Preventative Maintenance Service Report
SMITHFIELD TREATMENT PLANT
RAW SEWAGE #1 VFD
11/18/2012

Customer Name:	SMITHFIELD TOWNSHIP	**Customer Purchase Order #:**	200228A
Address:	2306 POWELL ROAD	**Contact Person's Name**	MICHAEL SMITH
City:	SMITHFIELD TOWNSHIP	**Contact's Company Name:**	SMITHFIELD TOWNSHIP
State: PA	**Zip Code:** 16066	**Contact's Phone Number:**	724-777-1111 EXT. 1300
Job Site Name:	SMITHFIELD TREATMENT PLANT	**Contact's E-mail Address:**	mike.smith@smithfieldtownship.org
DRV Technician:	TANNER CATONE	**Date of Service:**	11/18/2012

Drive Manufacturer:	ALLEN BRADLEY 1336 PLUS II	**Wiring Diagram:**	BJPK42-0003-2
Drive Model #:	BJPK42-0003	**Cabinet/Bypass Model #:**	N.A
Drive Serial/Lot #:	BJPK42-0003-MEAGOVS7	**Cabinet/Bypass Serial #:**	N/A
Drive Date Stamp:	N/A	**Customer's Tag #:**	RAW SEWAGE #1 VFD
Catalog #:	1336-F-BXO-60V-AJ-CF-CB-BM-D13-D21-D41-JF-JR-LT-HJ2C-ME-KD-UL-CUSTOM		

Motor Manufacturer:	US MOTORS	**Motor Service Factor (SF):**	1.15
Motor Model #:	868200	**Motor Frame Size:**	365VP DP
Motor Serial #:	W03W0120672R-2	**Motor Insulation Class:**	F
Motor Horsepower:	40	**Motor Voltage:**	460
Motor Amperage:	56	**Motor RPM:**	875

HOT TESTING - WEAR APPROPRIATE PPE

Temperatures *(record only after one hour of continuous operation)* **:**

Door closed (top): 81 °F **Sub-panel above VFD:** 90 °F

Incoming Power Cables	**L1:**	89 °F	**L2:**	85 °F	**L3:**	83 °F
Line Side CB Lugs:	**L1:**	92 °F	**L2:**	93 °F	**L3:**	92 °F
Load Side CB Lugs:	**L1:**	88 °F	**L2:**	89 °F	**L3:**	88 °F
Line Side Line Reactor:	**L1:**	98 °F	**L2:**	94 °F	**L3:**	92 °F
Load Side Line Reactor:	**L1:**	99 °F	**L2:**	93 °F	**L3:**	79 °F

VFD Heat Sink Top: 95 °F

VFD Heat Sink Bottom: 78 °F

VFD Output Lugs:	**U:**	84 °F	**V:**	85 °F	**W:**	86 °F
VFD Output Cables:	**U:**	89 °F	**V:**	87 °F	**W:**	86 °F
Motor Cables (VFD Encl.):	**U:**	82 °F	**V:**	79 °F	**W:**	79 °F

Door fans operating normally: YES, NOISE COMING FROM FAN BEARINGS, FAN NEEDS TO BE REPLACED.

Internal fans operating normally: YES

Visual thermal damage: NONE FOUND

HOT TESTING - WEAR APPROPRIATE PPE

Motor temperature information:

Hours running at time of measurement (approx.): 8+ **hrs.**

Output Freq.: 51 **Hz** **Output I:** 34 **A** **Output Volts:** 386 **V**

Case Top Center: 126 **°F** **Shaft:** 76 **°F**

Case Top Front: 91 **°F** **Vibration Note:** NONE

Case Top Rear: 100 **°F** **Noise Note:** NONE

Hot Motor Notes: VFD WAS CYCLING BEWEEN RUN/STOP BECAUSE OF WATER LEVEL WHICH IS WHY THE MOTOR WAS WARMER THAN #2 AND #3. DRV TUNED THE SYSTEM TO CORRECT THE HUNTING MOTOR..

HOT TESTING - WEAR APPROPRIATE PPE

Wiring distance between motor & drive: 15 FEET **Is there an output reactor present?** ____ **Yes** X **No**

Drive Input Line Voltage (VAC):	**L1 to L2:**	482	**L2 to L3:**	484	**L3 to L1:**	485
Drive Input Line Voltage (VAC):	**L1 to Gnd:**	277	**L2 to Gnd:**	278	**L3 to Gnd:**	280
Output Voltage(VAC) at 60 **Hz:**	**T1 to T2:**	460	**T2 to T3:**	461	**T3 to T1:**	468

HOT TESTING - WEAR APPROPRIATE PPE

Line Side No Load AUHF Current:	**L1:**	0.1	**L2:**	0.2	**L3:**	0.2
Drive Input Current:	**L1:**	44	**L2:**	42	**L3:**	42
Drive Output Current (at full speed):	**T1:**	54	**T2:**	53	**T3:**	53

HOT TESTING - WEAR APPROPRIATE PPE

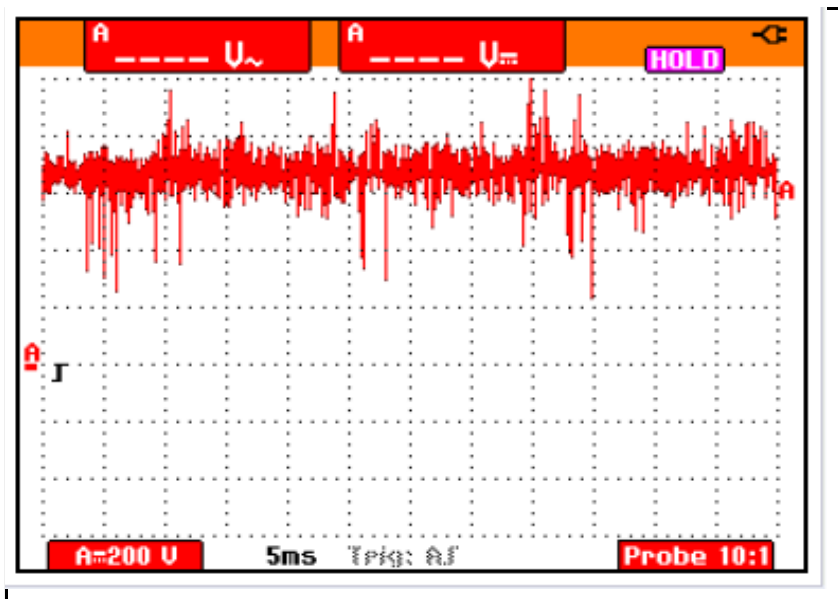
DC Bus Voltage Ripple:

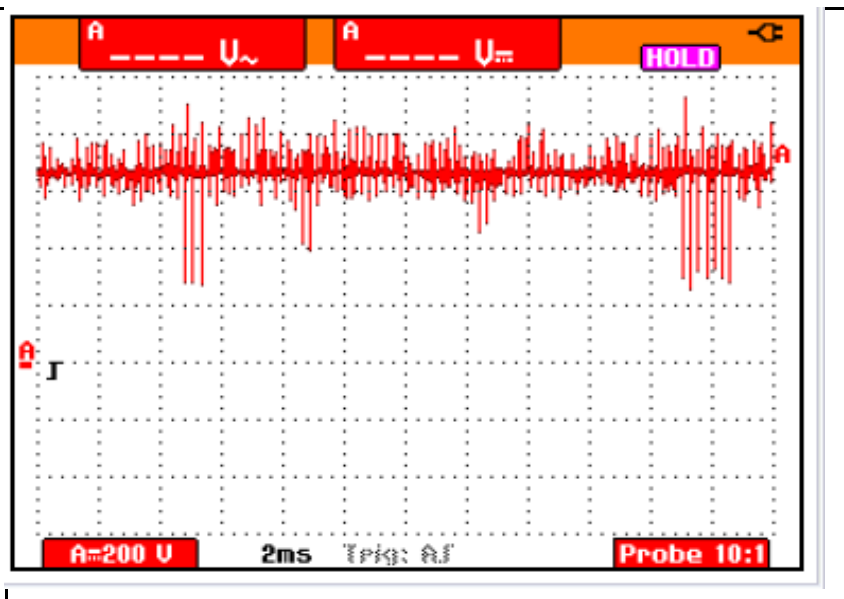
Line Voltage: 484 **DC Bus Voltage:** 643

Motor Current: 44 **AC Ripple Content:** 0

Output Frequency: 60 **Notes:** DISTORTED WAVEFORM

DC Bus Waveform:





Comments:

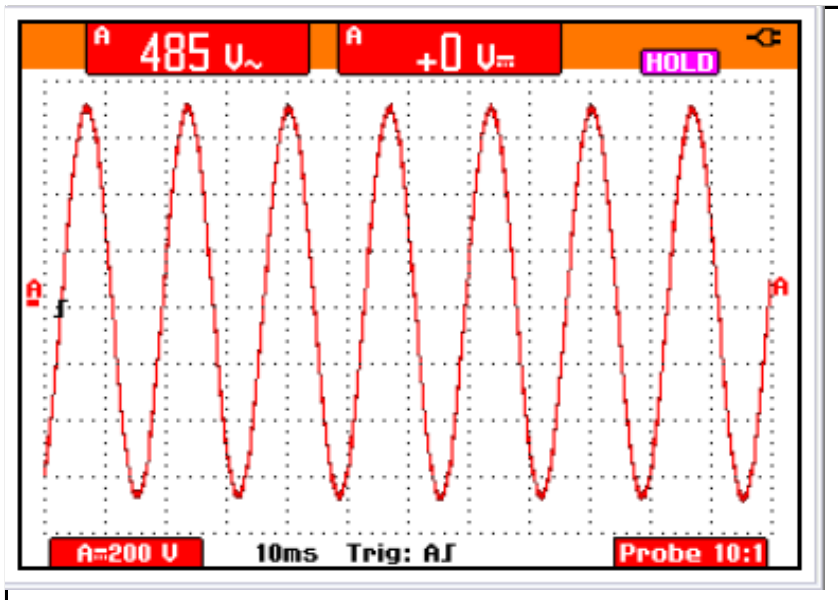
THE VOLTAGE LEVEL IS GOOD HOWEVER THERE IS EXCESSIVE NOISE ON THE DC BUS. PLEASE REFERENCE THE DV/DT PORTION OF THIS REPORT.

HOT TESTING - WEAR APPROPRIATE PPE

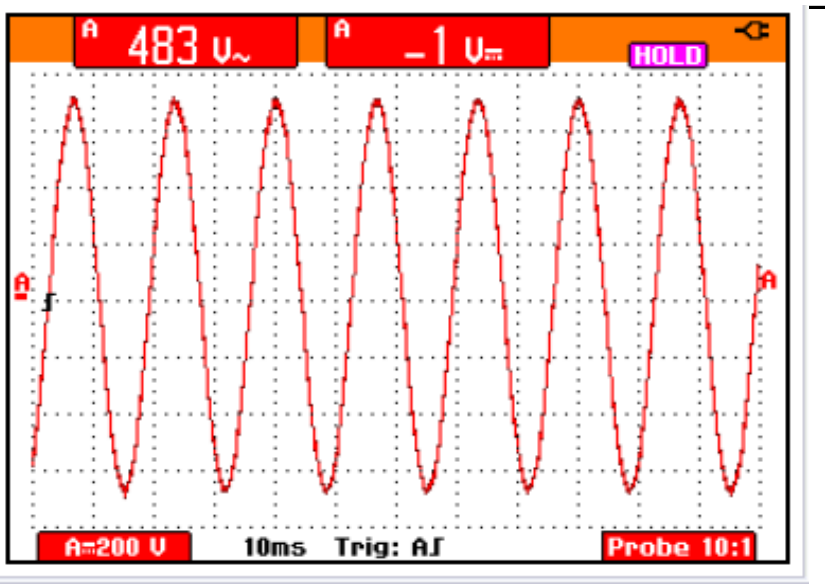
Power Quality Analysis:

Incoming Line Voltage Wave Form

L1-L2:



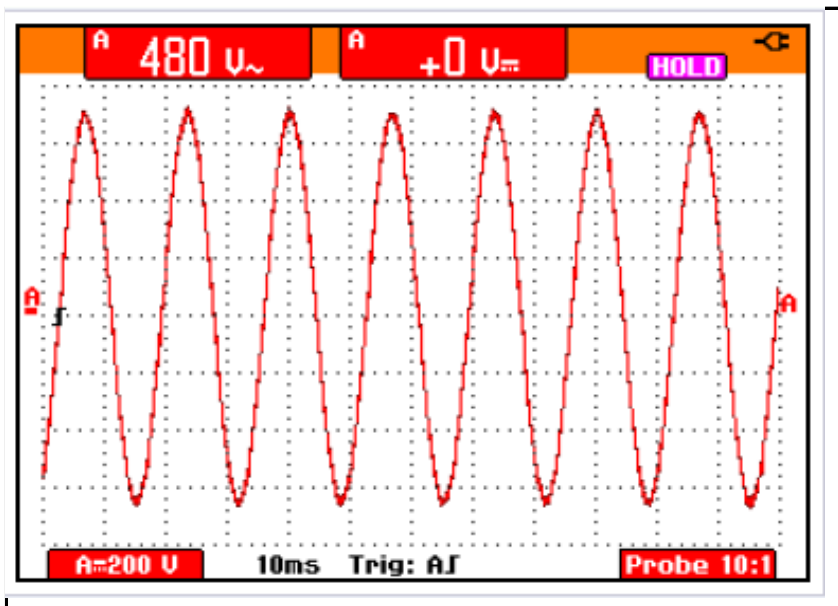
L2-L3:



Comments:

SEE BELOW

L3-L1:



Power Quality Analysis Notes:

Comments:

INPUT LINE VOLTAGE IS GOOD. THERE IS NO SIGNS OF CLIPPING OR DISTORTIONS IN THE WAVEFORM.

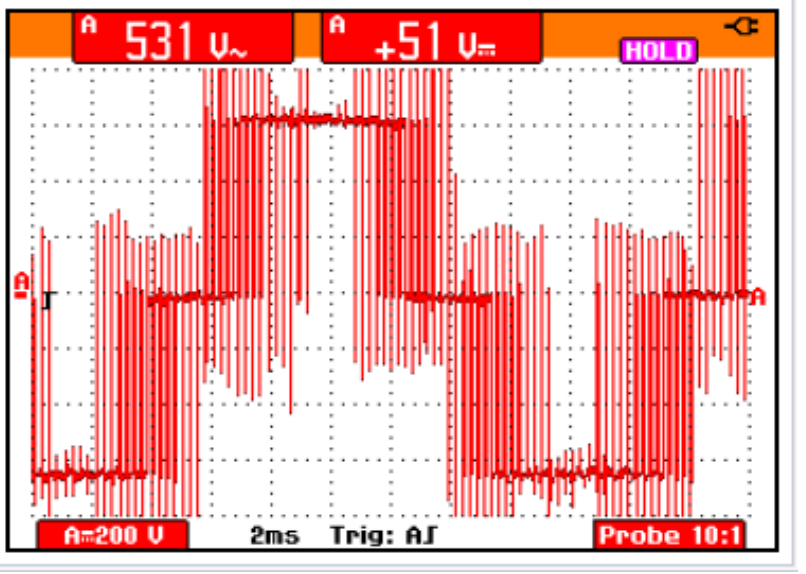
HOT TESTING - WEAR APPROPRIATE PPE

dv/dt Waveform Measurements:

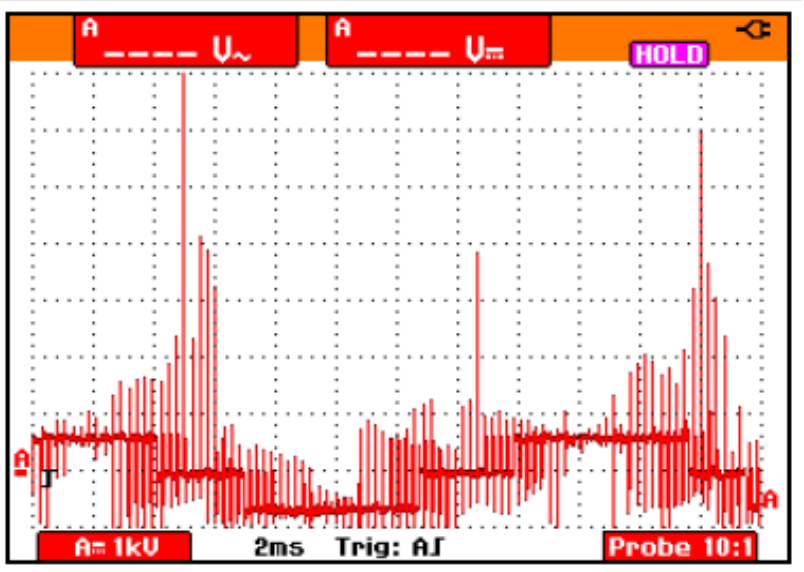
At motor peak voltage, positive side: U-V 1600 **V** **Rise Time:** 0.25 **usec**

negative side: U-V 1600 **V**

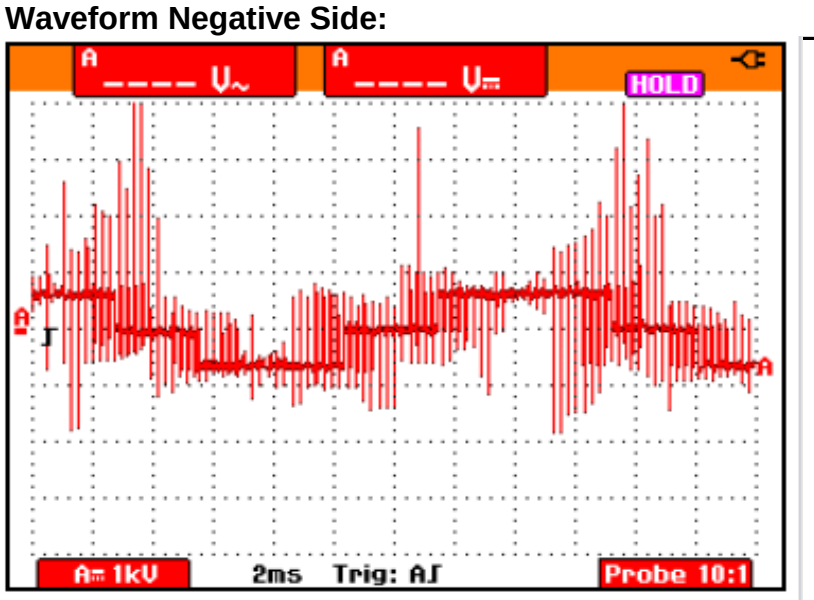
200V/DIV DVDT OVERVIEW



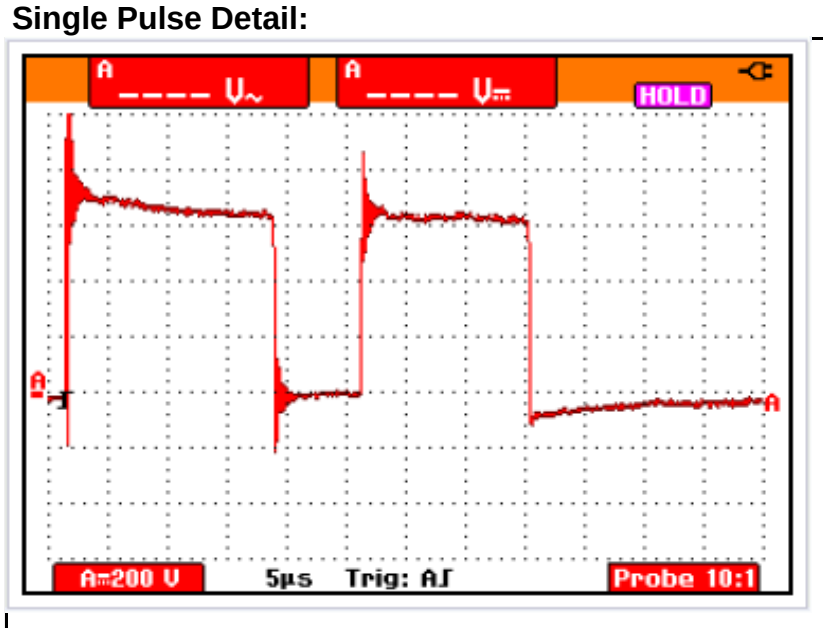
Waveform Positive Side:



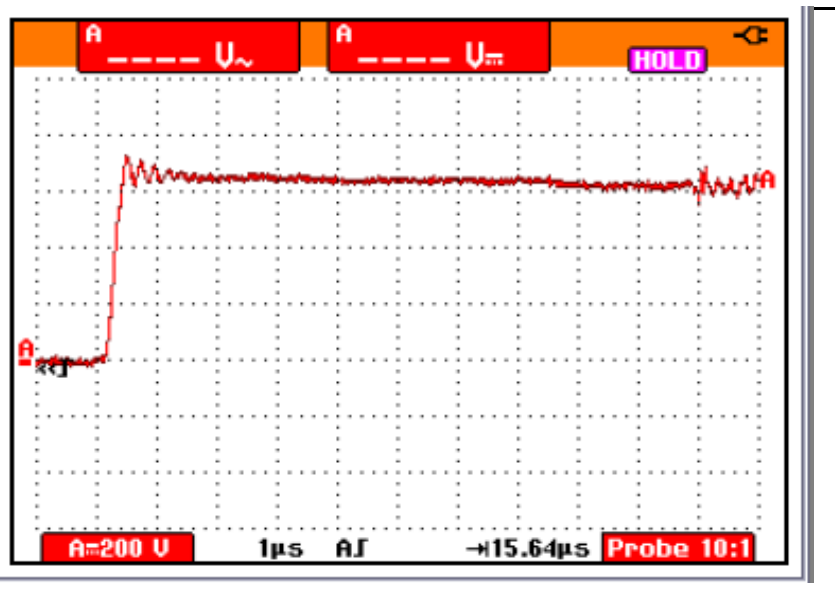
Waveform Negative Side:



Single Pulse Detail:



Rise Time:



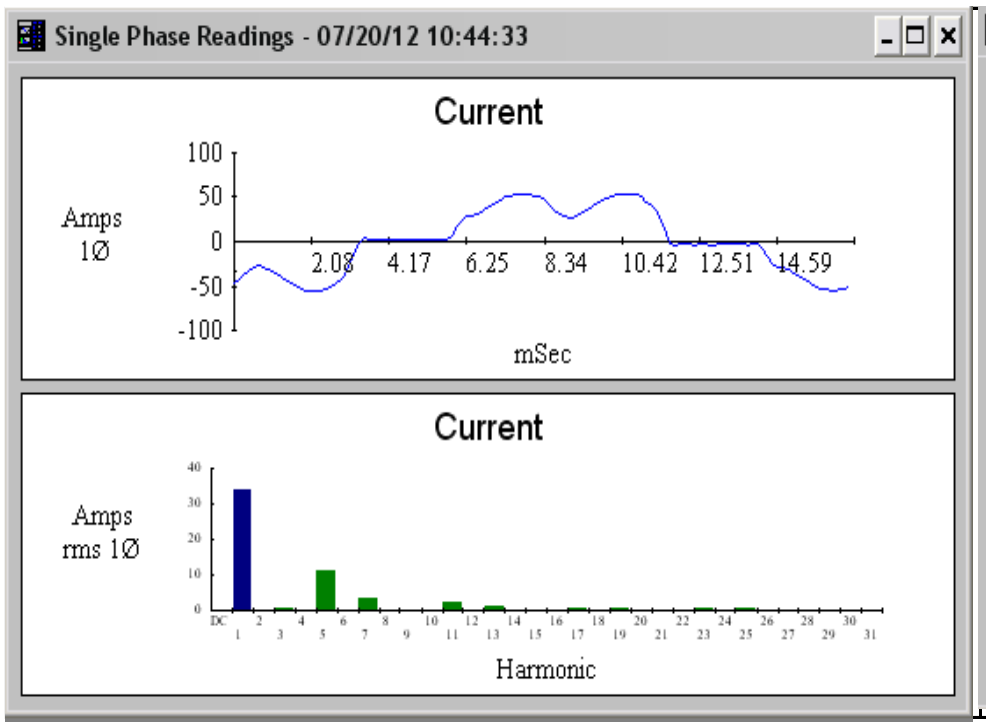
Comments:

THE DVDT PRESENT IS EXTREMELY HARMFUL TO THE MOTOR. DRV 100% RECOMMENDS AN OUTPUT FILTER BE INSTALLED. PEAK VOLTAGES SHOULD NOT EXCEED 1000V. RISE TIME SHOULD BE GREATER THAN 3 mS.

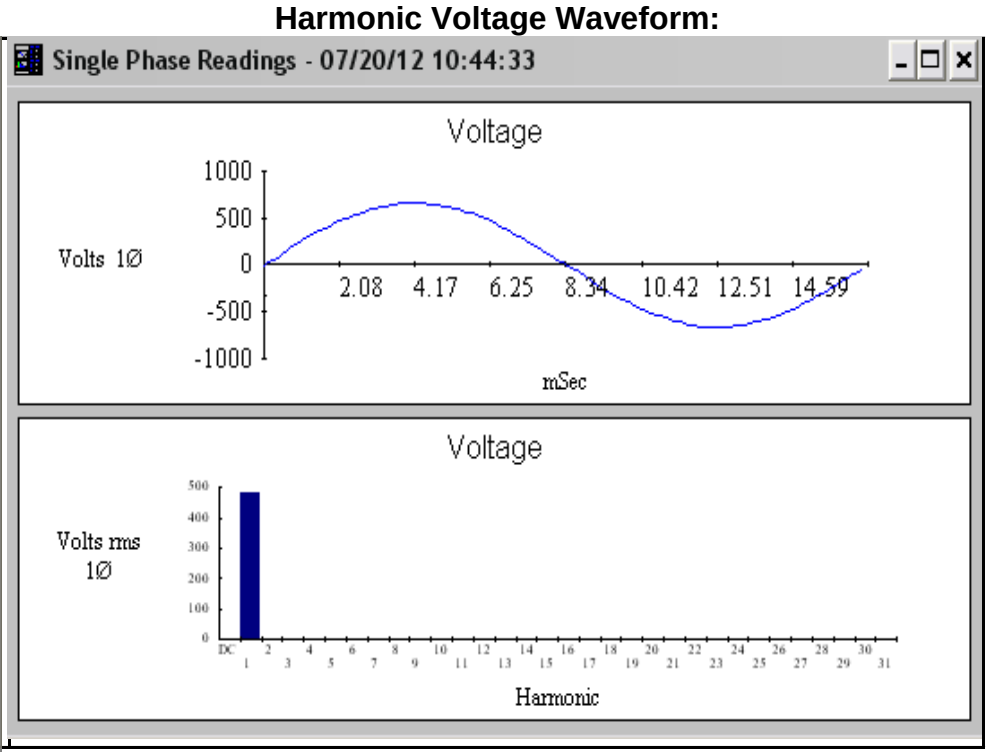
HOT TESTING - WEAR APPROPRIATE PPE

Harmonic Analysis *(optional)* :

Harmonic Current Waveform:



Harmonic Voltage Waveform:



Harmonic Analysis Report:

Single Phase Readings - 07/20/12 10:44:33

Summary Information			Voltage	Current
Frequency	59.96	RMS	481.4	36.31
Power		Peak	685.1	56.43
KW	-2.62	DC Offset	-0.2	-0.27
KVA	17.48	Crest	1.42	1.55
KVAR	16.25	THD Rms	1.22	33.37
Peak KW	-29.94	THD Fund	1.22	35.39
Phase	99° lag	HRMS	5.9	12.10
Total PF	-0.15	KFactor		5.31
DPF	-0.16			

Record	Max	Average	Min
V RMS			
A RMS			
V Peak			
A Peak			
V THD-R%			
A THD-R%			
KWatts			
KVA			
TPF			
DPF			
Frequency			

Harmonics	Freq.	V Mag	%V RMS	V Ø°	I Mag	%I RMS	I Ø°	Power (KW)
DC	0.00	0.22	0.05	0	0.27	0.74	0	0.00
1	59.96	481.41	100.01	0	34.20	94.19	-99	-2.62
2	119.92	0.34	0.07	69	0.08	0.22	158	0.00
3	179.88	1.13	0.23	-160	0.97	2.67	155	0.00
4	239.85	0.13	0.03	79	0.01	0.02	-174	0.00
5	299.81	2.09	0.43	-120	11.13	30.66	22	-0.02
6	359.77	0.06	0.01	-28	0.06	0.15	0	0.00

Harmonic Analysis Notes:

TOTAL HARMONIC DISTORTION PRESENT IS 33%. TOTAL VOLTAGE DISTORTION IS 1.22%. THESE READINGS ARE NORMAL FOR VFD'S WITHOUT HARMONIC MITIGATION EQUIPMENT.

Motor Connection Box Verification Inspection (Condition of Cable Connections):

U: GOOD, TAPED TIGHT NO RUBBING

V: GOOD, TAPED TIGHT NO RUBBING

W: GOOD, TAPED TIGHT NO RUBBING

Ground: GOOD

Other Connections:

NONE, MOTOR THERMAL NOT USED.

Input Rectifier/IGBT 12-Point Check: This tests the VFD'S semi-conductors.

DC Bus +				DC Bus -			
L1:	OL **Ω**	**U:**	OL **Ω**	**L1:**	OL **Ω**	**U:**	OL **Ω**
	OL **Diode**		0.294 **Diode**		OL **Diode**		0.293 **Diode**
L2:	OL **Ω**	**V:**	OL **Ω**	**L2:**	OL **Ω**	**V:**	OL **Ω**
	OL **Diode**		0.292 **Diode**		OL **Diode**		0.291 **Diode**
L3:	OL **Ω**	**W:**	OL **Ω**	**L3:**	OL **Ω**	**W:**	OL **Ω**
	OL **Diode**		0.29 **Diode**		OL **Diode**		0.288 **Diode**

Notes: 12 POINT CHECK NORMAL.

Motor Insulation meg-Ohm (mΩ)Test:

Motor: US MOTOR #1 **Test Measurement Voltage:** 546

L1 to Ground: 2000 **L2 to Ground:** 2000 **L3 to Ground:** 2000

Findings: MOTOR MEG TEST NORMAL.

Electro-Mechanical Fastener Torque Inspection Results:

VFD #1 CONTROL TERMINALS, RELAY AND TIMER CAPTIVE SCREWS, TERMINAL BLOCKS AND DOOR OPERATOR SCREWS WERE VERIFIED TO BE TORQUED AT 5 INCH LBS. 4-20 MA SPEED REFERENCE ON VFD TERMINALS 2 AND 4 WERE LOOSE. WIRE 5215 PULLED OUT OF TB#5. VFD POWER TERMINALS WERE VERIFIED TO BE TORQUED AT 18 INCH LBS. NONE WERE LOOSE. LINE REACTOR TERMINALS WERE VERIFIED TO BE TORQUED AT 36 INCH LBS. ALL CONTACTOR LUGS WERE VERIFIED TO BE TORQUED AT 150 INCH LBS. NONE WERE LOOSE. THE L3 MECHANICAL LUG ON THE LOAD SIDE OF THE INPUT CONTACTOR IS BEGINNING TO STRIP.

Comments:

THE FOLLOWING LIGHTS WERE BURNED OUT ON THE FRONT OF THE DOOR: "CONTROL POWER ON" "DRIVE MODE." THERE IS AN EXTREMELY HIGH AMOUNT OF PEAK VOLTAGES THAT WERE RECORDED ON THE OUTPUT OF THE VFD. AN OUTPUT FILTER NEEDS INSTALLED TO PROTECT THE MOTOR AND ELIMINATE THESE PEAK VOLTAGES. THE FILTER WILL CLAMP THE PEAKS TO LESS THAN 1000V AND EXTEND THE RISE TIME. DOOR FAN BEARINGS BAD, FAN NEEDS TO BE REPLACED BEFORE FAILURE OCCURS.