Siemens Marine Solutions
Commissioning & Field Services Report

REPORT BY: Loren Bailey Jr
REPORT NO: n/a
DATE: 8/05 to 8/08/2014
JOB NO. : 5002295945
REPORT PERIOD: 8/05 to 8/08/2014

DISTRIBUTION:

SII/CS/Marine-Services

1. SERVICE / PROJECT NAME IDENTIFICATION:

Washington-State-Ferry, WSF "Tacoma" Investigation of "July-29th" Incident

2. CUSTOMER & WORK LOCATION:

Owner / Operator:	WSF
Vessel Name:	"TACOMA"
IMO No.:	1052576
Contact Person:	Staff C/E Ben Davis
Work Location	Eagle Harbor
City / State / Zip:	Bainbridge, WAQ

3. EQUIPMENT IDENTIFICATION

Propulsion System Switchboard End 2

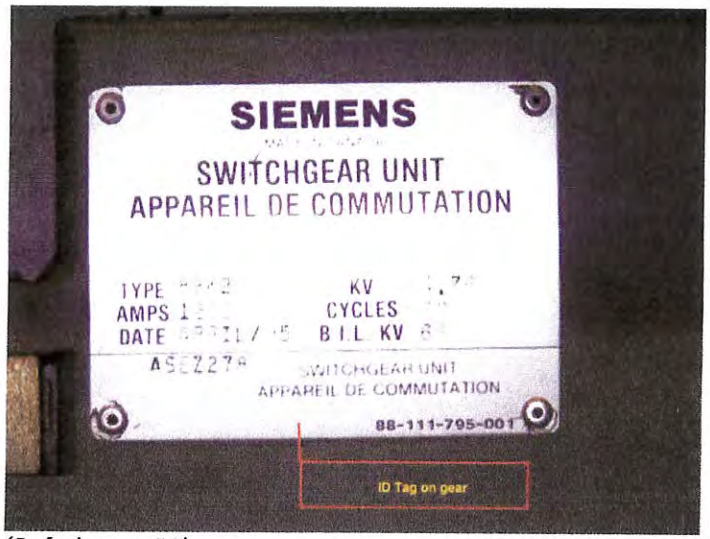
Siemens Switchgear Unit (Made In Canada)

ID# ASEZ278 Other ID# 88-111-795-001

TYPE: 8BK20 KV: 4.76

AMPS: 1200 CYCLES: 60

B.I.L. KV60 DATE: April/95



(Ref.picture #1)

AS FOUND CONDITION

- Switchgear was De-energized on arrival and the rear bottom panel covers were removed on sections 4 and 5 for (Gen # 4 and # 3)
- Feeder breakers for the Generators were removed, and so were the Surge arrestors and mounting bracket (Surge Arrestor were bad and the brackets were bent out of shape).
- Extensive damage in the rear of switchgear section 4 (Gen. #4) burnt insulators and melted disconnect contact fingers on all three phases,

(Ref.picture #2)

5kv rated red shrink tubing discolored and burnt,

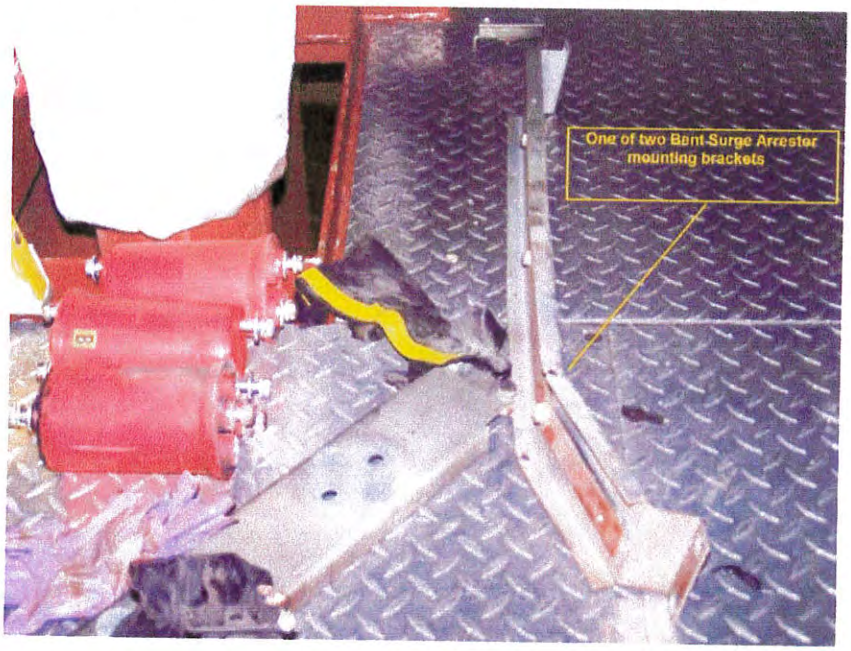
(Ref.picture #3)

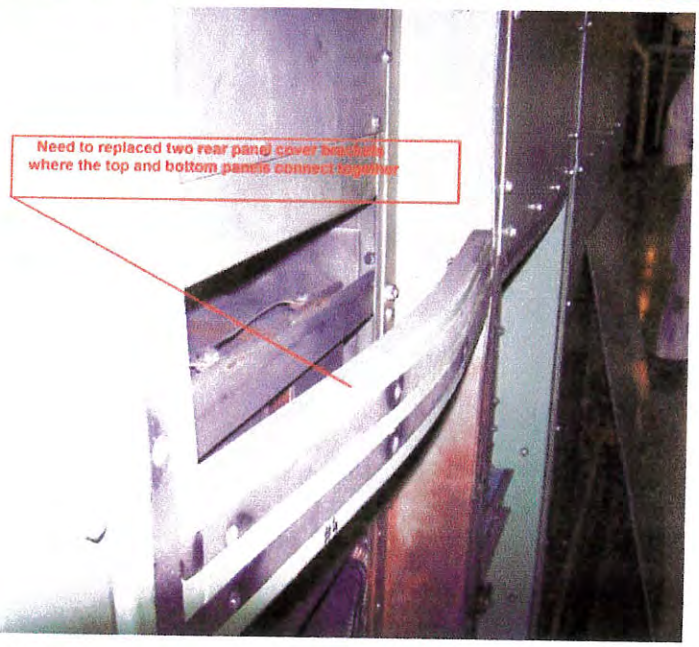
100 Technology Drive, Alpharetta, Ga. 30005
Tel. +1-770-740-3570

Damage to all three surge arrestors,

(Ref.picture #4)

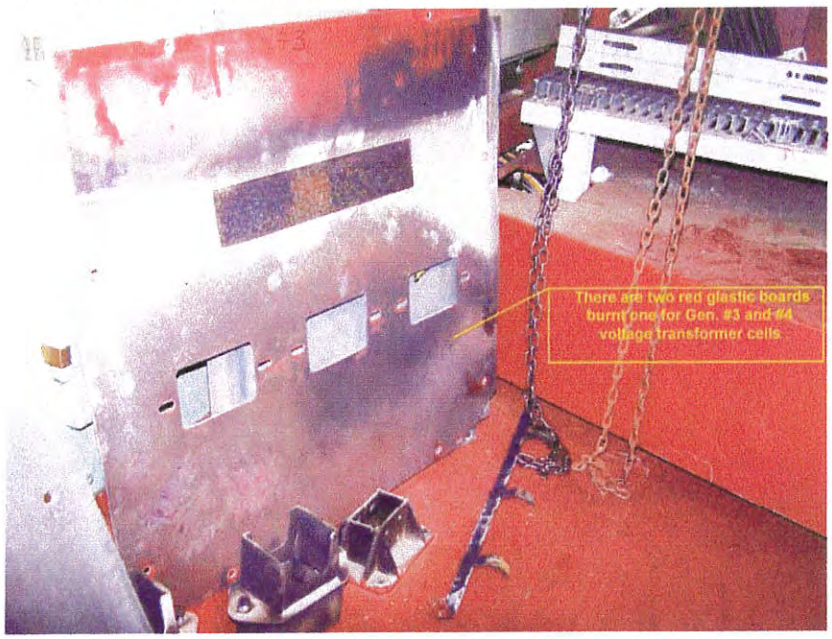
Mounting brackets for the surge arrestors and frame damage,

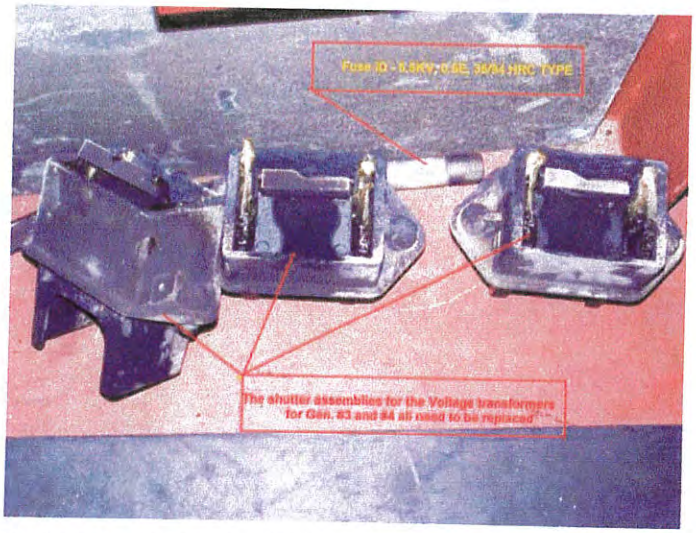




(Ref.picture #5and #6)

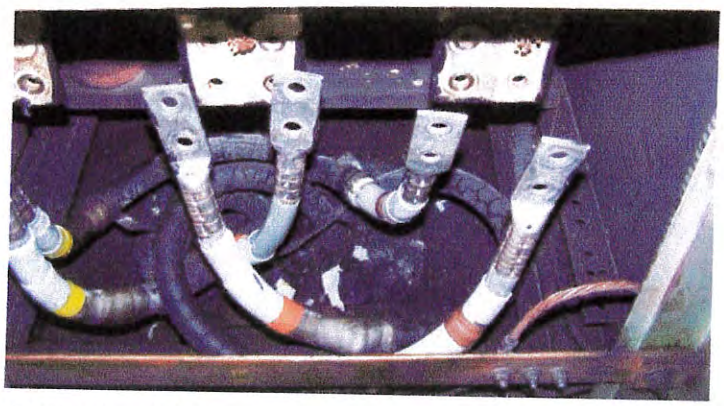
Red glastic boards with individual phase shutters badly burnt,





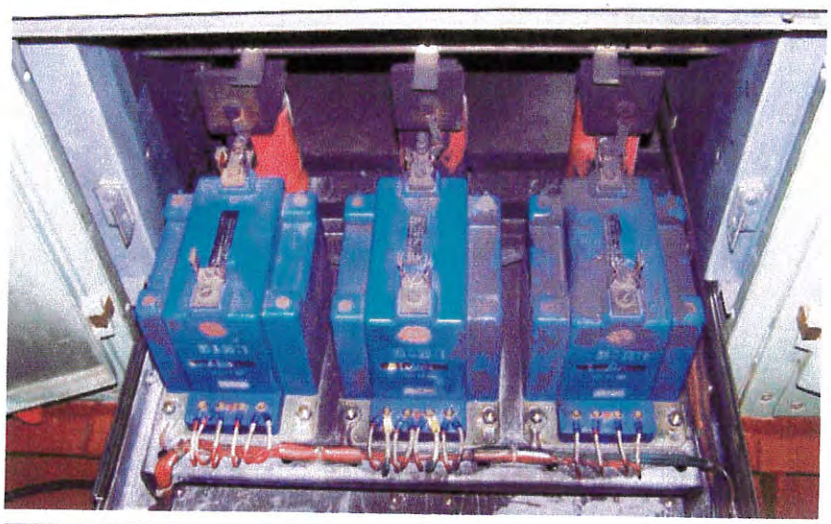
(Ref.picture #7, #8 and #9)

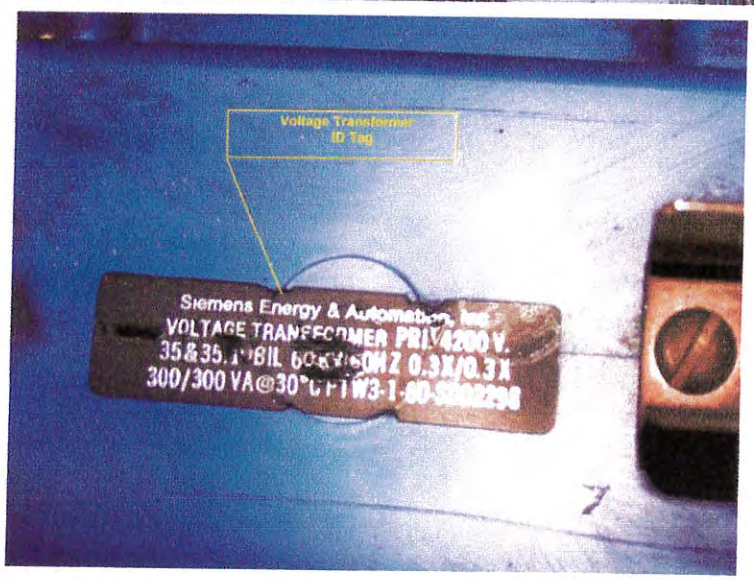
5KV 500 Marine type cables with extra damage.



(Ref.picture #10)

- Damage in the Voltage Transformer drawer of switchgear section 4 (Gen. #4) burnt insulators, All three voltage transformers, and blown fuses,

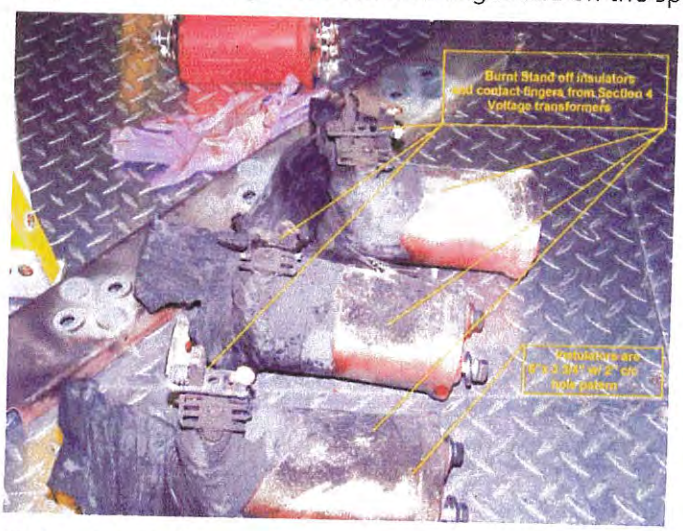




(Ref.picture #11and # 14)

Red glastic boards with individual phase shutters.

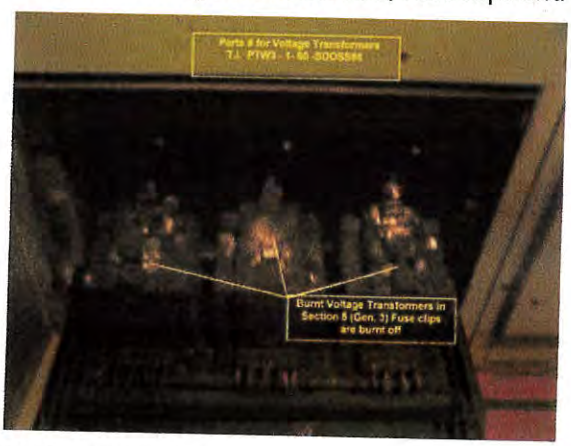
- Extensive damage in the rear of switchgear section 5 (Gen. #3) burnt insulators, 5KV 500 Marine type cable with external damage, damage to all three surge arrestors, some mounting brackets and frame damage, red glastic boards with individual phase shutters badly burnt, disconnect contact fingers on all three phases tinsel strength bad on the springs, 5kv rated red shrink tubing discolored



(Ref.picture #2)

- Extensive damage in the Voltage Transformer drawer of switchgear section 5 (Gen. #3);

All three Voltage Transformers, fuse clips and fuses, secondary control power wiring,

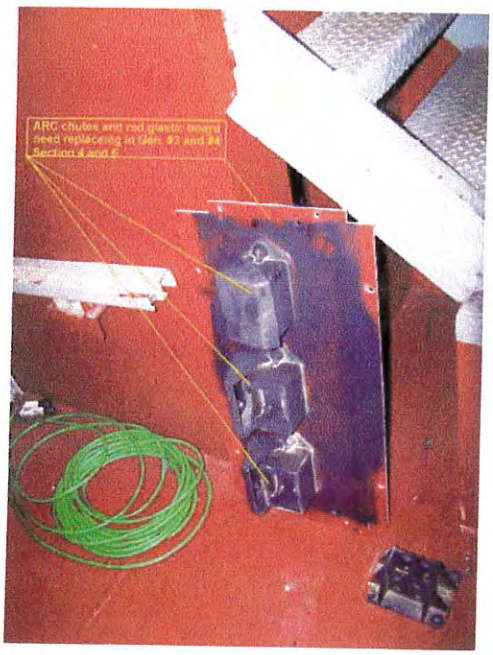


(Ref.picture #12)

Uninsulated braded wiring from fuse clips and from surge arrestors to the bus,

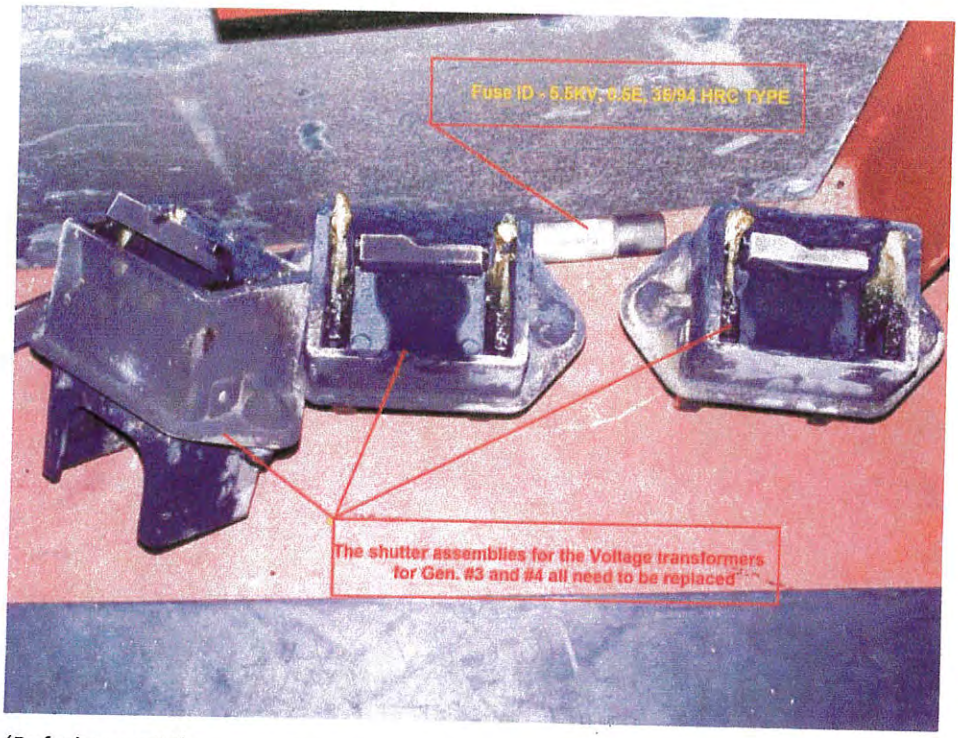
(Ref.picture #13)

Red glastic boards with individual phase shutters.



(Ref.picture #8)

5.5KV,0.5E, Type 35/94 HRC fuses



(Ref.picture #9)

ACTION TAKEN

- Performed device testing.
- Disassembled some bus and other parts in order to do troubleshooting and testing.

WRITTEN BY:

Loren Bailey Jr.
Sr. Field Service Technician
Customer Services

WSF - Tacoma

Propulsion System Switchboard Parts List

Recommended for repair	Extra spare parts recommended by WSF-Engineering
• 2ea. **Red glastic boards** 29"x14"x¼" w/ all mounting holes drilled out and shutter mounting holes cut out. • 2ea. **Red glastic boards** 30⅛"x28½"x⅛" w/ all mounting holes drilled out and shutter mounting holes cut out. • 6ea. **Disconnect fingers** w/ total of 4 fingers on each. • 18ea. **5kv Red insulators** 6"H x 3¼"to 3¾" W • 12ea. **Single phase shutters** (to install on red boards) • 9ea. **5Kv Surge Arrestors:** 3EFI C48-0, UR 4.8Kv,IN 1KA, K1994 • 6ea. **Voltage Transformers**:35/35:1 ratio, 4200/120v, B.I.L. 60Kv, 300/300VA @ 30° C PTW3-1-60-SDO2298 • 6ea. **BUSSMAN High Voltage fuses** Type: H.R.C. ABWNA, 5Kv, 0.5E, 50000A Interrupting, 5½" L x 1" W • 12ea. **Fuse clips** (to mount on VT's for the BUSSMAN High Voltage fuses). • 20' roll of 3/8" **Braded uninsulated copper wire**. • **Uninsulated wire lugs** w/ 10/23" screw hole, to fit on braded copper wire. • 20' roll of ½" **Clear tubing** (to put on the 3/8" Braded uninsulated copper wire). • 2ea. **Rear panel cover brackets**. • 2ea. **Surge Arrestor mounting brackets**.	• 3ea. **Disconnect fingers** w/ total of 4 fingers on each. • 9ea. **5kv Red insulators** 6"H x 3¼"to 3¾" W • 3ea. **5Kv Surge Arrestors:** 3EFI C48-0, UR 4.8Kv,IN 1KA, K1994 • 6ea. **Voltage Transformers**:35/35:1 ratio, 4200/120v, B.I.L. 60Kv, 300/300VA @ 30° C PTW3-1-60-SDO2298 • 6ea. **BUSSMAN High Voltage fuses** Type: H.R.C. ABWNA, 5Kv, 0.5E, 50000A Interrupting, 5½" L x 1" W • 6ea. **Fuse clips** (to mount on VT's for the BUSSMAN High Voltage fuses).

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DISTRIBUTION:

SII/CS/Marine-Services

1. SERVICE / PROJECT NAME IDENTIFICATION:

Washington-State-Ferry, WSF "Tacoma" 3AF Circuit Breaker Initial Examination

2. CUSTOMER & WORK LOCATION:

Owner / Operator:	WSF
Vessel Name:	"TACOMA"
IMO No.:	1052576
Contact Person:	Staff C/E Ben Davis
Work Location	Eagle Harbor
City / State / Zip:	Bainbridge, WAQ

3. EQUIPMENT IDENTIFICATION

Propulsion System Switchboard End 2
Siemens Switchgear Unit (Made In Canada)
ID# ASEZ278 Other ID# 88-111-795-001
TYPE: 8BK20 KV: 4.76
AMPS: 1200 CYCLES: 60
B.I.L. KV60 DATE: April/95

Siemens Circiut Breakers
TYPE: 3AF 1052-4
VOLTAGE RATING: 4.76 Kv
CURRENT RATING: 1200A
CONTROL VOLTAGE: 20 TO 26 VDC

AS FOUND CONDITION

- Gen.# 4 breaker was sitting out of the swicthgear area on a cart and Gen.# 3 breaker was sitting on deck in the switchgear #2 area.
- Both circuit breakers had black debris from fault all over them. #4 Gen. breaker had excessive amount of black debris.
- #4 Gen. breaker was missing it's name plate ID tag, and when doing the Integrity test on the vacuum bottles "B" phase failed, When doing the open timing test I found that timing was higher then expected based on previous 3AF breaker testing on the Puyallup ferry boat.
- #3 Gen. breaker I found that timing was also higher then expected.

ACTION TAKEN

- Inspected and tested 2 Siemens 3AF circuit breakers.
- The breaker testing performed included;
- Contact Resistance testing in Microhms using a digital low resistance ohmmeter.
- Insulation Resistance testing in Ohms using a 500 to 5000Vdc Megger .
- Vacuum integrity testing of the Vacuum bottles using a 30KVAC hi-pot. Vacuum integrity testing was done as per manufactures operation maintenance booklet SG-3158-01, pg.29
- Using a AC temp. power supply and a AC/DC rectifier in line for testing the electrical functions of the-Closing and Tripping coils.
- Timing test on the opening circuit using a Vanguard CB 7000 test set.
- Checked wiring, micro switches, and aux. switches in the breakers.
- Had to clean the vacuum bottles off on both #3 and #4 Generator breakers before doing the vacuum integrity testing of the bottles.

WRITTEN BY:

Loren Bailey Jr.
Sr. Field Service Technician
Customer Services

SIEMENS

Siemens Industrial Services

A business of
Siemens Energy and Automation, Inc.

MEDIUM VOLTAGE VACUUM CIRCUIT BREAKER TEST REPORT

Customer:	WASHINGTON STATE FERRIES	**Location:**	Tacoma Ferry		
Substation:	Propulsion Switchboard # 2	**Feeder/Cubicle:**	# 3 Gen.	**Unique ID:**	

Nameplate Data

Manufacturer:	Siemens	**Voltage Rating:**	4.76kV
Type / Style:	3AF 1052-4	**Current Rating:**	1200A
YR / Serial Number:	CAN - 0535	**Interrupting Rating:**	31.5kA
IB Number:	60Kv	**Trip Coil / Close Coil:**	20 TO 29 VDC

Inspection

Primary Fingers:	B	**Charging Motor Operation:**	B
Vac. Contact Wear Indicators:	B	**Clean and Lubricate Mechanism:**	C
Vac. Contact Wipe Indicators:	B	**Racking and Shutter Mechanism:**	NA
Clean Bottles and Insulation:	D	**Mechanical Interlocks:**	B
Auxiliary Contacts:	B	**Electrical Charge Test:**	B
Control Circuit Wiring:	B	**Electrical Close and Trip Test:**	B
		Relay Trip Test:	NA
Operation As Found:	8567		
Operation As Left:	8571		

CODE LEGEND
A= Like New Condition
B= Good Condition
C= Poor Condition Requires Correction
D= Corrections Made
E= Unacceptable Condition Do Not Use!
NA= Not Applicable

	A Phase	**B Phase**	**C Phase**
Contact Gap / Wear Indication:	OK	OK	OK

Electrical Tests

Insulation Resistance

Readings in Gig-Ohms @ 2500 VDC

As Found						As Left					
A-G	> 500	**A-B**	> 500	**A-A'**	> 500	**A-G**	> 500	**A-B**	> 500	**A-A'**	> 500
B-G	> 500	**B-C**	> 500	**B-B'**	> 500	**B-G**	> 500	**B-C**	> 500	**B-B'**	> 500
C-G	> 500	**C-A**	> 500	**C-C'**	> 500	**C-G**	> 500	**C-A**	> 500	**C-C'**	> 500

Control Wiring (Tested at 500 VDC) 2G

HIPOT Across Open VAC Contacts @ 14 **kV** AC **AC or DC**

Phase A (MA)	**Phase B (MA)**	**Phase C (MA)**
0.7 - Pass	0.7 - Pass	0.7 - Pass

Contact Resistance
Readings in Micro-Ohms

As Found		As Left	
A	27.6	**A**	27.6
B	30.8	**B**	30.8
C	31.6	**C**	31.6

Environmental Conditions

	Selection
Indoor/Outdoor	Indoor
Clean / Dirty	Dirty
Wet / Damp / Dry	Dry
Temp (Degree C)	22°
Relative Humidity (%)	40

COMMENTS

Satisfactory for Continued Service	No	**Requires Repair**	Yes	**Repairs Made During Maintenance**	No

NOTE: Time Test - ms - cy
AØ - 55.95 - 3.34
BØ - 55.80 - 3.35
CØ - 55.50 - 3.33

1) Breaker is rated 3 cy. Did time test from close to open on breaker.
2) Vacuum integrity testing was done as per manufactures operation maintenance booklet SG-3158-01, pg.29

Job No:	5002295945	**Tested By:**	L.Bailey Jr.	**Date Tested**	8-15-2014	**ID #**	

K. Rolley

SIEMENS

Siemens Industrial Services

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Siemens Energy and Automation, Inc.

MEDIUM VOLTAGE VACUUM CIRCUIT BREAKER TEST REPORT

Customer:	WASHINGTON STATE FERRIES	**Location:**	Tacoma Ferry		
Substation:	Propulsion Switchboard # 2	**Feeder/Cubicle:**	# 4 Gen.	**Unique ID:**	

Nameplate Data

Manufacturer:	Siemens	**Voltage Rating:**	4.76kV
Type / Style:	3AF 1052-4	**Current Rating:**	1200A
YR / Serial Number:	CAN - ?	**Interrupting Rating:**	31.5kA
IB Number:	60Kv	**Trip Coil / Close Coil:**	20 TO 29 VDC

Inspection

Primary Fingers:	B	**Charging Motor Operation:**	B
Vac. Contact Wear Indicators:	B	**Clean and Lubricate Mechanism:**	C
Vac. Contact Wipe Indicators:	B	**Racking and Shutter Mechanism:**	NA
Clean Bottles and Insulation:	D	**Mechanical Interlocks:**	B
Auxiliary Contacts:	B	**Electrical Charge Test:**	B
Control Circuit Wiring:	B	**Electrical Close and Trip Test:**	B
		Relay Trip Test:	NA
Operation As Found:	9106		
Operation As Left:	9110		

CODE LEGEND
A= Like New Condition
B= Good Condition
C= Poor Condition Requires Correction
D= Corrections Made
E= Unacceptable Condition Do Not Use!
NA= Not Applicable

	A Phase	**B Phase**	**C Phase**
Contact Gap / Wear Indication:	OK	OK	OK

Electrical Tests

Insulation Resistance

Readings in Gig-Ohms @ 2500 VDC

As Found						As Left					
A-G	> 500	**A-B**	> 500	**A-A'**	> 500	**A-G**	> 500	**A-B**	> 500	**A-A'**	> 500
B-G	> 500	**B-C**	> 500	**B-B'**	> 500	**B-G**	> 500	**B-C**	> 500	**B-B'**	> 500
C-G	> 500	**C-A**	> 500	**C-C'**	> 500	**C-G**	> 500	**C-A**	> 500	**C-C'**	> 500

Control Wiring (Tested at 500 VDC) 1G

HIPOT Across Open VAC Contacts @ 14 **kV** AC **AC or DC**

Phase A (MA)	**Phase B (MA)**	**Phase C (MA)**
0.7 - Pass	fail @ 8Kv	0.7 - Pass

Contact Resistance
Readings in Micro-Ohms

As Found		As Left	
A	31.5	**A**	31.5
B	32.1	**B**	32.1
C	32.2	**C**	32.2

Environmental Conditions

	Selection
Indoor/Outdoor	Indoor
Clean / Dirty	Dirty
Wet / Damp / Dry	Dry
Temp (Degree C)	22°
Relative Humidity (%)	40

COMMENTS

Satisfactory for Continued Service	No	**Requires Repair**	Yes	**Repairs Made During Maintenance**	No

NOTE: Time Test - ms - cy
AØ - 58.95 - 3.52
BØ - 55.70 - 3.52
CØ - 55.70 - 3.52

1) Breaker is rated 3 cy. Did time test from close to open on breaker.
2) Vacuum integrity testing was done as per manufactures operation maintenance booklet SG-3158-01, pg.29
3) Name plate missing

Job No:	5002295945	**Tested By:**	L.Bailey Jr.	**Date Tested**	8-15-2014	**ID #**	

BREAKER TIMING RESULTS - 60 Hz

SHOT NUMBER: 0001
DATE: 11/29/11 TIME: 15:19:38

COMPANY: WSF
STATION: PUYALLUP FERRY
CIRCUIT: ~~GEN 2~~ out of Gen #2
MFR: SIEMENS
MODEL: 3AF1052 4
S/N: CAN 0767
OPERATOR: LB

TEST: OPEN

CONTACT TIME

CH	TIME <mS>	CYCLE	BOUNCE <mS>	WIPE <in>
1	041.60	02.50	000.10	00.00
2	040.90	02.45	000.10	00.00
3	040.90	02.45	000.10	00.00

DELTA TIME <mS>: 000.80

TRAVEL ANALYSIS		T1
STROKE	in	00.00
SPEED	ft/S	00.00
OVER-TRAVEL	in	00.00
BOUNCE BACK	in	00.00

SPEED ANALYSIS:
POINT 1 = 01.12 in
POINT 2 = 05.12 in

V1 NOMINAL VOLTAGE = 0 VOLTS
V1 MINIMUM VOLTAGE = 0 VOLTS
INITIATOR CURRENT = 19.5 AMPS

SHOT LENGTH: 1 SECOND
INSERTION RESISTOR: NO
TRIGGER: INTERNAL

VANGUARD INSTRUMENT CO., HPN (C) 1998-2009
1520 S. HELLMAN AVE. ONTARIO, CA 91761
TEL (909)923-9390 FAX (909)923-9391
REV: 2.047
OPERATION: 007B
SERIAL NUMBER: 70204
CLOSED THRESHOLD = 017 OPENED THRESHOLD = 200
SAMPLE = 044 VOLTAGE = 064
RESISTIVE CONTACT FILTER = 001 SAMPLES

BREAKER TIMING RESULTS - 60 Hz

SHOT NUMBER: 0002
DATE: 11/30/11 TIME: 12:13:21

COMPANY: WSF
STATION: PUYALLUP FERRY
CIRCUIT: GEN #2 SPARE
MFR: SIEMENS
MODEL: 3AF1052 4
S/N: CAN 0957
OPERATOR: LB

TEST: OPEN

CONTACT TIME

CH	TIME <mS>	CYCLE	BOUNCE <mS>	WIPE <in>
1	040.80	02.45	000.20	00.00
2	040.90	02.45	000.20	00.00
3	041.30	02.49	000.10	00.00

DELTA TIME <mS>: 000.50

TRAVEL ANALYSIS T1

STROKE	in	00.00
SPEED	ft/S	00.00
OVER-TRAVEL	in	00.00
BOUNCE BACK	in	00.00

SPEED ANALYSIS:
POINT 1 = 01.12 in
POINT 2 = 05.12 in

V1 NOMINAL VOLTAGE = 0 VOLTS
V1 MINIMUM VOLTAGE = 0 VOLTS
INITIATOR CURRENT = 19.0 AMPS

SHOT LENGTH: 1 SECOND
INSERTION RESISTOR: NO
TRIGGER: INTERNAL

VANGUARD INSTRUMENT CO., HPN (C) 1998-2009
1520 S. HELLMAN AVE. ONTARIO, CA 91761
TEL (909)923-9390 FAX (909)923-9391
REV: 2.047
OPERATION: 0083
SERIAL NUMBER: 70204
CLOSED THRESHOLD = 017 OPENED THRESHOLD = 200
SAMPLE = 044 VOLTAGE = 064
RESISTIVE CONTACT FILTER = 001 SAMPLES

BREAKER TIMING RESULTS - 60 Hz

SHOT NUMBER: 0002
DATE: 12/01/11 TIME: 08:33:28

COMPANY: WSF
STATION: PUYALLUP FERRY
CIRCUIT: SPARE
MFR: SIEMENS
MODEL: 3AF1052 4
S/N: CAN 0763
OPERATOR: LB

TEST: OPEN

CONTACT TIME

CH	TIME <mS>	CYCLE	BOUNCE <mS>	WIPE <in>
1	041.20	02.47	000.30	00.00
2	040.80	02.45	000.20	00.00
3	040.60	02.44	000.10	00.00

DELTA TIME <mS>: 000.60

TRAVEL ANALYSIS		T1
STROKE	in	00.00
SPEED	ft/S	00.00
OVER-TRAVEL	in	00.00
BOUNCE BACK	in	00.00

SPEED ANALYSIS:
POINT 1 = 01.12 in
POINT 2 = 05.12 in

V1 NOMINAL VOLTAGE = 0 VOLTS
V1 MINIMUM VOLTAGE = 0 VOLTS
INITIATOR CURRENT = 19.5 AMPS

SHOT LENGTH: 1 SECOND
INSERTION RESISTOR: NO
TRIGGER: INTERNAL

VANGUARD INSTRUMENT CO., HPN (C) 1998-2009
1520 S. HELLMAN AVE. ONTARIO, CA 91761
TEL (909)923-9390 FAX (909)923-9391
REV: 2.047
OPERATION: 0084
SERIAL NUMBER: 70204
CLOSED THRESHOLD = 017 OPENED THRESHOLD = 200
SAMPLE = 044 VOLTAGE = 064
RESISTIVE CONTACT FILTER = 001 SAMPLES

BREAKER TIMING RESULTS - 60 Hz

SHOT NUMBER: 0002
DATE: 12/01/11 TIME: 11:12:09

COMPANY: WSF
STATION: PUYALLUP FERRY
CIRCUIT: GEN 1
MFR: SIEMENS
MODEL: 3AF1052 4
S/N: CAN 0769
OPERATOR: LB

TEST: OPEN

CONTACT TIME

CH	TIME <mS>	CYCLE	BOUNCE <mS>	WIPE <in>
1	044.40	02.66	000.20	00.00
2	047.60	02.86	000.10	00.00
3	047.60	02.86	000.10	00.00

DELTA TIME <mS>: 003.20

TRAVEL ANALYSIS		T1
STROKE	in	00.00
SPEED	ft/S	00.00
OVER-TRAVEL	in	00.00
BOUNCE BACK	in	00.00

SPEED ANALYSIS:
POINT 1 = 01.12 in
POINT 2 = 05.12 in

V1 NOMINAL VOLTAGE = 0 VOLTS
V1 MINIMUM VOLTAGE = 0 VOLTS
INITIATOR CURRENT = 19.3 AMPS

SHOT LENGTH: 1 SECOND
INSERTION RESISTOR: NO
TRIGGER: INTERNAL

VANGUARD INSTRUMENT CO., HPN (C) 1990-2009
1520 S. HELLMAN AVE. ONTARIO, CA 91761
TEL (909)923-9390 FAX (909)923-9391
REV: 2.047
OPERATION: 0086
SERIAL NUMBER: 70204
CLOSED THRESHOLD = 017 OPENED THRESHOLD = 200
SAMPLE = 044 VOLTAGE = 064
RESISTIVE CONTACT FILTER = 001 SAMPLES

BREAKER TIMING RESULTS - 60 Hz

SHOT NUMBER: 0009
DATE: 12/01/11 TIME: 14:23:36

COMPANY: WSF
STATION: PUYALLUP FERRY
CIRCUIT: 1 PROP XFMR
MFR: SIEMENS
MODEL: 3AF1052 4
S/N: CAN 0771
OPERATOR: LB

TEST: OPEN

CONTACT TIME

CH	TIME <mS>	CYCLE	BOUNCE <mS>	WIPE <in>
1	043.60	02.62	000.20	00.00
2	043.10	02.59	000.10	00.00
3	043.10	02.59	000.10	00.00

DELTA TIME <mS>: 000.50

TRAVEL ANALYSIS		T1
STROKE	in	00.00
SPEED	ft/S	00.00
OVER-TRAVEL	in	00.00
BOUNCE BACK	in	00.00

SPEED ANALYSIS:
POINT 1 = 01.12 in
POINT 2 = 05.12 in

V1 NOMINAL VOLTAGE = 0 VOLTS
V1 MINIMUM VOLTAGE = 0 VOLTS
INITIATOR CURRENT = 18.4 AMPS

SHOT LENGTH: 1 SECOND
INSERTION RESISTOR: NO
TRIGGER: INTERNAL

VANGUARD INSTRUMENT CO., HPN (C) 1998-2009
1520 S. HELLMAN AVE. ONTARIO, CA 91761
TEL (909)923-9390 FAX (909)923-9391
REV: 2.047
OPERATION: 0087
SERIAL NUMBER: 70204
CLOSED THRESHOLD = 017 OPENED THRESHOLD = 200
SAMPLE = 044 VOLTAGE = 064
RESISTIVE CONTACT FILTER = 001 SAMPLES

BREAKER TIMING RESULTS - 60 Hz

SHOT NUMBER: 0004
DATE: 12/01/11 TIME: 16:01:39

COMPANY: WSF
STATION: PUYALLUP FERRY
CIRCUIT: 3 PROP XFMR TO 1 PX
MFR: SIEMENS
MODEL: 3AF1052 4
S/N: CAN 0770
OPERATOR: LB

TEST: OPEN

CONTACT TIME

CH	TIME <mS>	CYCLE	BOUNCE <mS>	WIPE <in>
1	039.00	02.34	000.20	00.00
2	039.00	02.34	000.20	00.00
3	039.70	02.38	000.20	00.00

DELTA TIME <mS>: 000.70

TRAVEL ANALYSIS		T1
STROKE	in	00.00
SPEED	ft/S	00.00
OVER-TRAVEL	in	00.00
BOUNCE BACK	in	00.00

SPEED ANALYSIS:
POINT 1 = 01.12 in
POINT 2 = 05.12 in

V1 NOMINAL VOLTAGE = 0 VOLTS
V1 MINIMUM VOLTAGE = 0 VOLTS
INITIATOR CURRENT = 19.3 AMPS

SHOT LENGTH: 1 SECOND
INSERTION RESISTOR: NO
TRIGGER: INTERNAL

VANGUARD INSTRUMENT CO., HPN (C) 1998-2009
1520 S. HELLMAN AVE. ONTARIO, CA 91761
TEL (909)923-9390 FAX (909)923-9391
REV: 2.047
OPERATION: 0088
SERIAL NUMBER: 70204
CLOSED THRESHOLD = 017 OPENED THRESHOLD = 200
SAMPLE = 044 VOLTAGE = 064
RESISTIVE CONTACT FILTER = 001 SAMPLES

BREAKER TIMING RESULTS - 60 Hz

SHOT NUMBER: 0004
DATE: 12/02/11 TIME: 12:12:01

COMPANY: WSF
STATION: PUYALLUP FERRY
CIRCUIT: 4 PROP XFMR
MFR: SIEMENS
MODEL: 3AF1052 4
S/N: CAN 0765
OPERATOR: LB

TEST: OPEN

CONTACT TIME

CH	TIME <mS>	CYCLE	BOUNCE <mS>	WIPE <in>
1	044.70	02.68	000.10	00.00
2	044.40	02.66	000.10	00.00
3	045.00	02.70	000.10	00.00

DELTA TIME <mS>: 000.60

TRAVEL ANALYSIS		T1
STROKE	in	00.00
SPEED	ft/S	00.00
OVER-TRAVEL	in	00.00
BOUNCE BACK	in	00.00

SPEED ANALYSIS:
POINT 1 = 01.12 in
POINT 2 = 05.12 in

V1 NOMINAL VOLTAGE = 0 VOLTS
V1 MINIMUM VOLTAGE = 0 VOLTS
INITIATOR CURRENT = 19.5 AMPS

SHOT LENGTH: 1 SECOND
INSERTION RESISTOR: NO
TRIGGER: INTERNAL

VANGUARD INSTRUMENT CO., HPN (C) 1998-2009
1520 S. HELLMAN AVE. ONTARIO, CA 91761
TEL (909)923-9390 FAX (909)923-9391
REV: 2.047
OPERATION: 0089
SERIAL NUMBER: 70204
CLOSED THRESHOLD = 017 OPENED THRESHOLD = 200
SAMPLE = 044 VOLTAGE = 064
RESISTIVE CONTACT FILTER = 001 SAMPLES

BREAKER TIMING RESULTS - 60 Hz

SHOT NUMBER: 0005
DATE: 12/02/11 TIME: 14:51:04

COMPANY: WSF
STATION: PUYALLUP FERRY
CIRCUIT: GEN 3
MFR: SIEMENS
MODEL: 3AF1052 4
S/N: CAN 0766
OPERATOR: LB

TEST: OPEN

CONTACT TIME

CH	TIME (mS)	CYCLE	BOUNCE (mS)	DIFF (mS)
1	038.10	02.29	000.10	00.00
2	037.10	02.23	000.20	00.00
3	037.60	02.26	000.20	00.00

DELTA TIME (mS): 001.00

TRAVEL ANALYSIS		T1
STROKE	in	00.00
SPEED	ft/S	00.00
OVER-TRAVEL	in	00.00
BOUNCE BACK	in	00.00

SPEED ANALYSIS:
POINT 1 = 01.12 in
POINT 2 = 05.12 in

V1 NOMINAL VOLTAGE = 0 VOLTS
V1 MINIMUM VOLTAGE = 0 VOLTS
INITIATOR CURRENT = 19.5 AMPS

SHOT LENGTH: 1 SECOND
INSERTION RESISTOR: NO
TRIGGER: INTERNAL

ANGUARD INSTRUMENT CO., HPN (C) 1998-2009
520 S. HELLMAN AVE. ONTARIO, CA 91761
EL (909)923-9390 FAX (909)923-9391
EV: 2.047
PERATION: 008C
ERIAL NUMBER: 70204
LOSED THRESHOLD = 017 OPENED THRESHOLD = 200
AMPLE = 044 VOLTAGE = 064
ESISTIVE CONTACT FILTER = 001 SAMPLES

19.7°C
46%

BREAKER TIMING RESULTS - 60 Hz

SHOT NUMBER: 0006
DATE: 12/02/11 TIME: 16:13:23

COMPANY: WSF
STATION: PUYALLUP FERRY
CIRCUIT: 2 PROP XFMR
MFR: SIEMENS
MODEL: 3AF1052 4
S/N: CAN 0768
OPERATOR: LB

TEST: OPEN

CONTACT TIME

CH	TIME <mS>	CYCLE	BOUNCE <mS>	WIPE <in>
1	044.30	02.66	000.10	00.00
2	044.40	02.66	000.20	00.00
3	044.60	02.68	000.20	00.00

DELTA TIME <mS>: 000.30

TRAVEL ANALYSIS		T1
STROKE	in	00.00
SPEED	ft/S	00.00
OVER-TRAVEL	in	00.00
BOUNCE BACK	in	00.00

SPEED ANALYSIS:
POINT 1 = 01.12 in
POINT 2 = 05.12 in

U1 NOMINAL VOLTAGE = 0 VOLTS
U1 MINIMUM VOLTAGE = 0 VOLTS
INITIATOR CURRENT = 18.5 AMPS

SHOT LENGTH: 1 SECOND
INSERTION RESISTOR: NO
TRIGGER: INTERNAL

VANGUARD INSTRUMENT CO., HPN (C) 1996-2009
1520 S. HELLMAN AVE. ONTARIO, CA 91761
TEL (909)923-9390 FAX (909)923-9391
REV: 2.047
VERSION: 008D
SERIAL NUMBER: 70204
CLOSED THRESHOLD = 017 OPENED THRESHOLD = 200
SAMPLE = 044 VOLTAGE = 064
RESISTIVE CONTACT FILTER = 001 SAMPLES

1 2 3
C C C

HOOKUP TEST RESULTS (C = CLOSED)

1 2 3
C C C

BREAKER TIMING RESULTS - 60 Hz

SHOT NUMBER: 2
DATE: 08/15/14 TIME: 12:36:03

COMPANY: WSF TACOMA
STATION: NO 2 END
CIRCUIT: NO 3 GEN
MFR: SIEMENS
MODEL: 3AE 1052 4
S/N: CAN 0535
OPERATOR: LB

TEST: OPEN

CONTACT TIME

CH	TIME (mS)	CYCLE	BOUNCE (mS)	WIPE (in)
1	55.95	3.34	0.05	0.00
2	55.80	3.35	0.10	0.00
3	55.50	3.33	0.05	0.00

DELTA TIME (mS): 0.45

TRAVEL ANALYSIS		T1
STROKE	in	0.00
SPEED	ft/S	0.00
OVER-TRAVEL	in	0.00
BOUNCE BACK	in	0.00

SPEED ANALYSIS:
POINT 1 = 0.75 in
POINT 2 = 3.00 in

V1 NOMINAL VOLTAGE = 0 VOLTS
V1 MINIMUM VOLTAGE = 0 VOLTS
INITIATOR CURRENT = 16.6 AMPS

SHOT LENGTH: 1 SECOND
INSERTION RESISTOR: NO
TRIGGER: INTERNAL

VANGUARD INSTRUMENTS CO., INC. REV 1.27 (C) 2006-2011
1520 S. HELLMAN AVE.
ONTARIO, CA. 91761. USA
TEL:(909) 923-9390 FAX: (909) 923-9391
WWW.VANGUARD-INSTRUMENTS.COM
SERIAL NUMBER: 71167
OPERATION: 344
CLOSED THRESHOLD = 272 OPEN THRESHOLD = 2400
SAMPLE = 600 VOLTAGE = 1
RESISTIVE CONTACT FILTER = 1 SAMPLES

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Vanguard Instruments
Company, Inc.

BREAKER TIMING RESULTS – 60 Hz

SHOT NUMBER: 2
DATE: 08/15/14 TIME: 13:07:16

COMPANY: WSF TACOMA
STATION: NO 2 END
CIRCUIT: NO 4 GEN
MFR: SIEMENS
MODEL: 3AE 1052 4
S/N: CAN [redacted] ? missing Name plate
OPERATOR: LB

TEST: OPEN

CH	CONTACT TIME <mS>	CYCLE	BOUNCE <mS>	WIPE <in>
1	58.95	3.52	0.05	0.00
2	58.70	3.52	0.05	0.00
3	58.70	3.52	0.05	0.00

DELTA TIME <mS>: 0.25

TRAVEL ANALYSIS		T1
STROKE	in	0.00
SPEED	ft/S	0.00
OVER-TRAVEL	in	0.00
BOUNCE BACK	in	0.00

SPEED ANALYSIS:
POINT 1 = 20%
POINT 2 = 3.00 in

V1 NOMINAL VOLTAGE = 0 VOLTS
V1 MINIMUM VOLTAGE = 0 VOLTS
INITIATOR CURRENT = 12.0 AMPS

SHOT LENGTH: 1 SECOND
INSERTION RESISTOR: NO
TRIGGER: INTERNAL

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ONTARIO, CA. 91761. USA
TEL:(909) 923-9390 FAX: (909) 923-9391
WWW.VANGUARD-INSTRUMENTS.COM
SERIAL NUMBER: 71167
OPERATION: 345
CLOSED THRESHOLD = 272 OPEN THRESHOLD = 2400
SAMPLE = 600 VOLTAGE = 1
RESISTIVE CONTACT FILTER = 1 SAMPLES