.00	8,996.00			8,996.00	100%		899.60
141	CAR 16 Added Sprinkler Head	27,426.00	27,426.00			27,426.00	100%		2,742.60
142	CAR 17 Fiber Change	10,906.00	10,906.00			10,906.00	100%		1,090.60
143	CAR 18 AKD20 Tray	10,542.00	10,542.00			10,542.00	100%		1,054.20
144	CAR 19 Bulleting #4	38,079.00	38,079.00			38,079.00	100%		3,807.90
145	CAR 20 Building Permit	10,606.25	10,606.25			10,606.25	100%		1,060.63
146	CAR 21 Heating #2	8,980.00	8,980.00			8,980.00	100%		898.00
147	CAR 22 Hydr. Split	307.00	307.00			307.00	100%		30.70
148	CAR 23 400 Tie In	6,075.00	6,075.00			6,075.00	100%		607.50
149	CAR 24 Handrail Mod	4,176.00	4,176.00			4,176.00	100%		417.60
150	CAR 25 Control Room Windows	1,694.00	1,694.00			1,694.00	100%		169.40
151	CAR 26 Misc Elec	1,191.00	1,191.00			1,191.00	100%		119.10
152	CAR 27 Unload Material	615.00	615.00			615.00	100%		61.50
153	CAR 28 Trench Cutting	8,981.00	8,981.00			8,981.00	100%		898.10
154	CAR 29 Power Second Split	4,982.00	4,982.00			4,982.00	100%		498.20
155	CAR 30 Scrap Pipe Removal	(614.00)	(614.00)			(614.00)	100%		(61.40)
156	CAR 31 Commissioning Assist	(16,915.00)	(16,915.00)			(16,915.00)	100%		(1,691.50)
157	CAR 32 Saddle Thickness	4,976.00	4,976.00			4,976.00	100%		497.60
158	CAR 33 PDP Descope	(750.00)	(750.00)			(750.00)	100%		(75.00)
159	CAR 34 400 Tin In Insulation	2,954.00	2,954.00			2,954.00	100%		295.40
160	CAR 35 Light Switch Credit	(750.00)	(750.00)			(750.00)	100%		(75.00)
161	CAR 36 Added Duke Costs	2,196.00	2,196.00			2,196.00	100%		219.60
162	CAR 37 Cone Light Credit	(780.00)	(780.00)			(780.00)	100%		(78.00)

Description of Item G: _____

A	B	C	D	E	F	G		H	I
Item No.	Description of Work	Scheduled Value	WORK COMPLETED		Other (Not in D or E)	Total Completed to Date (Describe Below) (D+E+F)	(G ÷ C) %	Balance to Finish	Retainage Ten %
			From Previous Application (D + E)	This Period					
163	CAR 38 Split Syst Relocation	4,244.00	4,244.00			4,244.00	100%		424.40
164	CAR 39 Battery Charger Install	1,629.00	1,629.00			1,629.00	100%		162.90
165	CAR 40 Boiler Controls	7,840.00	7,840.00			7,840.00	100%		784.00
166	CAR 41 Elevator Lighs	736.00	736.00			736.00	100%		73.60
167	CAR 42 Storefront Door	3,934.00		3,934.00		3,934.00	100%		393.40
168	CAR 43 Replace damanged floor sinks	1,169.00		1,169.00		1,169.00	100%		116.90
Totals		13,356,873.25	13,351,570.25	5,103.00		13,356,873.25			1,335,687.33

Description of Item G: _____

EQUIPMENT SPECIFICATION

PROJECT NAME	North Utility Plant
LOCATION	Building 451
CLIENT	GE Aviation - Evendale
EQUIPMENT	Variable Frequency Drives
EQUIPMENT NO.	See Performance Schedule Within
TOTAL NO. REQ'D.	32

DATE 10/12/15

* THESE ARE THE BID SPECIFICATIONS PREPARED BY GE AVIATION

SCOPE:

This specification covers the basic requirements for total of thirty-two (32) solid-state, PWM, VFDs for speed control of three-phase squirrel-cage induction motors utilized including, pumps, air handling unit fans, and exhaust fans.

SUMMARY:

This section includes wall or base mounted Variable Frequency Drives.

See the MECHANICAL and ELECTRICAL drawings provided for reference with this bid package

☐ REVIEWED ☒ REVIEWED/CORRECTIONS NOTED
☐ REJECTED ☐ REVISE AND RESUBMIT
Corrections or comments made on the submittals during this review do not relieve Contractor from compliance with requirements of the Contract Documents. This review is for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Document. The Contractor remains responsible for determining the accuracy and completeness of other details such as dimensions and quantities; for subcontracting instructions for installations; verifying materials, field measurements and related construction criteria; checking, coordinating, and performing Work in compliance with the Contract Documents.
KZF DESIGN Inc. PN Date 4/12/16

SUBMITTALS:

General: Submit the following:

Product data for the Variable Frequency Drives, including the following:

1. Matching load ratings to device of use including pumps or fans.
2. Output ratings for phase throughout voltage range.
3. Unit operating requirements including tolerances, efficiencies, overload capability, starting torque and speed regulation.
4. Other interface abilities including internal adjustability capabilities, self-protection and reliability, automatic reset/restart, torque boost, motor temperature compensation, manual bypass (where applicable) and indicating devices.
5. Shop drawings from manufacturer detailing dimensions, required clearances, components and location and size of each field connection meeting the maximum length, width and height requirements as described herein.
6. Wiring diagrams detailing wiring for power and controls and differentiating between manufacturers installed wiring and field installed wiring.
7. Delivery and shipping information including delivery within seven (7) days of purchase order.

QUALITY ASSURANCE:

NFPA 70: Listed and laveled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

UL and NEMA Compliance: Provide electrical components required as part of variable frequency drives, which have been listed and labeled by UL and comply with NEMA Standards.

DELIVERY:

Deliver variable frequency drives as a factory assembled unit to the extent allowable by shipping limitations, with protective crating and covering. Variable frequency drives shall be protected from exposure to dirt, fumes, water, corrosive substances and physical damage.

SEQUENCING AND SCHEDULING:

Coordinate the delivery of variable frequency drives with written notification to the Owner's Representative 48 hours prior to deliver.

GENERAL DESCRIPTION:

General: Variable Frequency Drive shall include all items as listed herein for each size range:

WALL MOUNTED VARIABLE FREQUENCY DRIVES:

1. Variable Frequency Drives for use on fan motors smaller than 75 HP shall be wall mounted types.
2. Drives shall be NEMA ICS 2, IGBT, PWM: listed and labeled as a complete unit and arranged to provide variable speed of a NEMA MG 1, Design B, 3-phase induction motor by adjusting output voltage and frequency.
3. Drives design and rating shall match load type such as fans or blowers and type of connection used between motor and load such as direct or through a power-transmission connection.
4. Drive enclosure shall come as a single unit of NEMA 12 construction and shall include a panel mounted operator station with start-stop and auto-manual selector switches with manual speed control potentiometer and elapsed time meter.

BASE MOUNTED VARIABLE FREQUENCY DRIVES:

1. Variable Frequency Drives for use on pump motors larger than 100 HP shall be base mounted, cabinet enclosure types.
2. Drives shall be NEMA ICS 2, IGBT, PWM: listed and labeled as a complete unit and arranged to provide variable speed of a NEMA MG 1, Design B, 3-phase induction motor by adjusting output voltage and frequency.
3. Drives design and rating shall match load type of pumps and type of connection used between motor and load such as direct or through a power-transmission connection.

4. Drive enclosure shall come as a single unit of NEMA 12 construction and shall include a panel mounted operator station with start-stop and auto-manual selector switches with manual speed control potentiometer and elapsed time meter.
5. Drives shall include a manual bypass consisting of a magnetic contactor arranged to safely transfer motor between controller output and bypass controller circuit when motor is at zero speed. Controller-off-bypass selector switch sets mode, and indicator lights give indication of mode selected. Unit shall be capable of stable operation (starting, stopping and running), with motor completely disconnected from controller (no load).

FEATURES COMMON TO ALL VARIABLE FREQUENCY DRIVES:

1. Output Rating: 3-phase; 6 to 60 Hz, with voltage proportional to frequency throughout voltage range.
2. Drive Operating Requirements:

   A. Input AC voltage tolerance of 208V, plus or minus 5 percent or 380 to 500 V, plus or minus 10 percent as needed for voltage application as indicated on the Drawings.
   B. Input frequency tolerance of 50/60 Hz, plus or minus 6 percent.
   C. Minimum Efficiency: 96 percent at 60 Hz, full load.
   D. Minimum Displacement Primary-Side Power Factor: 96 percent.
   E. Overload Capability: 1.1 times the base load current for 1 minute every 10 minutes, 130% overload for 2 seconds.
   F. Starting Torque: 100 percent of rated torque or as indicated.
   G. Speed Regulation: Plus or minus 1 percent.

3. Drive to include isolated control interface to allow controller to follow control signal over an 11:1 speed range with an electrical signal of 4 to 20 mA at 24 volts.
4. Internal Adjustment Capabilities:

   A. Minimum Speed: 5 to 25 percent of maximum RPM.
   B. Maximum Speed: 80 to 100 percent of maximum RPM.
   C. Acceleration: 1 to 1800 seconds.
   D. Deceleration: 1 to 1800 seconds.
   E. Seven (7) programmable preset speeds.
   F. Current Limit: 50 to a minimum of 110 percent of maximum rating.

5. Self-Protection and Reliability Features:

   A. Input transient protection by means of surge suppressors.
   B. Under-and-overvoltage trips; inverter over-temperature, overload, and overcurrent trips.

C. Motor Overload Relay: Adjustable and capable of NEMA ICSS 2, Class 20 performance.
D. Notch filter to prevent operation of the controller-motor-load combination at a natural frequency of the combination.
E. Instantaneous line-to-line and line-to-ground overcurrent trips.
F. Loss-of-phase protection.
G. Reverse-phase protection.
H. Short-circuit protection.
I. Motor overcurrent fault.

6. Automatic Reset/Restart: Attempts three restarts after controller fault or on return of power after an interruption and before shutting down for manual reset or fault correction. Bidirectional auto-speed search shall be capable of starting into rotating loads spinning in either direction and returning motor to set speed in proper direction, without damage to controller, motor, or load.
7. Torque Boost: Automatically varies starting and continuous torque to at least 1.5 times the minimum torque to ensure high-starting torque and increased torque at slow speeds.
8. Motor Temperature Compensation at Slow Speeds: Adjustable current fall-back based on output frequency for temperature protection of self-cooled, fan-ventilated motors at slow speeds.
9. Indicating Devices: Meters or digital readout devices and selector switch, mounted flush in controller door and connected to indicate the following controller parameters:

A. Output Frequency (Hz).
B. Motor Speed (rpm).
C. Motor Current (amperes).
D. Motor Torque (percent).
E. Motor Power (kw).
F. DC-Link Voltage (VDC).
G. Motor Output Voltage (V).

10. Control Signal Interface:

A. Electric Input Signal Interface: A minimum of 2 analog inputs (0 to 10 V or 0/4-20 mA) and 6 programmable digital inputs.
B. Remote Signal Inputs: Capability to accept any of the following speed-setting input signals from the BMS or other control systems:

I. 0 to 10 V dc.
II. 0-20 or 4-20 mA.
III. Potentiometer using up/down digital inputs.
IV. Fixed frequencies using digital inputs.

V. RS485.
VI. Keypad display for local hand operation.

C. Output Signal Interface: A minimum of 1 analog output signal (0/4-20 mA), which can be programmed to any of the following:

I. Output Frequency (Hz).
II. Output Current (load).
III. DC-Link Voltage (VDC).
IV. Motor Torque (percent).
V. Motor Speed (rpm).
VI. Set-Point Frequency (Hz).

D. Remote Indication Interface: A minimum of 3 programmable digital form relay outputs (120 VAC, 1 A) with the following settings:

I. Motor Running
II. Not faulted (fail safe).
III. Run permissive.

11. Communications: Provide an RS485 interface allowing drive to be used with an external system within a multi-drop LAN configuration. Interface shall allow all parameter settings of drive to be programmed via BMS control. Provide capability for drive to retain these settings within the nonvolatile memory.
12. Integral Disconnecting Means: Provide a NEMA KS 1, fusible switch with lockable handle.

ACCESSORIES:

1. Devices shall be factory installed in controller enclosure, unless otherwise indicated.
2. Push-Button Stations, Pilot Lights and Selector Switches: NEMA ICS 2, heavy-duty type.
3. Control Relays: Auxiliary and adjustable time-delay relays.
4. Standard Displays:

A. Output Frequency (Hz).
B. Motor Current (amperes).
C. Motor Torque (percent).
D. Motor Speed (rpm).
E. Motor Output Voltage (V).
F. DC Bus Voltage (V).
G. Motor Power (kw).

5. Historical Logging Information and Displays:

   A. Real-time clock with current time and date.
   B. Running log of total power versus time.
   C. Total run time.
   D. Fault log, maintaining last four faults with time and date stamp for each.

VARIABLE FREQUENCY DRIVE PERFORMANCE:

DESIGNATION	SERVES	DRIVE HP	DRIVE VOLAGE (V/PH/HZ)	BYPASS (Y/N)
VFD-451-AHU-1-1	AHU-451-1 SF	15	480/3/60	No
VFD-451-AHU-1-2	AHU-451-1 SF	15	480/3/60	No
VFD-451-AHU-1-3	AHU-451-1 RF	5	480/3/60	No
VFD-451-AHU-1-4	AHU-451-1 RF	5	480/3/60	No
VFD-451-AHU-2-1	AHU-451-2 SF	20	480/3/60	No
VFD-451-AHU-2-2	AHU-451-2 SF	20	480/3/60	No
VFD-451-AHU-2-3	AHU-451-2 RF	15	480/3/60	No
VFD-451-AHU-2-4	AHU-451-2 RF	15	480/3/60	No
VFD-451-AHU-3-1	AHU-451-3 SF	7.5	480/3/60	No
VFD-451-AHU-3-2	AHU-451-3 SF	7.5	480/3/60	No
VFD-451-AHU-3-3	AHU-451-3 RF	3	480/3/60	No
VFD-451-AHU-3-4	AHU-451-3 RF	3	480/3/60	No
VFD-451-AHU-4-1	AHU-451-4 SF	15	480/3/60	No
VFD-451-AHU-4-2	AHU-451-4 RF	5	480/3/60	No
VFD-451-AHU-5-1	AHU-451-5 SF	7.5	480/3/60	No
VFD-451-AHU-5-2	AHU-451-5 RF	2	480/3/60	No
VFD-451-EF-1-1	EF-451-1	20	480/3/60	No
VFD-451-EF-2-1	EF-451-2	20	480/3/60	No
VFD-451-EF-3-1	EF-451-3	20	480/3/60	No
VFD-451-EF-4-1	EF-451-4	20	480/3/60	No
~~VFD-451-CT-1-1~~	~~CT-451-1~~	~~60~~	~~480/3/60~~	~~Yes~~
~~VFD-451-CT-2-1~~	~~CT-451-2~~	~~60~~	~~480/3/60~~	~~Yes~~
~~VFD-451-CT-3-1~~	~~CT-451-3~~	~~60~~	~~480/3/60~~	~~Yes~~
~~VFD-451-CT-4-1~~	~~CT-451-4~~	~~60~~	~~480/3/60~~	~~Yes~~
VFD-451-CHP-1-1	CHP-451-1	400	480/3/60	Yes

VFD-451-CHP-2-1	CHP-451-2	400	480/3/60	Yes
VFD-451-CHP-3-1	CHP-451-3	400	480/3/60	Yes
VFD-451-CWP-1-1	CWP-451-1	200	480/3/60	Yes
VFD-451-CWP-2-1	CWP-451-2	200	480/3/60	Yes
VFD-451-CWP-3-1	CWP-451-3	200	480/3/60	Yes
VFD-451-HWP-1-1	HWP-451-1	150	480/3/60	Yes
VFD-451-HWP-2-1	HWP-451-2	150	480/3/60	Yes

250

SHIPPING:

Shall be FOB JOBSITE

All components shall be adequately protected during shipment against physical and weather damage either by separate protective covering or disassembly and separate packing. Separate packages shall be clearly identified, shipped together with main equipment, and be separately itemized on the "Bill of Lading."

VARIABLE FREQUENCY DRIVE START UP AND TESTING:

Factory testing shall be provided for each variable frequency drive. Technical and Service assistance will be included until the drives are performing as expected, and is accepted by GE Facilities Engineering.

WARRANTY and MAINTENANCE:

The variable frequency drive manufacturer's warranty shall cover parts costs for the repair or replacement of defects in material or workmanship, for a period of five years from equipment acceptance or 66 months from shipment, whichever occurs first. Warranty support shall be provided by company direct or factory authorized service permanently located near the job site.

Vendor shall provide an alternate for an additional five (5) year period for a parts warranty for a total coverage of ten (10) years.

INSTRUCTIONS TO EQUIPMENT VENDORS:

Quote per the instructions provided to bidder in the bid package requested from

CH2MHill
1 Neumann way,
Cincinnati, Ohio 45241.

All shipping and handling costs are to be included as separate line items on quotes.

Provide with quote, accurate (factory-certified) shipping and delivery schedules.

The successful vendor shall submit for approval, within one week after receipt of order, seven (7) sets of factory-certified shop drawings containing the following data:

1. "Certified correct" equipment dimensional drawings, including minimum clearances for servicing, general mounting requirements, including loads and support frame size plus hold-down bolt size and location.
2. Equipment installation, operating, and maintenance instruction manuals.
3. Vendor suggested spare parts lists with model (part) numbers and pricing information.
4. Starter and motor data sheet.
5. Equipment weight data.
6. Pressure ratings and pressure drops.

Deviations from this specification are permitted to accommodate Manufacturer standard construction. Deviations will be evaluated and compared to this specification by GE Aviation Facilities Engineering. Any such deviations must be clearly indicated on the quotation, with the associated cost add to meet the specifications.

Attachment "A" **GE Aviation**

GE INDUSTRIAL SOLUTIONS BLANKET RELEASE FORM

GE AVIATION PURCHASE ORDER NO.

REQUESTER NAME: Dave Swigart **MAIL DROP** _____ **PHONE NO.** 604-4675

DATE: 2/11/16 **GE AVIATION ACCOUNT NO:** - - -

Deferred account no: - - -

(ADN #)

SELECT TYPE:

☐ **TIME & MATERIAL:** ***Requester*** -- Please identify the amount of man-days needed in work scope section.
GE IS -- Please fill out GE IS section.

☒ **FIRM PRICE:** ***Requester*** -- Check this box if you wish to have GE IS provide you with a firm price for a specific work scope. Fill out work scope section.
GE IS -- Please fill out GE IS section.

WORK SCOPE: **Requester** -- Provide job description, number of man-days required, completion date, comments and location.

Provide twenty-eight (28) enclosed variable frequency drives according to the equipment specification for the North Utility Plant Building 451 Variable Frequency Drives dated 10/12/15.

After completing the above information, submit this form to GE IS for processing.

TO BE COMPLETED BY GE IS:

FIELD SERVICE REPORT NO.: G801134-1215WLH Rev. 2 **CASE NO.:** _____

DOLLAR AMOUNT: _____ **NOT TO EXCEED (NTE) / FIRM PRICE**
CIRCLE ONE OF THE ABOVE ITEMS

GE IS APPROVAL SIGNATURE: _____ **DATE:** 2/11/16

PHONE NUMBER: 513-530-7177

COMMENTS: GEIS will provide twenty-eight (28) enclosed variable frequency drives according to the equipment specification for the North Utility Plant Building 451 Variable Frequency Drives dated 10/12/15 with exceptions as noted.

GE TEAM - PLEASE NOTE

This firm price proposal is in response to C2HM RFQ # 111915/EBF1945-04 and Addendum 1&2 Inclusive Contract Number EBF1945-40559 dated November 19, 2015.

After completing the above information, submit this form to Requester for his/her approval and signature. Note: The Requester must sign in the following area before GE IS can proceed.

Requester signature: _____ **Date:** _____

GEA Indirect Sourcing signature: _____ **Date:** _____

**General Electric Aviation Indirect Sourcing Facilities Buyer Signature required when material purchases exceed $100,000*

Requester: shall mail a copy of the completed form to GE IS and GE Aviation Blanket Administrator.

GE Aviation Blanket Administrator
Evendale Plant: Dave Swigart, Mail Drop B-67, Fax # 786-1996

Workscope:
The Industrial Solutions business (GEIS) of General Electric International, Inc. is pleased to provide this proposal for twenty-eight (28) variable frequency digital drives for use at the GE Aviation (GEA) North Utility Plant Bldg. 451 in Evendale, Ohio.

This is a "Parts Only" proposal. No field engineering services are included. The equipment offered by GEIS in this proposal is based solely on the information contained in GEA specification "NUP VFD Pre Purchase Spec 10 12 15" (Addendum 1 & 2 inclusive), information gathered during recent site visits, and GEIS's understanding of the existing power distribution system at the GEA Evendale facility. The product offering and price are subject to change as more information is obtained and/or clarification of the existing data is provided.

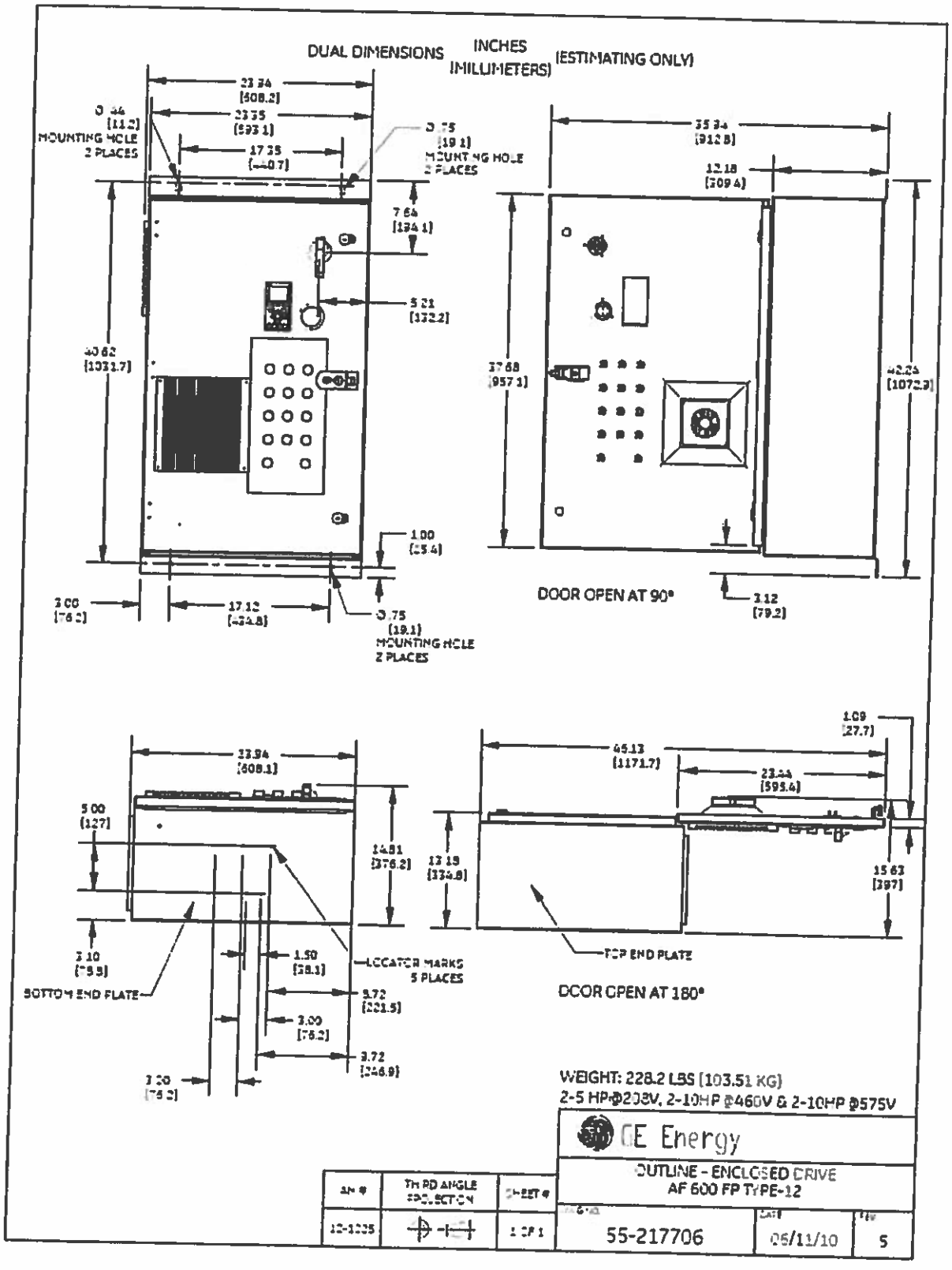
For the North Utility Plant variable frequency drive Project, GE IS will provide the following equipment:

QTY	CURRENT	MOTOR HP	DRIVE HP	BYPASS (Y/N)	NEMA 12 Enclosure Type
5	21	15	15	No	Wall mount
3	8.2	5	5	No	Wall mount
6	27	20	20	No	Wall mount
3	11	7.5	7.5	No	Wall mount
2	4.8	3	3	No	Wall mount
1	3.4	2	2	No	Wall mount
3	540	400	450	Yes	Free standing
3	240	200	200	Yes	Free standing
2	190	150	150	Yes	Free standing

250

The digital drives will have the following features:

- AF600 Drive
- 480 V three phase 60hz input
- Standard AC disconnect
- Door mounted manual speed pot
- NEMA 12 Ventilated Construction
- 2 Contactor manual bypass (if specified)
- Door mounted keypad
- Elapsed time meter
- Start/stop PB
- EStop PB (for UL508A compliance)
- Drive/Off/Bypass switch
- Auto/manual switch
- Modbus RTU/Metasys N2/Apgen FLN P1 serial communications interface
- BacNet Communications Module (OPTION 1)
- Equivalent of 5% line reactor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23.35 [593.1]
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0.75 [19.1] MOUNTING HOLE 2 PLACES
7.54 [194.1]
5.21 [132.2]
40.62 [1031.7]
1.00 [25.4]
3.00 [76.2]
17.12 [434.8]
0.75 [19.1] MOUNTING HOLE 2 PLACES
35.94 [912.8]
12.18 [309.4]
37.68 [957.1]
42.25 [1072.9]
DOOR OPEN AT 90°
3.12 [79.2]
23.94 [608.1]
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3.10 [78.8]
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LOCATOR MARKS 5 PLACES
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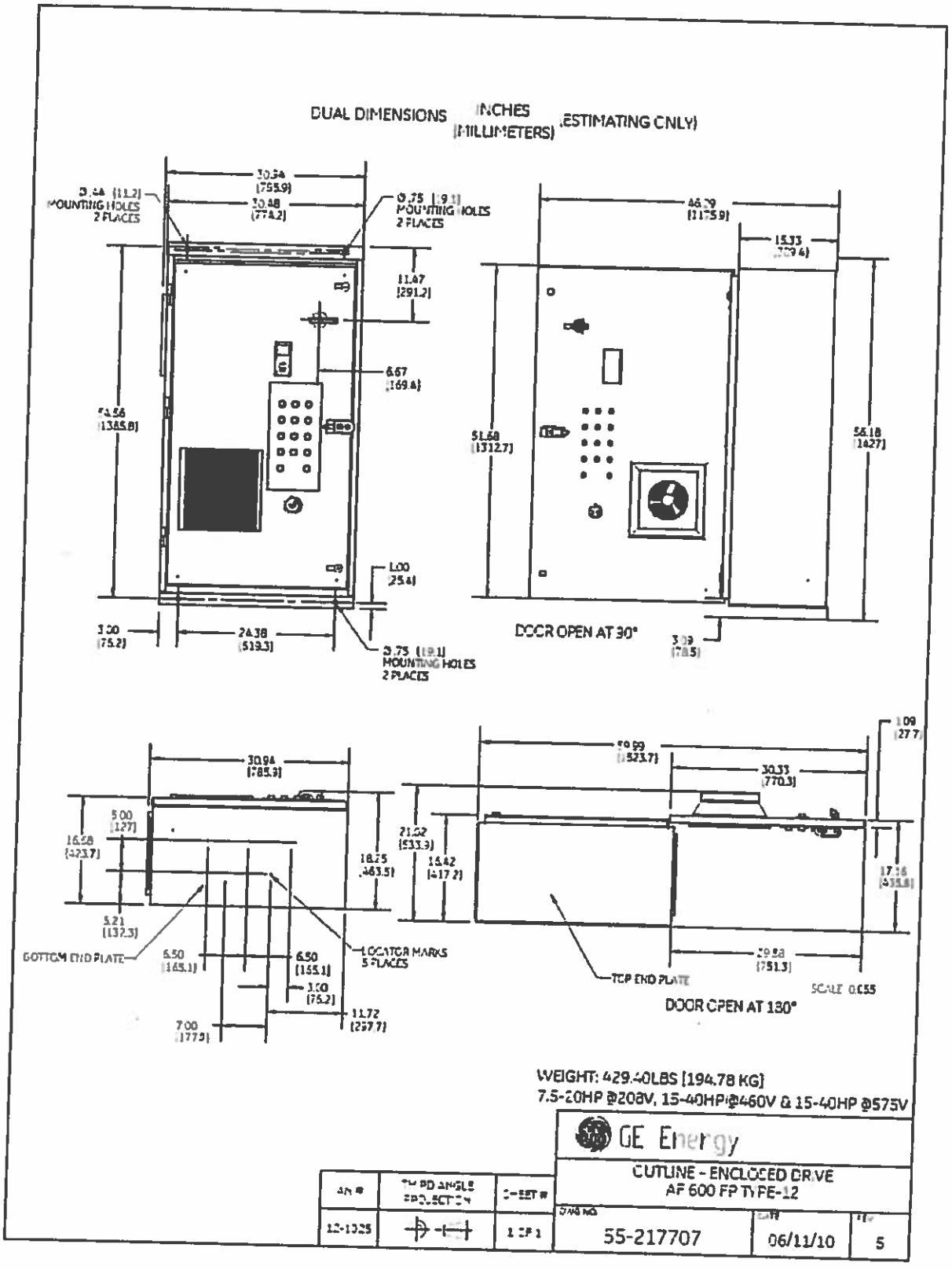
3.00 [76.2]
9.72 [246.9]
3.20 [76.2]
1.09 [27.7]
45.13 [1171.7]
23.44 [595.4]
13.15 [334.8]
15.63 [397]
TOP END PLATE
DOOR OPEN AT 180°
WEIGHT: 228.2 LBS [103.51 KG]
2-5 HP@208V, 2-10HP @460V & 2-10HP @575V
GE Energy
OUTLINE - ENCLOSED DRIVE
AF 600 FP TYPE-12
55-217706
05/11/10
5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(MILLIMETERS) ESTIMATING ONLY
30.54
(755.9)
30.48
(774.2)
0.44 (11.2)
MOUNTING HOLES
2 PLACES
0.75 (19.1)
MOUNTING HOLES
2 PLACES
11.47
(291.2)
6.67
(169.4)
54.56
(1385.8)
1.00
(25.4)
3.00
(75.2)
24.38
(619.3)
0.75 (19.1)
MOUNTING HOLES
2 PLACES
46.29
(1175.9)
15.33
(389.4)
51.68
(1312.7)
54.18
(1427)
DOOR OPEN AT 30°
3.09
(78.5)
30.94
(785.9)
5.00
(127)
16.68
(423.7)
5.21
(132.3)
18.25
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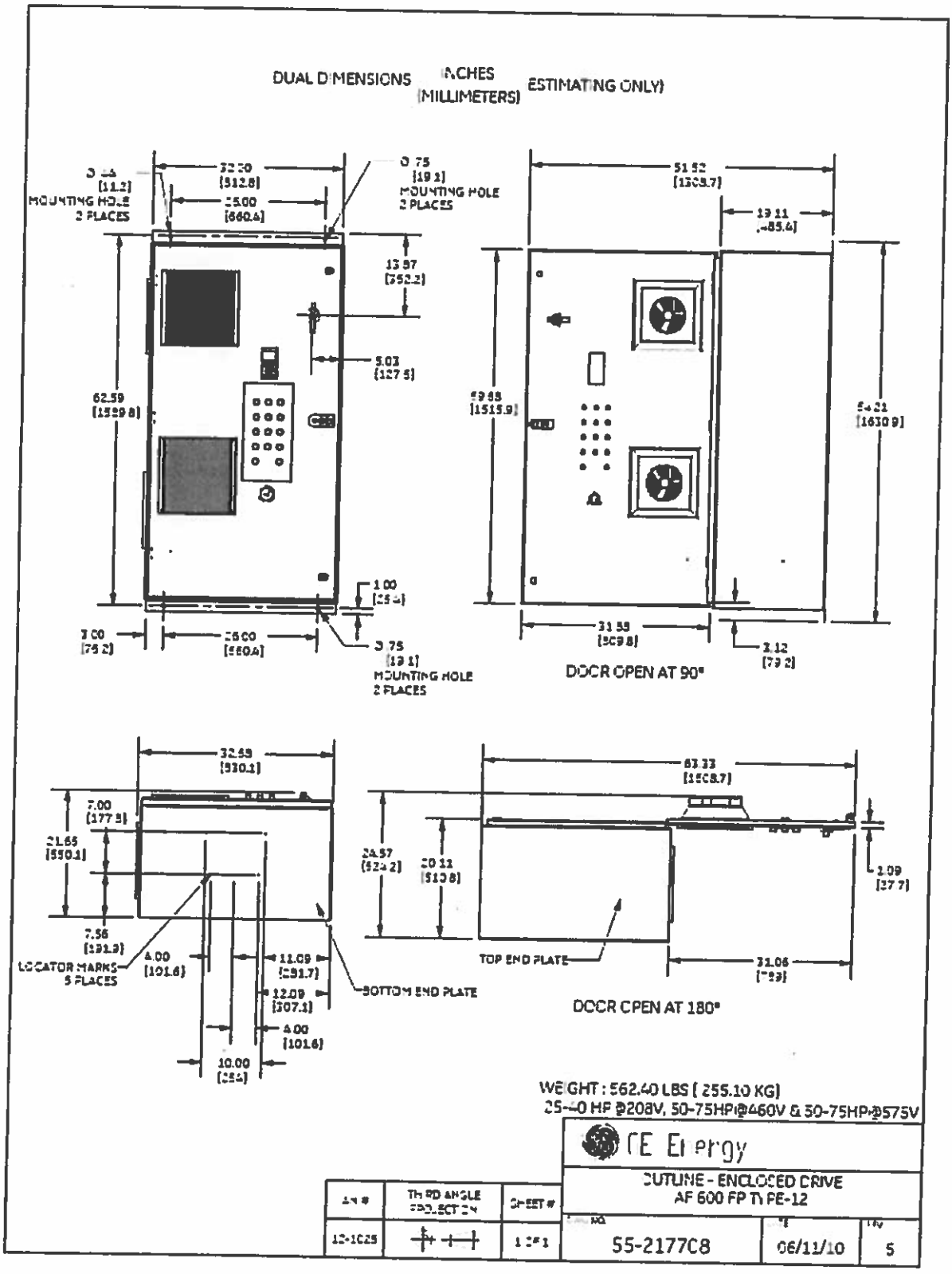
21.02
(533.9)
16.42
(417.2)
1.09
(27.7)
29.99
(761.7)
30.33
(770.3)
17.16
(435.8)
BOTTOM END PLATE
6.50
(165.1)
6.50
(165.1)
LOCATOR MARKS
5 PLACES
3.00
(76.2)
11.72
(297.7)
7.00
(177.8)
TOP END PLATE
29.58
(751.3)
SCALE 0.055
DOOR OPEN AT 180°
WEIGHT: 429.40LBS [194.78 KG]
7.5-20HP @208V, 15-40HP@460V & 15-40HP @575V
GE Energy
CUTLINE - ENCLOSED DRIVE
AF 600 FP TYPE-12
DWG NO.
55-217707
DATE
06/11/10
REV
5
12-1325
1 OF 1


DUAL DIMENSIONS INCHES (MILLIMETERS) ESTIMATING ONLY)
MOUNTING HOLE 2 PLACES
MOUNTING HOLE 2 PLACES
MOUNTING HOLE 2 PLACES
DOOR OPEN AT 90°
DOOR OPEN AT 180°
LOCATOR MARKS 5 PLACES
TOP END PLATE
BOTTOM END PLATE
WEIGHT : 562.40 LBS (255.10 KG)
25-40 HP @208V, 50-75HP@460V & 50-75HP@575V
CE Energy
OUTLINE - ENCLOSED DRIVE
AF 600 FP TYPE-12
55-2177C8
06/11/10
5

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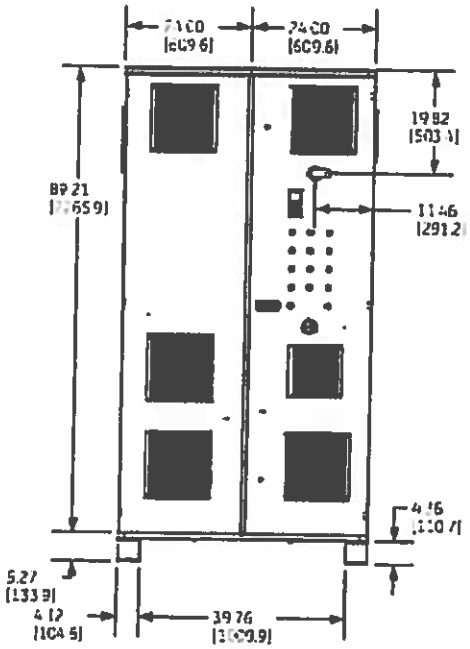
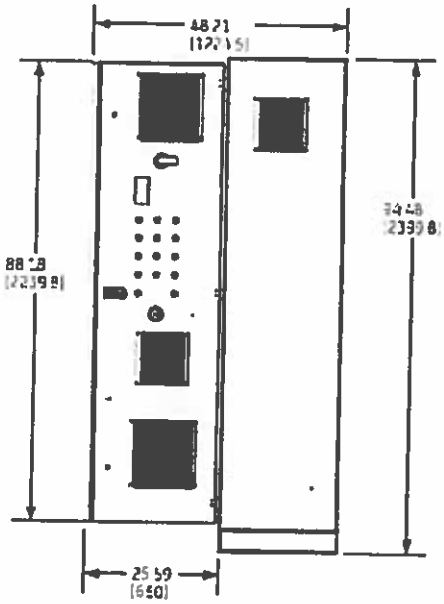
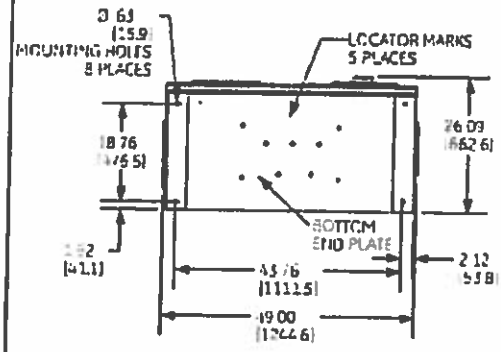
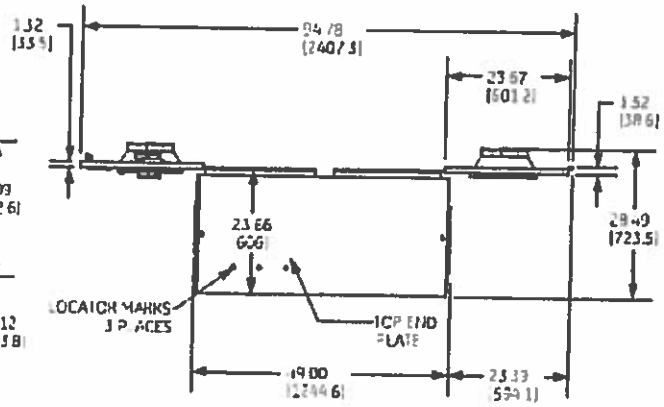




DOOR OPEN AT 90°





DOOR OPEN AT 180°

WEIGHT 1503.30 LBS [681.90 KG]
150-300HP@460V & 150HP@575V

			integration at work		
			OUTLINE - ENCLOSED DRIVE AF 600 FP TYPE 12		
SIZE	THIRD ANGLE PROJECTION	SHEET #	DRAWING NO.	DATE	REV
		1 OF 1	55-217710	07/15/09	2

AF-600 FP Fan and Pump Drive
Standard Specifications

Operation

Operation Method	Keypad operation: Hand, Off, Auto Digital Input: Programmable for Start/Stop, Forward/Reverse, Jog Timer operation: Stop after predetermined time frame Communications: RS-485 Modbus RTU, Metasys N2, and Apogee FLN P1 USB Port for programming drive with optional PC Software
Frequency Reference Signal	Left or Right Arrow buttons on keypad in Manual Mode Speed Potentiometer: 0 to +10 Vdc, 10 to 0 Vdc 0-10Vdc analog input 0/4-20ma analog input
References	Up to 3 Input References can be selected from Analog Input #1 or #2, Frequency Input #1 or #2, Network, or Potentiometer
Digital Input Signal	No Operation Reset after drive trip or alarm Drive at stop with no holding current Quick Stop according to Quick Stop Decel Time 1 Stop on input going low Start Maintained Start after signal applied for Minimum of 2ms Reversing Start Reverse Enable Start Forward only Enable Start Reverse only Jog Multi-Step Frequency selection (1 to 8 Steps) Hold Drive Frequency Hold Reference Speed Up; activated by Hold Drive Frequency or Hold Reference Slow Down; activated by Hold Drive Frequency or Hold Reference Drive Parameter Set-up Select 1-4 Precise Start or Stop; Activated when drive parameter precise start or stop function is selected Catch Up or Slow Down; Activated by signal to add to or subtract from input reference to control speed Pulse Input selectable from 100 - 110000Hz Accel / Decel Time select. Set Input to Accel / Decel Times 1 to 4 Digital Potentiometer Input Increase or Decrease Mechanical Brake Feedback

Keypad

Keypad Features	LCD Display with 6 A Multi-Language Supp Hot Pluggable, Remote Feature, IP65 rating w LED's - Green - drive is Red - indicates an alc Menu keys and H-O-A
Keypad Keys	Status - shows status Quick Menu - Enters Q or Trending Modes Main Menu - Used for p Alarm Log - Used to dis Back - Reverts to previ structure Cancel - Used to cance Info - Displays informat parameter, or functior Hand/Off/Auto - Used in remote mode Reset - Used to reset W
Password	2 Level Password Protec
Alternate Motor Parameters	Up to 4 Separate compl ovcable
Graphical Trending	Trend - Speed, Power

RS485 Modbus RTU Serial Communication

Physical Level:	EIA/RS485
Transmission distance:	1640 ft (500m)
Node Address:	32
Transmission Speed:	2400, 4800, 9600, 1920
Transmission Mode:	Half Duplex
Transmission Protocol:	Modbus RTU
Character Code:	Binary
Character Length:	8 Bits
Error Check:	CRC

Mounting Clearance

	All AF-650 GP drives can without spacing. For all allow 3.4 inches (100mm For all drives rated 15 (225mm) free space abo

Technical Comments/Clarifications/Exceptions to Customer Specifications

General

1) Exception is taken to Article 7.

Production leadtime is as follows:

- (2HP – 20HP) have a production leadtime of 7 weeks, not including transportation
- (60HP – 200HP) have a production leadtime of 9 weeks, not including transportation
- (450HP) has a production leadt time of 13 weeks, not including transportation

Note that lead-times are subject to the prior sale of the production space. If approval drawings are required, the lead times will be increased by the amount of time required to release the drawings to manufacturing.

2) Agreed upon terms between GE Aviation and GE IS will apply (GE International and GE Aviation Override Agreement, dated April 9, 2014).

GE AVIATION PLEASE NOTE

Quality Assurance

3) CE, UL, cUL, and C-Tick approved. Drives are not labelled for NFPA 70 approval.

General Description

Both wallmount and free standing drive enclosures will be of NEMA 12 construction with filtered air ventilated to permit the flow of cooling air.

Features Common To All Variable Frequency Drives

4) Exception is taken to article 11. BMS control protocol unknown at this time. The drives are equipped with a standard Modbus RTU/Metasys N2/Apgen FLN P1 serial communications interface.

Accessories

5) Exception is taken to article 4. These quantities are displayed on the door mounted programmer and not as individual displays.

6) Exception is taken to article 5. Historical logging and trending information is not available.

Shipping

7) Equipment will be delivered FCA destination with freight charges prepaid and allowed a to a common carrier delivery point nearest Evendale, Ohio. GEIS assumes risk of loss to the job site at the point while it is still on the common carrier. Once the product leaves the common carrier the material passes title and customer assumes ownership. Any subsequent shipping or handling damage must be resolved between GEA and the carrier.

GE AVIATION PLEASE NOTE

Variable Frequency Drive Start Up And Testing

The equipment described herein carries a "parts only" warranty. No field engineering service for installation supervision, startup/commissioning, repair, or replacement is included in this proposal.

Warranty And Maintenance

8) The standard warranty period is 36 months after shipment from the company. This includes all drives, panels and 18 Pulse / MultiPulse panels.

Extended Warranty Pricing

- [removed]

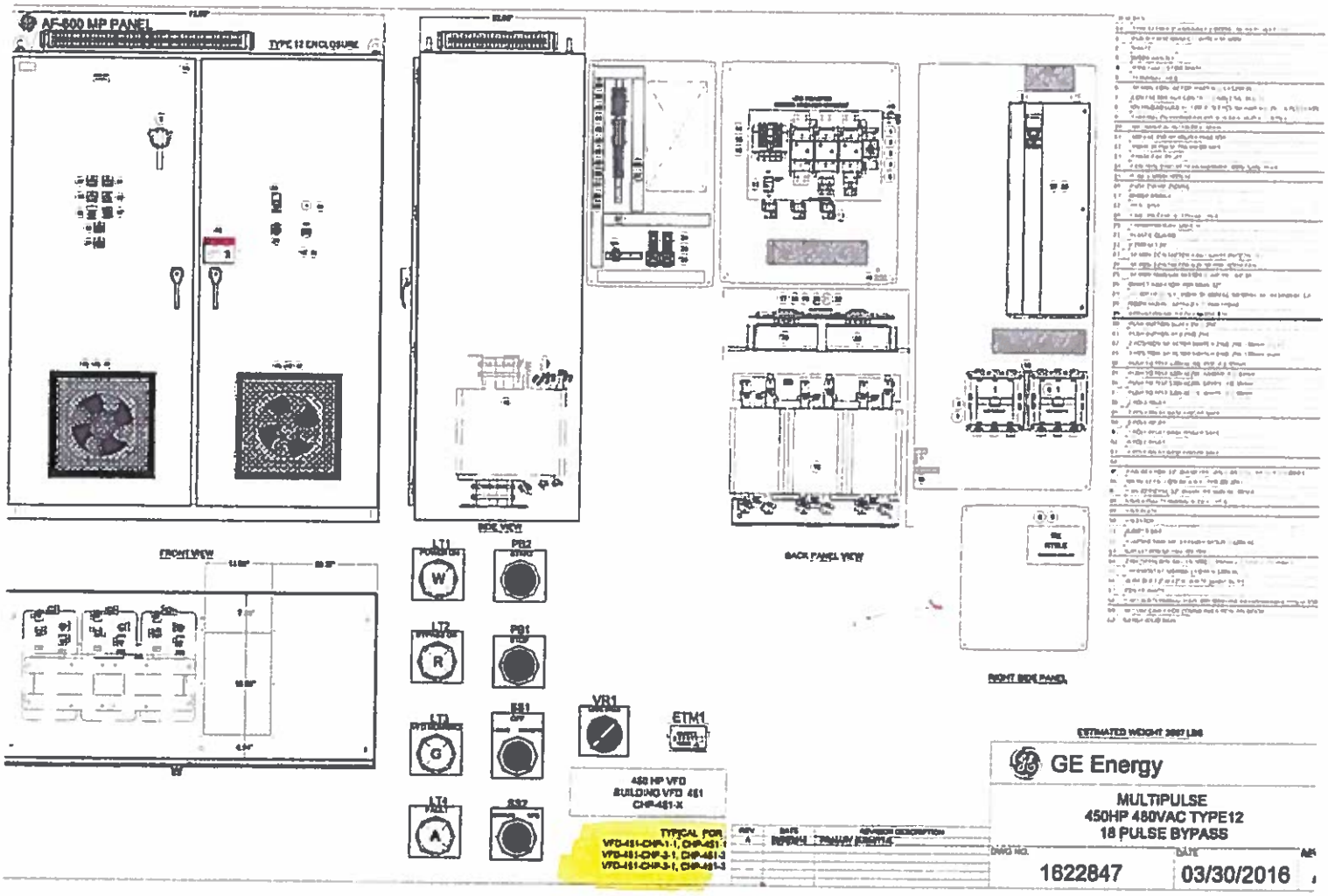
General Comments/Clarifications/Exceptions

- GEA is responsible to off-load, rig, and store equipment at the site and protect from the environment.
- Any items or services not specifically outlined herein are not included. The BOM included above is the factory's interpretation of what the client wants to purchase. If during the bid evaluation there are any questions about this proposal, please advise.
- Freight prepaid and allowed (FOB Destination) with the destination as defined in the bid. Freight is prepaid and allowed to first truck unload point in Evendale, Ohio. Freight prepaid and allowed includes only the trucking expense and does not include offloading equipment, cranes, rail, ship or any other carriage. Re-consignment or redirection of shipment will incur a handling fee and additional freight charges will apply. All prices are contingent upon gaining valid shipping clearances at the time of shipment. If clearance is not available due to highway construction, changes in state regulations, changes in bridge limitations or other items beyond our control, GEIS will not be responsible for any additional shipping or handling charges. Due to the volatility in the price of fuel a surcharge may apply at time of shipment.
- GEIS reserves the right to select the method of transportation provided for all products unless specified by the client not less than 72 hours prior to shipment. Any premium transportation or required special handling is in addition and shall be the billed to GEA as an extra.
- Shipping method shall be by truck.
- Final documentation is provided two weeks following shipment of the equipment from the factory. If customer approval of the test reports is required prior to releasing for shipment, two business days will be provided in the schedule for review and approval.
- Lead times are quoted for estimating purposes only. Delivery is dependent on factory loading at the time of order. Factory certified shipping and delivery schedules cannot be provided without an exact order date.

Pricing

Payment Terms

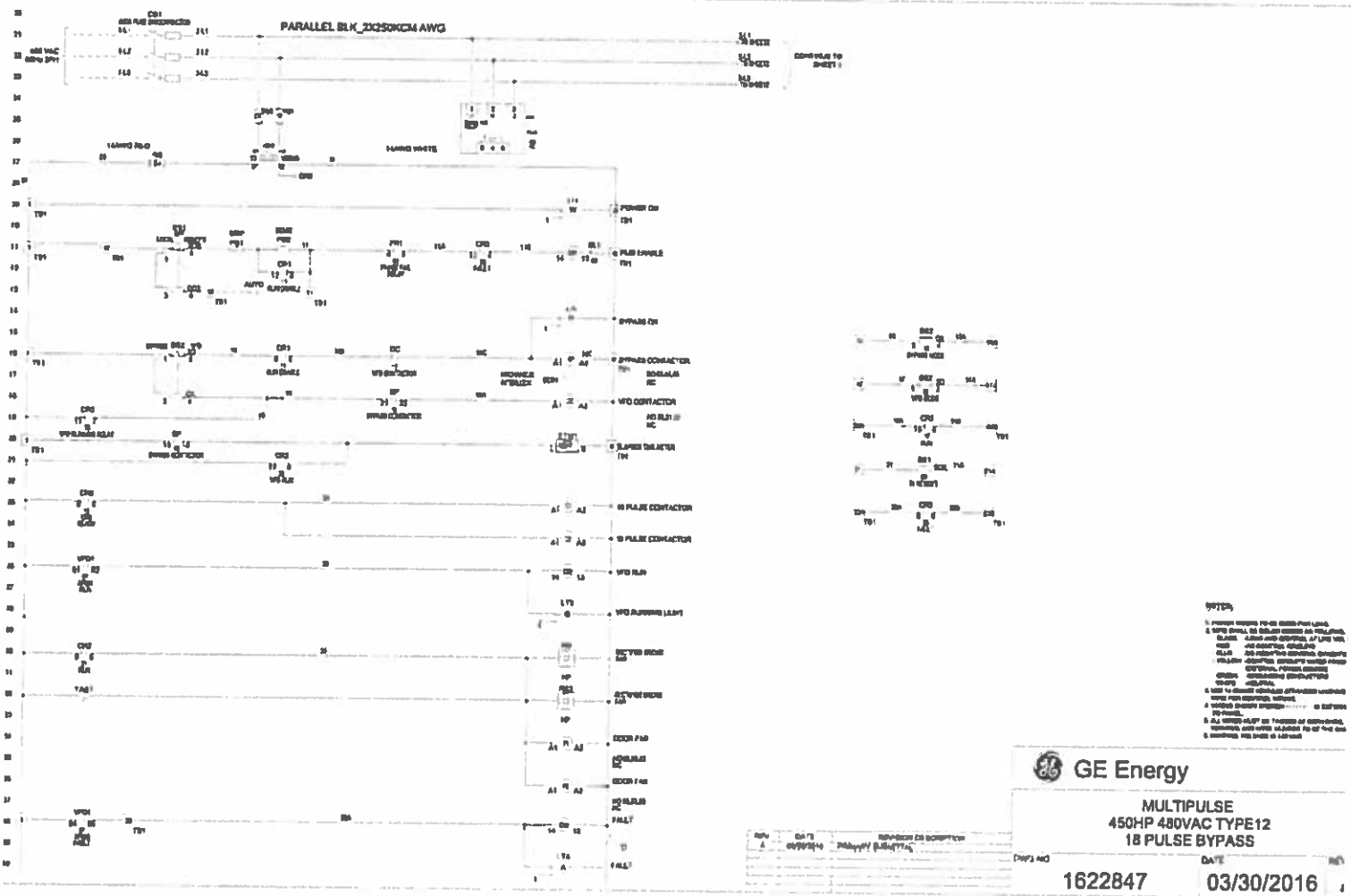
Order Cancellation - Schedule of Charges



☐ REVIEWED
☐ REJECTED
☒ REVIEWED/CORRECTIONS NOTED
☐ REVISE AND RESUBMIT

Corrections or comments made on the submittals during this review do not relieve Contractor from compliance with requirements of the Contract Documents. This review is for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents. The Contractor remains responsible for confirming the accuracy and completeness of other details such as dimensions and quantities; for selection, instructions for installation; safety devices, final connections and related construction criteria; checking, coordinating, and performing Work in compliance with the Contract Documents.

KZF DESIGN Inc. JCN Date 4/21/16

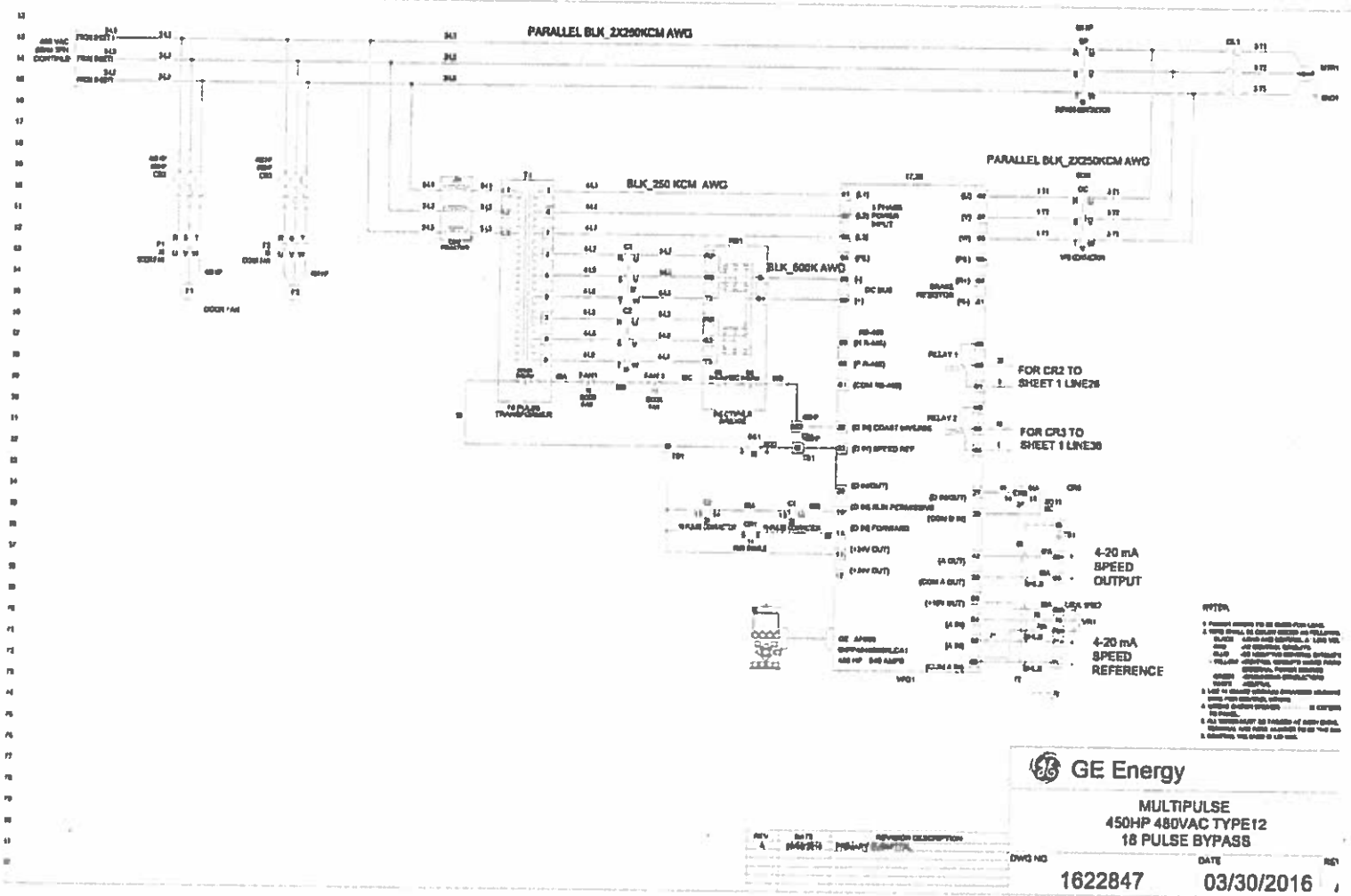


GE Energy

MULTIPULSE
450HP 480VAC TYPE12
18 PULSE BYPASS

1622847

03/30/2016



GE Energy

MULTIPULSE
450HP 480VAC TYPE12
18 PULSE BYPASS

DWG NO	DATE
1622847	03/30/2016

AF - 600 MP

GE Panel Model Number
6HFPH31254400320

Type:12
Max. Motor HP : 450 HP

Source Ratings

Voltage: 480 VAC
Total FLA: 515 AMPS
Phase: 3
Hz: 60

Output Ratings

Voltage: 480 VAC
Total FLA: 515 AMPS
Phase: 3
Hz: 0 - 100

Drawings

Elementary: E-1622847
Layout: P-1622847

Instructions

Book: DEH-41601A

Drive

Model: 6HFPH31254400320
WO : 1623115

DATE CODE: 08-18-2016

The Maximum Short Curcuit of Panel:
65 kA RMS Symmetrical Amperes at 480volts AC

MADE IN U.S.A
55-218011P1

FUSE LABEL

GE Panel Model Number. 6HFPH3250200207

Fuse Nomenclature	Voltage Rating	Current Rating	Class or Type
PFUS1	600	4.5 A	CC Time Delay
PFUS2	600	4.5 A	CC Time Delay
SFUS	250	15 A	Time Delay 1/4" X 1-1/4"

55-218013P1

c UL US LISTED

AF-600 FP

GE Panel Model Number
6KFPH2150202630

Source Ratings

Voltage: 460Vac
Amps: 190
Phase: 3
Hz: 60

Output Ratings

Voltage: 460Vac
Amps: 183
Phase: 3
Hz: 0 – 1000

Drawings

Elementary: 55 – 539738
Layout: 55 – 686666
Outline: 55 – 217710

Instructions

Book: DEH40600

Drive

Model: 6KFP43150X9XXCB1

DATE CODE: MM628j

The Maximum Short Curcuit Rating of Panel:
100 kA RMS Symmetrical Amperes at 460 volts AC

MADE IN MEXICO
55 – 217731

FUSE TABLE

GE Panel Model No. 6KFPH2150202630

Fuse Nomenclature	Voltage Rating	Current Rating	Class or Type
PFUS1	600	7	CC Time Delay
PFUS2	600	7	CC Time Delay
SFUS	250	10	Time Delay 1/4" x 1 – 1/4"
MFUS1	600	300	J Time delay
MFUS2	600	300	J Time Delay
MFUS3	600	300	J Time Delay

55 – 217732

COVER PILOT LAYOUT

FUSE TABLE

GE Panel Model No:6FPH2250202629

Fuse Nomenclature	Voltage Rating	Current Rating	Class or Type
PFUS1	600	7	CC Time Delay
PFUS2	600	7	CC Time Delay
SFUS	250	10	Time Delay 1/4" x 1-1/4"
MFUS1	600	400	J Time Delay
MFUS2	600	400	J Time Delay
MFUS3	600	400	J Time Delay

55-217732

AF-600 FP

GE Panel Model Number
6KFPH225020269

Source Ratings

Voltage: 460Vac
Amps: 302
Phase: 3
Hz: 60

Output Ratings

Voltage: 460Vac
Amps: 291
Phase: 3
Hz: 0-1000

Drawings

Elementary: 55-538737
Layout: 55-686666
Outline: 55-217710

DATE CODE: MM8821

Instructions

Book: DEH40600

Drive

Model: 6KFP43250X9XX0B1

The Maximum Short Circuit Rating of Panel:
100 kA RMS Symmetrical Amperes at 460 volts AC

MADE IN MEXICO
55-217721

COVER PILOT LAYOUT

INSIDE VIEW

ENABLE	POWER ON	MOTOR OVERLOAD
DRIVE RUN	DRIVE FAULT	BYPASS RUN
HAND AUTO OFF	START	DRIVE BYPASS OFF
E-STOP	STOP	

ENERGY EFFICIENT MEASURES
VARIABLE FREQUENCY DRIVE

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ENERGY SAVINGS INPUT DATA

Customer Name:	**GE Aviation**
Customer Location:	**Ohio**
Date:	**4/24/2018**
Improvement Description:	**GE Aviation put (3) GE Drives 6HFPH31254400320 onto their chilled water pumps (CHP-451-6, CHP-451-7, CHP-451-8).**

Motor Size	400.00	H.P.	Proposed Control Type:	VFD			
Number of Motors	3	# Proposed					
Total Motor Size	1,200.00	H.P.	Motor Efficiency	95.4%		VFD Efficiency =	98%
Current Motor Type	New		Electric Demand Rate =	$0.00	kW	Hours of Operation =	8,760
Existing Control	None - Pump		Electricity Rate =	$0.060	kWh	Operating Months =	12
Load Profile	Standard						

System Rated Flow	Operating Time	Percent of Full Input Power: Existing	Proposed VFD	Full Load Power kW	Existing Motor Input Power	Proposed Motor Input Power	kW Power Savings	Hours Per Year	kWh/Yr. Energy Savings
0%	0%	100%	27%	0.0	0.0	0.0	0.0	0	0
20%	0%	100%	14%	938.4	938.4	137.2	801.2	0	0
25%	0%	100%	13%	938.4	938.4	126.9	811.5	0	0
30%	0%	100%	13%	938.4	938.4	125.0	813.4	0	0
35%	0%	100%	14%	938.4	938.4	131.6	806.8	0	0
40%	0%	100%	15%	938.4	938.4	146.5	791.8	0	0
45%	0%	100%	18%	938.4	938.4	170.0	768.4	0	0
50%	0%	100%	21%	938.4	938.4	201.8	736.5	0	0
55%	0%	100%	25%	938.4	938.4	242.1	696.3	0	0
60%	0%	100%	30%	938.4	938.4	290.8	647.5	0	0
65%	0%	100%	36%	938.4	938.4	348.0	590.4	0	0
70%	100%	100%	43%	938.4	938.4	413.6	524.8	8,760	4,596,943
75%	0%	100%	51%	938.4	938.4	487.6	450.7	0	0
80%	0%	100%	60%	938.4	938.4	570.1	368.3	0	0
85%	0%	100%	69%	938.4	938.4	661.0	277.4	0	0
90%	0%	100%	79%	938.4	938.4	760.3	178.0	0	0
95%	0%	100%	91%	938.4	938.4	868.1	70.2	0	0
100%	0%	100%	103%	938.4	938.4	984.3	(46.0)	0	0
	100%							Total	4,596,943

ECONOMIC EVALUATION:

Estimated Installed Drive Cost	$120,000.00
kWh Saved	4,596,943
kW Saved	524.8
Savings $	$275,816.58
Rebate	$377,516.07
Payback	1.5

Rebate Rate

$0.065	/kWh
$150	/kW

Disclaimer: All values are estimates based on information provided at the time. These values are not to be taken as fact and proof of installation is needed for rebates to be issued.

Prepared by: Mark Goudreault
Email: MGoudreault@emsenergy.com
Phone Number: 952-797-3025

ENERGY EFFICIENT MEASURES
VARIABLE FREQUENCY DRIVE

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ENERGY SAVINGS INPUT DATA

Customer Name:	**GE Aviation**
Customer Location:	**Ohio**
Date:	**4/24/2018**
Improvement Description:	**GE Aviation put (3) GE Core Drives 6KFP43250X9XXCB1 onto their condensed water pumps (CWP-451-1, CWP-451-2, CWP-451-3).**

Motor Size	250.00	H.P.	Proposed Control Type:	VFD			
Number of Motors	3	# Proposed					
Total Motor Size	750.00	H.P.	Motor Efficiency	95.4%		VFD Efficiency =	98%
Current Motor Type	New		Electric Demand Rate =	$0.00	kW	Hours of Operation =	8,760
Existing Control	None - Pump		Electricity Rate =	$0.065	kWh	Operating Months =	12
Load Profile	Standard						

		Percent of Full Input Power							
System Rated Flow	Operating Time	Existing	Proposed VFD	Full-Load Power kW	Existing Motor Input Power	Proposed Motor Input Power	kW Power Savings	Hours Per Year	kWh/Yr. Energy Savings
0%	0%	100%	27%	0.0	0.0	0.0	0.0	0	0
20%	0%	100%	14%	586.5	586.5	85.8	500.7	0	0
25%	0%	100%	13%	586.5	586.5	79.3	507.2	0	0
30%	0%	100%	13%	586.5	586.5	78.1	508.4	0	0
35%	0%	100%	14%	586.5	586.5	82.2	504.3	0	0
40%	0%	100%	15%	586.5	586.5	91.6	494.9	0	0
45%	0%	100%	18%	586.5	586.5	106.2	480.3	0	0
50%	0%	100%	21%	586.5	586.5	126.1	460.3	0	0
55%	0%	100%	25%	586.5	586.5	151.3	435.2	0	0
60%	0%	100%	30%	586.5	586.5	181.8	404.7	0	0
65%	0%	100%	36%	586.5	586.5	217.5	369.0	0	0
70%	100%	100%	43%	586.5	586.5	258.5	328.0	8,760	2,873,089
75%	0%	100%	51%	586.5	586.5	304.8	281.7	0	0
80%	0%	100%	60%	586.5	586.5	356.3	230.2	0	0
85%	0%	100%	69%	586.5	586.5	413.1	173.4	0	0
90%	0%	100%	79%	586.5	586.5	475.2	111.3	0	0
95%	0%	100%	91%	586.5	586.5	542.6	43.9	0	0
100%	0%	100%	103%	586.5	586.5	615.2	(28.7)	0	0
	100%							Total	2,873,089

ECONOMIC EVALUATION:

Estimated Installed Drive Cost	$262,500.00
kWh Saved	2,873,089
kW Saved	328.0
Savings $	$172,385.36
Rebate	$235,947.55
Payback	1.5

Rebate Rate

$0.065	/kWh
$150	/kW

Disclaimer: All values are estimates based on information provided at the time. These values are not to be taken as fact and proof of installation is needed for rebates to be issued.

Prepared by: Mark Goudreault
Email: MGoudreault@emsenergy.com
Phone Number: 952-797-3025

ENERGY EFFICIENT MEASURES
VARIABLE FREQUENCY DRIVE

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ENERGY SAVINGS INPUT DATA

Customer Name:	**GE Aviation**
Customer Location:	**Ohio**
Date:	**4/24/2018**
Improvement Description:	**GE Aviation put (2) GE Core Drives 6KFP43150X9XXCB1 onto their hot water pumps (HWP-451-4, HWP-451-5).**

Motor Size	150.00	H.P.	Proposed Control Type:	VFD			
Number of Motors	2	# Proposed					
Total Motor Size	300.00	H.P.	Motor Efficiency	95.0%	VFD Efficiency =	98%	
Current Motor Type	New		Electric Demand Rate =	$0.00 kW	Hours of Operation =	8,760	
Existing Control	None - Pump		Electricity Rate =	$0.060 kWh	Operating Months =	12	
Load Profile	Standard						

		Percent of Full Input Power							
System Rated Flow	Operating Time	Existing	Proposed VFD	Full-Load Power kW	Existing Motor Input Power	Proposed Motor Input Power	kW Power Savings	Hours Per Year	kWh/Yr. Energy Savings
0%	0%	100%	27%	0.0	0.0	0.0	0.0	0	0
20%	0%	100%	14%	235.6	235.6	34.4	201.1	0	0
25%	0%	100%	13%	235.6	235.6	31.9	203.7	0	0
30%	0%	100%	13%	235.6	235.6	31.4	204.2	0	0
35%	0%	100%	14%	235.6	235.6	33.0	202.6	0	0
40%	0%	100%	15%	235.6	235.6	36.8	198.8	0	0
45%	0%	100%	18%	235.6	235.6	42.7	192.9	0	0
50%	0%	100%	21%	235.6	235.6	50.7	184.9	0	0
55%	0%	100%	25%	235.6	235.6	60.8	174.8	0	0
60%	0%	100%	30%	235.6	235.6	73.0	162.6	0	0
65%	0%	100%	36%	235.6	235.6	87.4	148.2	0	0
70%	100%	100%	43%	235.6	235.6	103.8	131.7	8,760	1,154,075
75%	0%	100%	51%	235.6	235.6	122.4	113.2	0	0
80%	0%	100%	60%	235.6	235.6	143.1	92.5	0	0
85%	0%	100%	69%	235.6	235.6	165.9	69.6	0	0
90%	0%	100%	79%	235.6	235.6	190.9	44.7	0	0
95%	0%	100%	91%	235.6	235.6	217.9	17.6	0	0
100%	0%	100%	103%	235.6	235.6	247.1	(11.5)	0	0
	100%							Total	1,154,075

ECONOMIC EVALUATION:

Estimated Installed Drive Cost	$105,000.00
kWh Saved	1,154,075
kW Saved	131.7
Savings $	$69,244.48
Rebate	$94,776.40
Payback	1.5

Rebate Rate

$0.065	/kWh
$150	/kW

Disclaimer: All values are estimates based on information provided at the time. These values are not to be taken as fact and proof of installation is needed for rebates to be issued.

Prepared by: Mark Goudreault
Email: MGoudreault@emsenergy.com
Phone Number: 952-797-3025

GE Aviation - NUP Chiller and VFD Savings
10/19/2018

Measure:	kW Savings:	kWh Savings:
(2) 1000-ton York Chillers	45.86	948,049.57
VFD Upgrades (CT, AHU SF, AHU RF, HWP)	335.47	2,027,488.93
Total Savings	**381.34**	**2,975,538.50**

GE Aviation has installed and is operating multiple pieces of equipment in the new NUP building. In 2017 it came online and took place for building 200 and 204. These are the only buildings being considered for this mercantile rebate. Trend data was not available from start up of equipment, but is now available since July of 2018.

Equipment:	Date Online:	Measure:
(2) 1000-ton Chillers 12, 13	Jul-17	Chiller
CHW Pumps 6, 7, 8	Jul-17	Chiller
CW Pumps 1, 2, 3	Jul-17	Chiller
CT Fans 1, 2	Jul-17	VFD's
HW Pumps 4, 5	Jul-17	VFD's
Boilers 7, 8	Jul-17	-
AHU's 1, 2, 3	Jul-17	VFD's

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:

- Submitting this application does not guarantee an 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 will not be reviewed; all fields are required.

Refer to the complete list of Instructions and Disclaimers, found in the Mercantile Self 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	Chris Kearns
Company	GE Aircraft Engines

Equipment Vendor / Project Engineer Contact Information

Name	Brian Beckman
Company	Jacobs/CH2M

Location of Proposed VFD Project

Site Name	North Utility Plant (NUP)
Electric Account Number(s)	84500860013
Site Address	1 Neumann Way Cincinnati, Oh 45215

Before proceeding with the custom application, please verify that your project is not on the Self-Direct Prescriptive application.
The prescriptive rebate 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.

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

Driven Equipment	Name	GE 6HFPH31254400320	Type	Pump	App No.
Quantity		3			Rev.
Brake HP (BHP) at Full Load (see note 1)		400.0			
Nameplate HP		400.0			

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	%	400.0	100%	95.4	%	312.79	8,760	744	672	744	720	744	720	744	744	720	744	720	744	8,760
	%	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	0	0	0	0	0	0	0	0	0	0	0	0	0
						Totals	8,760	744	672	744	720	744	720	744	744	720	744	720	744	8,760

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	%	400.0	100%	95.4	%	312.79														0
90	%	360.0	90%	95.4	%	281.51														0
80	%	320.0	80%	95.4	%	250.23														0
70	%	280.0	70%	95.4	%	218.95														0
60	%	240.0	60%	95.4	%	187.67														0
50	%	200.0	50%	95.4	%	156.39														0
40	%	160.0	40%	95.4	%	125.12	8760	744	672	744	720	744	720	744	744	720	744	720	744	8760
30	%	120.0	30%	95.4	%	93.84														0
20	%	80.0	20%	95.4	%	62.56														0
10	%	40.0	10%	95.4	%	31.28														0
Not Running		0.0	0%	NA	%	0.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0
						Totals	0	0	0	0	0	0	0	0	0	0	0	0	0	0

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.

DUKE ENERGY.

App No.	0
Rev.	0

Operating Hours (see note 4)

24 x 7	Weekday		Saturday		Sunday		Weeks of Use in Year (see note 5)	Total Annual Hours of Use
	Start Hour	End Hour	Start Hour	End Hour	Start Hour	End Hour		
	12:00 AM	*12:00 AM*	*12:00 AM*	*12:00 AM*	*12:00 AM*	*12:00 AM*	*52*	*8,760*

Energy Savings

	Existing (no VFD)	Proposed (VFD)	Savings	Describe how energy numbers were calculated
Annual Electric Energy	8,220,077 kWh	3,623,132 kWh	4,596,945 kWh	
Electric Demand (kilowatts)	938 kW	414 kW	525 kW	
Calculations attached	Yes	Yes		Total for all 3 drives

Simple Payback

Average electric rate ($/kWh) on the applicable accounts (see note 6)			$0.06
Estimated annual electric savings			$275,817
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)			$420,000.00
Copy of vendor proposal is attached (see note 8)			Yes
Simple Electric Payback in years (see note 9)	1.522750467	Total Payback in years	1.522750467

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: N/A - In use 52 weeks/yr

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 payback on the project is less than 1 year, the rebate structure is affected.
Please check that the electric rate is accurate based on history.

This foregoing document was electronically filed with the Public Utilities

Commission of Ohio Docketing Information System on

12/6/2018 1:45:30 PM

in

Case No(s). 18-1808-EL-EEC

Summary: Application Application to Commit Energy
Efficiency/Peak Demand
Reduction Programs
(Mercantile Customers Only) PART 2 electronically filed by Carys Cochern on behalf of Duke
Energy