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**1994 Triggered Lightning Test Program:
Measured Responses of a Reinforced Concrete Building
Under Direct Lightning Attachments
Volume 2: Test Data**

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Abstract

A rocket-triggered lightning test was carried out during the summer of 1994 on a specially designed steel reinforced concrete test building located at Ft. McClellan, Alabama. Currents, voltages, and magnetic fields were measured at 24 instrumented locations during 42 return strokes triggered to designated points on the structure and its lightning protection system. Detailed descriptions of the test structure, measurements, and test procedures are given in Volume 1 of this report. The present volume contains plots of the complete set of test data.

MASTER

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Contents

Acronyms.....	6
Introduction.....	7
Storm 1 Data Plots.....	15
Storm 2 Data Plots.....	161
Storm 3 Data Plots.....	235
Storm 4 Data Plots.....	315

Illustrations

1 Main features of the simulated munitions handling building	11
2 Diagram of the lightning protection system installed on the test structure during part of the present tests	11
3 Map of test point locations throughout the test structure.....	12

Tables

1 Test Point Definition.....	9
2 Triggered Lightning Attachment Points	10
3 Building Configurations Tested During Various Storms	10
4 Summary of 1994 Triggered Flashes.....	12
5 Incident Stroke Current Summary	13

Acronyms

ARDEC	U.S. Army Armament Research, Development, and Engineering Center
AT	air terminal (lightning rod)
CTG	cloud-to-ground (lightning)
CVR	current viewing resistor
CVT	current viewing transformer
EM	electromagnetic
EMT	electrical metal tubing (conduit)
FM	frequency modulated
FOL	fiber optic link
GRE	ground ring electrode
LPS	lightning protection system
LTA	launch tube assembly
M&A	maintenance and assembly
OD	outside diameter
PVC	polyvinyl chloride (pipe)
rebar	concrete reinforcing bar
RTL	rocket-triggered lightning
SATTLIF	Sandia Transportable Triggered Lightning Instrumentation Facility
SNL	Sandia National Laboratories
SOTS	U.S. Army Security Operational Test Site
TP	test point

1994 Triggered Lightning Test Program: Measured Responses of a Reinforced Concrete Building Under Direct Lightning Attachments

Introduction

During the summer of 1994, rocket-triggered lightning tests were performed on a specially designed and constructed facsimile of a weapon maintenance and assembly (M&A) building. This structure was designed jointly by The Department of the Army's Armament Research, Development, and Engineering Center (ARDEC) and Sandia National Laboratories (SNL) to incorporate many of the design and constructional features found in real M&A buildings that most influence electromagnetic responses at critical points throughout the structure. Furthermore, the test structure was designed to allow the inclusion or removal of various key features during the course of the testing. In this way, assessment of the influence of each feature of interest could be accomplished through direct comparison of test results with and without its presence, all other factors being the same. Because one of the most significant questions was the effect on overall current flow within a structure attributable to the degree of connectivity between the individual steel concrete reinforcing rods (rebar) within the walls, the building was divided into two volumes, separated electromagnetically by a steel barrier. On one side of the barrier, the so-called "bad" side, the rebar within the walls was of a type in which the individual steel rods were coated with an epoxy layer, thereby ensuring that they were normally isolated electrically from one another at their crossover junctions throughout the walls and floor. On the other, "good," side, the rebar intersections were welded together at regular intervals.

Construction of the building was the responsibility of ARDEC and was accomplished using the U. S. Army Corps of Engineers as their contracting and construction supervision agency. The test structure was completed in September 1993 at ARDEC's Security Operations Test Site (SOTS), located at Ft. McClellan, Alabama. This is the same site at which previous triggered lightning tests in this program were carried out in 1991 and 1993. Technical planning of the 1994 experiments was developed jointly by SNL and ARDEC, with the testing itself being conducted by SNL personnel using the Sandia Transportable Triggered Lightning Instrumentation Facility (SATTLIF) with on-site technical and logistical assistance from ARDEC.

The SATTLIF arrived at the test site on April 19. Setup and checkout of the facility and instrumentation of the building was completed by early May. However, administrative impediments to the shipping of the triggering rockets delayed their arrival until June 6. Test readiness was achieved on June 7 and continued without interruption throughout the duration of the summer lightning season until September 2. During that period, which represented an unusually poor season for thunderstorms in Alabama,

triggering operations were carried out during the occurrence of overhead storms on seven different days. Data were acquired during four storms, in which a total of 10 flashes, comprising 51 individual return strokes, were successfully triggered to designated points on the test structure. High resolution digital data were acquired during 42 of the return strokes. Peak amplitudes of stroke currents ranged from 4.2 to 29.6 kA, while the range of return-stroke current rise times was from 0.06 to 7.0 μ s.

Data were acquired at all 24 planned test points and for attachments to all five planned terminus points on the structure and its lightning protection systems. In addition to the incident lightning flash currents, response currents were measured in the walls, on the LPS down conductors, on the two 100-ft long buried electrical power conduits, on the buried LPS ground ring electrode around the structure, and at several miscellaneous points inside the building. Voltages with respect to the floor rebar were recorded on the simulated overhead crane rail, on the metallic ventilation stack, and on elements of the interior power distribution system. Also measured were the transient potentials developed between the wall and floor rebar at six locations around the inside perimeter of the building. Magnetic fields were recorded at floor level in the two corners of the building that were adjacent to the exterior LPS down conductors.

Presented in Volume 1 of this report are detailed descriptions of the test structure, test procedures, and instrumentation. In that volume, the test data are also summarized and discussed, with the peak values of the entire set of measured responses being given in Tables 3-4 through 3-13. The set of plotted data found in the present volume includes all of the measurements for which high resolution digital data were obtained. Table 1 lists the set of measurements that were performed, while Tables 2 and 3 define the designated points to which lightning flashes were triggered and the variations of building configurations that were tested during the four storms for which data were acquired. Figures 1 and 2 depict the key features of the test structure and its baseline lightning protection system. For the sake of reference, Figure 3 is included to indicate the locations of the various test points defined Table 1. Tables 4 and 5 provide information on the incident triggered lightning flashes.

The data that follow are organized according to storm, flash and stroke. The instrumentation employed during each of the four storms is documented by means of a two page drawing that appears at the beginning of the section related to that particular storm. For each stroke in a given flash, the associated data are given in ascending test point number order.

Table 1. Test Point Definition

Test Point	Description	Channel Type ¹	Priority ²
Current			
1	Buried Conduit	S	1
2	Buried Conduit	S	1
3	Conduit Entry	S/F	1
4	Conduit Entry	F	2
5	GRE ³	S/F	1
5'	GRE	S/F	1
6	GRE	S/F	1
6'	GRE	S/F	1
7	GRE	S/F	1
8	GRE	S/F	1
9	GRE Stub, Good Side	S	1
9'	GRE Stub, Bad Side	S	2
10	Wall-to-Floor Rebar	S	1
11	Wall-to-Floor Rebar	S	1
12	Wall-to-Floor Rebar	S	1
13	Wall-to-Floor Rebar	S	1
14	Wall-to-Floor Rebar	S/F	1
15	Wall-to-Floor Rebar	S/F	1
Voltage			
16	Wall-to-Floor Rebar	F	1
17	Wall-to-Floor Rebar	F	1
18	Wall-to-Floor Rebar	F	1
19	Wall-to-Floor Rebar	F	1
20	Crane-to-Floor	F	1
21	Vent-to-Floor	F	1
22	Distribution Conduit/Floor	F	2
Magnetic Field			
23	Field ⁴	S/F	2
24	Field	S/F	2

¹ S = FM tape channel; F = LeCroy digitizer channel; S/F = digitizer with tape backup.

² Priority applies to those shots on which the listed TP is included.

³ Ground Ring Electrode system.

⁴ Floor level, 1 ft from walls in corners of each side adjacent to exterior down conductors; sensor axis at 45° with respect to the walls.

Table 2. Triggered Lightning Attachment Points

Point	Location	Remarks
A-1	SW AT	
A-2	NE AT	
A-3	Vent Stack AT	
A-4	Conduit Riser Stub	Remove AT's and conductors
A-5	LPS Mast	Remove AT's and conductors

Table 3. Building Configurations Tested During Various Storms

Storm No.	Attachment Point	Configuration and Test Points
1	A-1	Floor and wall rebar connected; vent bonded; buried conduit floating ¹ ; TP's: 1-2, 5, 5', 6, 7-8, 10-15, 20-24
	A-2	
2	A-1	Floor and wall rebar disconnected; vent unbonded; conduit floating; TP's: 1-2, 5, 5', 6, 6', 7-8, 16-24
	A-3	
3	A-2	Floor and wall rebar disconnected; vent bonded; conduit grounded to GRE inside structure; TP's: 1-2, 3-4, 5-9, 16-24
	A-4	
4	A-4	Floor and wall rebar connected; vent bonded; LPS AT's and conductors removed; TP's: 1-2, 5-5, 6'-6', 7-8, 10-15, 20-24
	A-5	

¹Buried conduit electrically disconnected from GRE.

Figure 1. Main features of the simulated munitions handling building

Figure 2. Diagram of the lightning protection system installed on the test structure during part of the present tests. During Storm 4, a single 49-ft high mast system was tested for comparison with the one shown in this figure.

Figure 3. Map of test point locations throughout the test structure

Table 4. Summary of 1994 Triggered Flashes

Flash ID	Date	Time ¹	Electric Field (kV/m) ²	No. Strokes	Attachment Point
Storm 1					
94-04	6/22	16:15:17.5	-4.7	3	NE AT
94-06	6/22	17:12:09.5	-3.6	10	SW AT
Storm 2					
94-07	6/29	16:38:17.5	-4.3	4	Vent Stack
94-09	6/29	16:59:59.6	-4.7	3	SW AT
94-10	6/29	17:25:27.1	-4.4	1	Vent Stack
Storm 3					
94-14	7/16	14:13:11.0	-5.3	4	NE AT
94-15	7/16	14:21:32.6	-3.1	3	Conduit Riser
Storm 4					
94-21	8/5	15:23:34.4	-5.8	8	LPS Mast
94-22	8/5	15:38:03.6	-4.4	3	Conduit Riser
94-24	8/5	16:07:43.3	-5.5	12	Conduit Riser

¹ Local Alabama time of wire-burn.

² Electric field at time launch was initiated.

Table 5. Incident Stroke Current Summary¹

Flash ID	Stroke No.	I _p (kA)	τ_r ² (μs)	di/dt ³ (10 ¹⁰ A/s)	FWHM ⁴	CC ⁵
94-04	1	12.7	1.2	0.72	71	N
	2	5.7	1.3	0.07	20	Y
	3	(False Trig)	—	—	—	—
	4	11.3	0.32	2.6	20	Y
94-06	1	10.9	0.50	1.6	46	N
	2	6.0	0.65	0.45	34	Y
	3	10.7	0.70	2.8	62	N
	4	4.2	0.52	0.31	23	N
	5	6.5	0.52	1.3	34	N
	6	15.7	0.28	5.0	46	N
	7	12.1	0.16	5.7	26	N
	8	7.4	0.24	2.5	34	Y
94-07	1	19.5	0.24	6.8	40	N
	2	8.8	0.12	5.0	5.7	N
	3	16.5	0.24	5.5	21	N
	4	14.6	0.26	4.2	5.9	Y
94-09	1	9.5	0.59	1.6	43	N
	2	10.9	0.16	5.1	31	N
	3	(<4) ⁶	—	—	—	—
94-10	1	12.9	0.44	4.6	7.9	Y
94-14	1	24.9	0.16	14.2	35	N
	2	11.9	0.20	4.0	2.1	Y
	3	20.2	0.21	7.3	20	N
	4	10.3	0.15	5.9	1.9	Y
94-15	1	17.4	0.22	6.1	48	Y
	2	10.9	0.12	4.4	6	Y
	3	8.4	0.48	1.7	34	N
94-21	1	7.5	0.62	0.73	30	N
	2	7.2	0.76	1.2	36	N
	3	5.2	1.76	0.73	34	N
	4	16.3	0.28	4.7	29	N
	5	12.3	0.33	2.3	38	Y
	6	18.5	0.32	4.9	7.3	Y
	7	8.0	0.06	8.0	3.8	N
94-22	1	9.9	0.37	2.0	32	Y
	2	20.1	0.21	6.6	33	Y
	3	10.9	0.24	3.8	7.3	Y
94-24	1	7.8	7.0	0.02	47	Y
	2	8.1	6.0	0.04	45	Y
	3	5.7	4.0	0.03	50	Y
	4	29.6	0.18	10.8	57	Y
	5	(False Trig)	—	—	—	—
	6	9.1	5.5	0.20	39	Y
	7	11.9	0.86	0.52	40	Y
	8	19.0	0.24	5.8	5.8	Y

¹ Table includes only strokes for which high resolution digital data are available.

² Rise time between 10 and 90 percent points.

³ Average slope between 10 and 90 percent points.

⁴ Full Width to Half Maximum is the width of return stroke current between the 50-percent amplitude points.

⁵ Return stroke followed by continuing current of duration greater than 10 ms.

⁶ No digital data.

Storm 1 Data Plots
Flashes 94-04 and 94-06

One-line drawing of the instrumentation installed during Storm 1 (page 1 of 2)

One-line drawing of the instrumentation installed during Storm 1 (page 2 of 2)

**94-04 STROKE 1
INCIDENT CURRENT**

**94-04 STROKE 1
TEST POINT 1** **94-04 STROKE 1
TEST POINT 2**

94-04 STROKE 1
TEST POINT 5

94-04 STROKE 1
TEST POINT 5'

**94-04 STROKE 1
TEST POINT 6'**

94-04 STROKE 1
TEST POINT 7

94-04 STROKE 1
TEST POINT 8

**94-04 STROKE 1
TEST POINT 10** **94-04 STROKE 1
TEST POINT 11**

**94-04 STROKE 1
TEST POINT 12**

**94-04 STROKE 1
TEST POINT 13**

94-04 STROKE 1
TEST POINT 14

94-04 STROKE 1
TEST POINT 15

**94-04 STROKE 1
TEST POINT 20** **94-04 STROKE 1
TEST POINT 21**

**94-04 STROKE 1
TEST POINT 23**

94-04 STROKE 2 INCIDENT CURRENT

**94-04 STROKE 2
TEST POINT 1**

**94-04 STROKE 2
TEST POINT 2**

94-04 STROKE 2
TEST POINT 5

**94-04 STROKE 2
TEST POINT 5'**

**94-04 STROKE 2
TEST POINT 6'**

94-04 STROKE 2
TEST POINT 7

94-04 STROKE 2
TEST POINT 8

**94-04 STROKE 2
TEST POINT 10**

**94-04 STROKE 2
TEST POINT 11**

**94-04 STROKE 2
TEST POINT 12** **94-04 STROKE 2
TEST POINT 13**

94-04 STROKE 2
TEST POINT 14

94-04 STROKE 2
TEST POINT 15

**94-04 STROKE 2
TEST POINT 20**

**94-04 STROKE 2
TEST POINT 21**

94-04 STROKE 2
TEST POINT 23

94-04 STROKE 4 INCIDENT CURRENT

**94-04 STROKE 4
TEST POINT 1** **94-04 STROKE 4
TEST POINT 2**

**94-04 STROKE 4
TEST POINT 5**

94-04 STROKE 4
TEST POINT 5'

**94-04 STROKE 4
TEST POINT 6'**

94-04 STROKE 4
TEST POINT 7

94-04 STROKE 4
TEST POINT 8

**94-04 STROKE 4
TEST POINT 10** **94-04 STROKE 4
TEST POINT 11**

**94-04 STROKE 4
TEST POINT 12**

**94-04 STROKE 4
TEST POINT 13**

94-04 STROKE 4
TEST POINT 14

**94-04 STROKE 4
TEST POINT 15**

**94-04 STROKE 4
TEST POINT 20** **94-04 STROKE 4
TEST POINT 21**

94-04 STROKE 4
TEST POINT 23

94-06 STROKE 1 INCIDENT CURRENT

**94-06 STROKE 1
TEST POINT 1**

**94-02 STROKE 1
TEST POINT 2**

94-06 STROKE 1
TEST POINT 5

94-06 STROKE 1
TEST POINT 5'

**94-06 STROKE 1
TEST POINT 6'**

94-06 STROKE 1
TEST POINT 7

94-06 STROKE 1
TEST POINT 8

**94-06 STROKE 1
TEST POINT 10**

**94-06 STROKE 1
TEST POINT 11**

**94-06 STROKE 1
TEST POINT 12** **94-06 STROKE 1
TEST POINT 13**

94-06 STROKE 1
TEST POINT 14

94-06 STROKE 1
TEST POINT 15

**94-06 STROKE 1
TEST POINT 20**

**94-06 STROKE 1
TEST POINT 21**

**94-06 STROKE 1
TEST POINT 23**

94-06 STROKE 2 INCIDENT CURRENT

**94-06 STROKE 2
TEST POINT 1** **94-02 STROKE 2
TEST POINT 2**

94-06 STROKE 2
TEST POINT 5

94-06 STROKE 2
TEST POINT 5'

**94-06 STROKE 2
TEST POINT 6'**

94-06 STROKE 2
TEST POINT 7

94-06 STROKE 2
TEST POINT 8

**94-06 STROKE 2
TEST POINT 10** **94-06 STROKE 2
TEST POINT 11**

**94-06 STROKE 2
TEST POINT 12**

**94-06 STROKE 2
TEST POINT 13**

94-06 STROKE 2
TEST POINT 14

94-06 STROKE 2
TEST POINT 15

**94-06 STROKE 2
TEST POINT 20** **94-06 STROKE 2
TEST POINT 21**

**94-06 STROKE 2
TEST POINT 23**

94-06 STROKE 3 INCIDENT CURRENT

**94-06 STROKE 3
TEST POINT 1**

**94-02 STROKE 3
TEST POINT 2**

94-06 STROKE 3
TEST POINT 5

**94-06 STROKE 3
TEST POINT 5'**

94-06 STROKE 3
TEST POINT 6'

94-06 STROKE 3
TEST POINT 7

94-06 STROKE 3
TEST POINT 8

**94-06 STROKE 3
TEST POINT 10**

**94-06 STROKE 3
TEST POINT 11**

**94-06 STROKE 3
TEST POINT 12** **94-06 STROKE 3
TEST POINT 13**

**94-06 STROKE 3
TEST POINT 14**

94-06 STROKE 3
TEST POINT 15

**94-06 STROKE 3
TEST POINT 20**

**94-06 STROKE 3
TEST POINT 21**

**94-06 STROKE 3
TEST POINT 23**

94-06 STROKE 4 INCIDENT CURRENT

94-06 STROKE 4
TEST POINT 1

94-02 STROKE 4
TEST POINT 2

**94-06 STROKE 4
TEST POINT 5**

94-06 STROKE 4
TEST POINT 5'

**94-06 STROKE 4
TEST POINT 6'**

94-06 STROKE 4
TEST POINT 7

94-06 STROKE 4
TEST POINT 8

**94-06 STROKE 4
TEST POINT 10** **94-06 STROKE 4
TEST POINT 11**

**94-06 STROKE 4
TEST POINT 12**

**94-06 STROKE 4
TEST POINT 13**

94-06 STROKE 4
TEST POINT 14

94-06 STROKE 4
TEST POINT 15

**94-06 STROKE 4
TEST POINT 20** **94-06 STROKE 4
TEST POINT 21**

**94-06 STROKE 4
TEST POINT 23**

94-06 STROKE 5 INCIDENT CURRENT

**94-06 STROKE 5
TEST POINT 1**

**94-06 STROKE 5
TEST POINT 2**

94-06 STROKE 5
TEST POINT 5

94-06 STROKE 5
TEST POINT 5'

94-06 STROKE 5
TEST POINT 6'

94-06 STROKE 5
TEST POINT 7

94-06 STROKE 5
TEST POINT 8

**94-06 STROKE 5
TEST POINT 10**

**94-06 STROKE 5
TEST POINT 11**

**94-06 STROKE 5
TEST POINT 12** **94-06 STROKE 5
TEST POINT 13**

94-06 STROKE 5
TEST POINT 14

94-06 STROKE 5
TEST POINT 15

**94-06 STROKE 5
TEST POINT 20**

**94-06 STROKE 5
TEST POINT 21**

**94-06 STROKE 5
TEST POINT 23**

**94-06 STROKE 6
INCIDENT CURRENT**

**94-06 STROKE 6
TEST POINT 1** **94-02 STROKE 6
TEST POINT 2**

**94-06 STROKE 6
TEST POINT 5**

94-06 STROKE 6
TEST POINT 5'

**94-06 STROKE 6
TEST POINT 6'**

94-06 STROKE 6
TEST POINT 7

**94-06 STROKE 6
TEST POINT 8**

**94-06 STROKE 6
TEST POINT 10** **94-06 STROKE 6
TEST POINT 11**

**94-06 STROKE 6
TEST POINT 12**

**94-06 STROKE 6
TEST POINT 13**

94-06 STROKE 6
TEST POINT 14

94-06 STROKE 6
TEST POINT 15

**94-06 STROKE 6
TEST POINT 20** **94-06 STROKE 6
TEST POINT 21**

**94-06 STROKE 6
TEST POINT 23**

94-06 STROKE 7 INCIDENT CURRENT

**94-06 STROKE 7
TEST POINT 1**

**94-02 STROKE 7
TEST POINT 2**

**94-06 STROKE 7
TEST POINT 5**

94-06 STROKE 7
TEST POINT 5'

**94-06 STROKE 7
TEST POINT 6'**

94-06 STROKE 7
TEST POINT 7

94-06 STROKE 7
TEST POINT 8

**94-06 STROKE 7
TEST POINT 10**

**94-06 STROKE 7
TEST POINT 11**

**94-06 STROKE 7
TEST POINT 12** **94-06 STROKE 7
TEST POINT 13**

**94-06 STROKE 7
TEST POINT 14**

94-06 STROKE 7
TEST POINT 15

**94-06 STROKE 7
TEST POINT 20**

**94-06 STROKE 7
TEST POINT 21**

**94-06 STROKE 7
TEST POINT 23**

**94-06 STROKE 8
INCIDENT CURRENT**

**94-06 STROKE 8
TEST POINT 1** **94-02 STROKE 8
TEST POINT 2**

94-06 STROKE 8
TEST POINT 5

94-06 STROKE 8
TEST POINT 5'

**94-06 STROKE 8
TEST POINT 6'**

94-06 STROKE 8
TEST POINT 7

**94-06 STROKE 8
TEST POINT 8**

**94-06 STROKE 8
TEST POINT 10** **94-06 STROKE 8
TEST POINT 11**

**94-06 STROKE 8
TEST POINT 12**

**94-06 STROKE 8
TEST POINT 13**

94-06 STROKE 8
TEST POINT 14

94-06 STROKE 8
TEST POINT 15

**94-06 STROKE 8
TEST POINT 20** **94-06 STROKE 8
TEST POINT 21**

**94-06 STROKE 8
TEST POINT 23**

Storm 2 Data Plots
Flashes 94-07, 94-09, and 94-10

One-line drawing of the instrumentation installed during Storm 2 (page 2 of 2)

94-07 STROKE 1 INCIDENT CURRENT

**94-07 STROKE 1
TEST POINT 1** **94-07 STROKE.1
TEST POINT 2**

**94-07 STROKE 1
TEST POINT 5**

**94-07 STROKE 1
TEST POINT 5'**

**94-07 STROKE 1
TEST POINT 6** **94-07 STROKE 1
TEST POINT 6'**

94-07 STROKE 1
TEST POINT 7

94-07 STROKE 1
TEST POINT 8

**94-07 STROKE 1
TEST POINT 16**

**94-07 STROKE 1
TEST POINT 17**

**94-07 STROKE 1
TEST POINT 18** **94-07 STROKE 1
TEST POINT 19**

**94-07 STROKE 1
TEST POINT 20**

**94-07 STROKE 1
TEST POINT 22**

**94-07 STROKE 1
TEST POINT 23** **94-07 STROKE 1
TEST POINT 24**

94-07 STROKE 2 INCIDENT CURRENT

**94-07 STROKE 2
TEST POINT 1** **94-07 STROKE 2
TEST POINT 2**

**94-07 STROKE 2
TEST POINT 5**

**94-07 STROKE 2
TEST POINT 5'**

**94-07 STROKE 2
TEST POINT 6** **94-07 STROKE 2
TEST POINT 6'**

**94-07 STROKE 2
TEST POINT 7**

94-07 STROKE 2
TEST POINT 8

**94-07 STROKE 2
TEST POINT 16**

**94-07 STROKE 2
TEST POINT 17**

**94-07 STROKE 2
TEST POINT 18** **94-07 STROKE 2
TEST POINT 19**

**94-07 STROKE 2
TEST POINT 20**

**94-07 STROKE 2
TEST POINT 22**

**94-07 STROKE 2
TEST POINT 23** **94-07 STROKE 2
TEST POINT 24**

**94-07 STROKE 3
INCIDENT CURRENT**

**94-07 STROKE 3
TEST POINT 1** **94-07 STROKE 3
TEST POINT 2**

**94-07 STROKE 3
TEST POINT 5**

**94-07 STROKE 3
TEST POINT 5'**

**94-07 STROKE 3
TEST POINT 6** **94-07 STROKE 3
TEST POINT 6'**

**94-07 STROKE 3
TEST POINT 7**

94-07 STROKE 3
TEST POINT 8

**94-07 STROKE 3
TEST POINT 16**

**94-07 STROKE 3
TEST POINT 17**

**94-07 STROKE 3
TEST POINT 18** **94-07 STROKE 3
TEST POINT 19**

**94-07 STROKE 3
TEST POINT 20**

**94-07 STROKE 3
TEST POINT 22**

**94-07 STROKE 3
TEST POINT 23** **94-07 STROKE 3
TEST POINT 24**

94-07 STROKE 4 INCIDENT CURRENT

**94-07 STROKE 4
TEST POINT 1** **94-07 STROKE 4
TEST POINT 2**

**94-07 STROKE 4
TEST POINT 5**

**94-07 STROKE 4
TEST POINT 5'**

**94-07 STROKE 4
TEST POINT 6** **94-07 STROKE 4
TEST POINT 6'**

94-07 STROKE 4
TEST POINT 7

94-07 STROKE 4
TEST POINT 8

**94-07 STROKE 4
TEST POINT 16**

**94-07 STROKE 4
TEST POINT 17**

**94-07 STROKE 4
TEST POINT 18** **94-07 STROKE 4
TEST POINT 19**

**94-07 STROKE 4
TEST POINT 20**

**94-07 STROKE 4
TEST POINT 22**

**94-07 STROKE 4
TEST POINT 23** **94-07 STROKE 4
TEST POINT 24**

**94-09 STROKE 1
INCIDENT CURRENT**

**94-09 STROKE 1
TEST POINT 1** **94-09 STROKE 1
TEST POINT 2**

**94-09 STROKE 1
TEST POINT 5**

**94-09 STROKE 1
TEST POINT 5'**

**94-09 STROKE 1
TEST POINT 6** **94-09 STROKE 1
TEST POINT 6'**

94-09 STROKE 1
TEST POINT 7

94-09 STROKE 1
TEST POINT 8

**94-09 STROKE 1
TEST POINT 16**

**94-09 STROKE 1
TEST POINT 17**

**94-09 STROKE 1
TEST POINT 18** **94-09 STROKE 1
TEST POINT 19**

94-09 STROKE 1 TEST POINT 20

94-09 STROKE 1 TEST POINT 22

**94-09 STROKE 1
TEST POINT 23** **94-09 STROKE 1
TEST POINT 24**

94-09 STROKE 2 INCIDENT CURRENT

**94-09 STROKE 2
TEST POINT 1** **94-09 STROKE 2
TEST POINT 2**

**94-09 STROKE 2
TEST POINT 5**

**94-09 STROKE 2
TEST POINT 5'**

**94-09 STROKE 2
TEST POINT 6** **94-09 STROKE 2
TEST POINT 6'**

94-09 STROKE 2
TEST POINT 7

94-09 STROKE 2
TEST POINT 8

**94-09 STROKE 2
TEST POINT 16**

**94-09 STROKE 2
TEST POINT 17**

**94-09 STROKE 2
TEST POINT 18** **94-09 STROKE 2
TEST POINT 19**

**94-07 STROKE 2
TEST POINT 20**

**94-07 STROKE 2
TEST POINT 22**

**94-09 STROKE 2
TEST POINT 23** **94-09 STROKE 2
TEST POINT 24**

94-10 STROKE 1 INCIDENT CURRENT

**94-10 STROKE 1
TEST POINT 1** **94-10 STROKE 1
TEST POINT 2**

**94-10 STROKE 1
TEST POINT 5**

**94-10 STROKE 1
TEST POINT 5'**

**94-10 STROKE 1
TEST POINT 6** **94-10 STROKE 1
TEST POINT 6'**

94-10 STROKE 1
TEST POINT 7

94-10 STROKE 1
TEST POINT 8

**94-10 STROKE 1
TEST POINT 16**

**94-10 STROKE 1
TEST POINT 17**

**94-10 STROKE 1
TEST POINT 18** **94-10 STROKE 1
TEST POINT 19**

94-10 STROKE 1 TEST POINT 20

94-10 STROKE 1 TEST POINT 22

**94-10 STROKE 1
TEST POINT 23** **94-10 STROKE 1.
TEST POINT 24**

Storm 3 Data Plots
Flashes 94-14 and 94-15

One-line drawing of the instrumentation installed during Storm 3 (page 1 of 2)

94-14 STROKE 1 INCIDENT CURRENT

94-14 STROKE 1
TEST POINT 4

**94-14 STROKE 1
TEST POINT 5**

**94-14 STROKE 1
TEST POINT 6**

**94-14 STROKE 1
TEST POINT 7** **94-14 STROKE 1
TEST POINT 8**

**94-14 STROKE 1
TEST POINT 9**

**94-14 STROKE 1
TEST POINT 9'**

**94-14 STROKE 1
TEST POINT 16** **94-14 STROKE 1
TEST POINT 17**

**94-14 STROKE 1
TEST POINT 18**

**94-14 STROKE 1
TEST POINT 19**

**94-14 STROKE 1
TEST POINT 20** **94-14 STROKE 1
TEST POINT 22**

**94-14 STROKE 1
TEST POINT 23**

**94-14 STROKE 1
TEST POINT 24**

94-14 STROKE 2 INCIDENT CURRENT

**94-14 STROKE 2
TEST POINT 1**

**94-14 STROKE 2
TEST POINT 2**

94-14 STROKE 2
TEST POINT 3

**94-14 STROKE 2
TEST POINT 4**

**94-14 STROKE 2
TEST POINT 5** **94-14 STROKE 2
TEST POINT 6**

**94-14 STROKE 2
TEST POINT 7**

**94-14 STROKE 2
TEST POINT 8**

**94-14 STROKE 2
TEST POINT 9** **94-14 STROKE 2
TEST POINT 9'**

**94-14 STROKE 2
TEST POINT 16**

**94-14 STROKE 2
TEST POINT 17**

**94-14 STROKE 2
TEST POINT 18** **94-14 STROKE 2
TEST POINT 19**

**94-14 STROKE 2
TEST POINT 20**

**94-14 STROKE 2
TEST POINT 22**

**94-14 STROKE 2
TEST POINT 23** **94-14 STROKE 2
TEST POINT 24**

94-14 STROKE 3 INCIDENT CURRENT

**94-14 STROKE 3
TEST POINT 1** **94-14 STROKE 3
TEST POINT 2**

94-14 STROKE 3
TEST POINT 3

94-14 STROKE 3
TEST POINT 4

**94-14 STROKE 3
TEST POINT 5**

**94-14 STROKE 3
TEST POINT 6**

**94-14 STROKE 3
TEST POINT 7** **94-14 STROKE 3
TEST POINT 8**

**94-14 STROKE 3
TEST POINT 9**

**94-14 STROKE 3
TEST POINT 9'**

**94-14 STROKE 3
TEST POINT 16** **94-14 STROKE 3.
TEST POINT 17**

**94-14 STROKE 3
TEST POINT 18**

**94-14 STROKE 3
TEST POINT 19**

**94-14 STROKE 3
TEST POINT 20** **94-14 STROKE 3
TEST POINT 22**

**94-14 STROKE 3
TEST POINT 23**

**94-14 STROKE 3
TEST POINT 24**

94-14 STROKE 4 INCIDENT CURRENT

**94-14 STROKE 4
TEST POINT 1**

**94-14 STROKE 4
TEST POINT 2**

94-14 STROKE 4
TEST POINT 3

**94-14 STROKE 4
TEST POINT 4**

**94-14 STROKE 4
TEST POINT 5** **94-14 STROKE 4
TEST POINT 6**

**94-14 STROKE 4
TEST POINT 7**

**94-14 STROKE 4
TEST POINT 8**

**94-14 STROKE 4
TEST POINT 9** **94-14 STROKE 4
TEST POINT 9'**

**94-14 STROKE 4
TEST POINT 16**

**94-14 STROKE 4
TEST POINT 17**

**94-14 STROKE 4
TEST POINT 18** **94-14 STROKE 4
TEST POINT 19**

**94-14 STROKE 4
TEST POINT 20**

**94-14 STROKE 4
TEST POINT 22**

**94-14 STROKE 4
TEST POINT 23** **94-14 STROKE 4
TEST POINT 24**

94-15 STROKE 1 INCIDENT CURRENT

**94-15 STROKE 1
TEST POINT 1** **94-15 STROKE 1
TEST POINT 2**

**94-15 STROKE 1
TEST POINT 3**

94-15 STROKE 1
TEST POINT 4

**94-15 STROKE 1
TEST POINT 5**

**94-15 STROKE 1
TEST POINT 6**

**94-15 STROKE 1
TEST POINT 7** **94-15 STROKE 1
TEST POINT 8**

**94-15 STROKE 1
TEST POINT 9**

**94-15 STROKE 1
TEST POINT 9'**

**94-15 STROKE 1
TEST POINT 16** **94-15 STROKE 1
TEST POINT 17**

**94-15 STROKE 1
TEST POINT 18**

**94-15 STROKE 1
TEST POINT 19**

**94-15 STROKE 1
TEST POINT 20** **94-15 STROKE 1
TEST POINT 22**

**94-15 STROKE 1
TEST POINT 23**

**94-15 STROKE 1
TEST POINT 24**

94-15 STROKE 2 INCIDENT CURRENT

**94-15 STROKE 2
TEST POINT 1**

**94-15 STROKE 2
TEST POINT 2**

94-15 STROKE 2
TEST POINT 3

94-15 STROKE 2
TEST POINT 4

**94-15 STROKE 2
TEST POINT 5** **94-15 STROKE 2
TEST POINT 6**

**94-15 STROKE 2
TEST POINT 7**

**94-15 STROKE 2
TEST POINT 8**

**94-15 STROKE 2
TEST POINT 9** **94-15 STROKE 2
TEST POINT 9'**

**94-15 STROKE 2
TEST POINT 16**

**94-15 STROKE 2
TEST POINT 17**

**94-15 STROKE 2
TEST POINT 18** **94-15 STROKE 2
TEST POINT 19**

**94-15 STROKE 2
TEST POINT 20**

**94-15 STROKE 2
TEST POINT 22**

**94-15 STROKE 2
TEST POINT 23** **94-15 STROKE 2
TEST POINT 24**

94-15 STROKE 3 INCIDENT CURRENT

**94-15 STROKE 3
TEST POINT 1** **94-15 STROKE 3
TEST POINT 2**

94-15 STROKE 3
TEST POINT 3

94-15 STROKE 3
TEST POINT 4

**94-15 STROKE 3
TEST POINT 5**

**94-15 STROKE 3
TEST POINT 6**

**94-15 STROKE 3
TEST POINT 7** **94-15 STROKE 3.
TEST POINT 8**

**94-15 STROKE 3
TEST POINT 9**

**94-15 STROKE 3
TEST POINT 9'**

**94-15 STROKE 3
TEST POINT 16** **94-15 STROKE 3
TEST POINT 17**

**94-15 STROKE 3
TEST POINT 18**

**94-15 STROKE 3
TEST POINT 19**

**94-15 STROKE 3
TEST POINT 20** **94-15 STROKE 3
TEST POINT 22**

**94-15 STROKE 3
TEST POINT 23**

**94-15 STROKE 3
TEST POINT 24**

Storm 4 Data Plots
Flashes 94-21, 94-22, and 94-24

One-line drawing of the instrumentation installed during Storm 4 (page 1 of 2)

One-line drawing of the instrumentation installed during Storm 4 (page 2 of 2)

94-21 STROKE 1
INCIDENT CURRENT

94-21 STROKE 1
TEST POINT 1

94-21 STROKE 1
TEST POINT 2

94-21 STROKE 1
TEST POINT 5

94-21 STROKE 1
TEST POINT 6

94-21 STROKE 1
TEST POINT 5'

94-21 STROKE 1
TEST POINT 6'

**94-21 STROKE 1
TEST POINT 10**

**94-21 STROKE 1
TEST POINT 11**

**94-21 STROKE 1
TEST POINT 12** **94-21 STROKE 1
TEST POINT 13**

94-21 STROKE 1
TEST POINT 14

94-21 STROKE 1
TEST POINT 15

**94-21 STROKE 1
TEST POINT 20**

**94-21 STROKE 1
TEST POINT 21**

**94-21 STROKE 1
TEST POINT 22**

**94-21 STROKE 1
TEST POINT 23**

**94-21 STROKE 1
TEST POINT 24**

94-21 STROKE 2 INCIDENT CURRENT

94-21 STROKE 2
TEST POINT 1

94-21 STROKE 2
TEST POINT 2

94-21 STROKE 2
TEST POINT 5

94-21 STROKE 2
TEST POINT 6

94-21 STROKE 2
TEST POINT 5'

94-21 STROKE 2
TEST POINT 6'

94-21 STROKE 2
TEST POINT 10

94-21 STROKE 2
TEST POINT 11

**94-21 STROKE 2
TEST POINT 12**

**94-21 STROKE 2
TEST POINT 13**

94-21 STROKE 2
TEST POINT 14

94-21 STROKE 2
TEST POINT 15

**94-21 STROKE 2
TEST POINT 20** **94-21 STROKE 2.
TEST POINT 21**

**94-21 STROKE 2
TEST POINT 22**

**94-21 STROKE 2
TEST POINT 23** **94-21 STROKE 2
TEST POINT 24**

**94-21 STROKE 3
INCIDENT CURRENT**

94-21 STROKE 3
TEST POINT 1

**94-21 STROKE 3
TEST POINT 2**

94-21 STROKE 3
TEST POINT 5

94-21 STROKE 3
TEST POINT 6

**94-21 STROKE 3
TEST POINT 5'** **94-21 STROKE 3
TEST POINT 6'**

**94-21 STROKE 3
TEST POINT 10**

**94-21 STROKE 3
TEST POINT 11**

**94-21 STROKE 3
TEST POINT 12** **94-21 STROKE 3.
TEST POINT 13**

**94-21 STROKE 3
TEST POINT 14**

94-21 STROKE 3
TEST POINT 15

**94-21 STROKE 3
TEST POINT 20**

**94-21 STROKE 3
TEST POINT 21**

**94-21 STROKE 3
TEST POINT 22**

**94-21 STROKE 3
TEST POINT 23**

**94-21 STROKE 3
TEST POINT 24**

94-21 STROKE 4
TEST POINT 24

**94-21 STROKE 4
INCIDENT CURRENT**

94-21 STROKE 4
TEST POINT 1

94-21 STROKE 4
TEST POINT 2

94-21 STROKE 4
TEST POINT 5

94-21 STROKE 4
TEST POINT 6

**94-21 STROKE 4
TEST POINT 5'** **94-21 STROKE 4
TEST POINT 6'**

**94-21 STROKE 4
TEST POINT 10**

**94-21 STROKE 4
TEST POINT 11**

**94-21 STROKE 4
TEST POINT 12** **94-21 STROKE 4
TEST POINT 13**

94-21 STROKE 4
TEST POINT 14

94-21 STROKE 4
TEST POINT 15

**94-21 STROKE 4
TEST POINT 20**

**94-21 STROKE 4
TEST POINT 21**

**94-21 STROKE 4
TEST POINT 22**

**94-21 STROKE 4
TEST POINT 23**

**94-21 STROKE 4
TEST POINT 24**

**94-21 STROKE 6
TEST POINT 5'** **94-21 STROKE 6
TEST POINT 6'**

94-21 STROKE 5 INCIDENT CURRENT

94-21 STROKE 5
TEST POINT 1

94-21 STROKE 5
TEST POINT 2

94-21 STROKE 5 TEST POINT 5

94-21 STROKE 5
TEST POINT 6

**94-21 STROKE 5
TEST POINT 5'** **94-21 STROKE 5
TEST POINT 6'**

**94-21 STROKE 5
TEST POINT 10**

**94-21 STROKE 5
TEST POINT 11**

**94-21 STROKE 5
TEST POINT 12** **94-21 STROKE 5
TEST POINT 13**

94-21 STROKE 5
TEST POINT 14

94-21 STROKE 5
TEST POINT 15

**94-21 STROKE 5
TEST POINT 20**

**94-21 STROKE 5
TEST POINT 21**

**94-21 STROKE 5
TEST POINT 22**

**94-21 STROKE 5
TEST POINT 23**

**94-21 STROKE 5
TEST POINT 24**

94-21 STROKE 6 INCIDENT CURRENT

94-21 STROKE 6
TEST POINT 1

94-21 STROKE 6
TEST POINT 2

94-21 STROKE 6
TEST POINT 5

94-21 STROKE 6
TEST POINT 6

**94-21 STROKE 6
TEST POINT 10**

**94-21 STROKE 6
TEST POINT 11**

**94-21 STROKE 6
TEST POINT 12** **94-21 STROKE 6
TEST POINT 13**

94-21 STROKE 6
TEST POINT 14

94-21 STROKE 6
TEST POINT 15

**94-21 STROKE 6
TEST POINT 20**

**94-21 STROKE 6
TEST POINT 21**

**94-21 STROKE 6
TEST POINT 22**

**94-21 STROKE 6
TEST POINT 23**

**94-21 STROKE 6
TEST POINT 24**

94-21 STROKE 7 INCIDENT CURRENT

94-21 STROKE 7
TEST POINT 1

94-21 STROKE 7
TEST POINT 2

94-21 STROKE 7
TEST POINT 5

94-21 STROKE 7
TEST POINT 6

**94-21 STROKE 7
TEST POINT 5'**

**94-21 STROKE 7
TEST POINT 6'**

**94-21 STROKE 7
TEST POINT 10** **94-21 STROKE 7
TEST POINT 11**

**94-21 STROKE 7
TEST POINT 12**

**94-21 STROKE 7
TEST POINT 13**

94-21 STROKE 7
TEST POINT 14

**94-21 STROKE 7
TEST POINT 15**

**94-21 STROKE 7
TEST POINT 20** **94-21 STROKE 7
TEST POINT 21**

**94-21 STROKE 7
TEST POINT 22**

**94-21 STROKE 7
TEST POINT 23** **94-21 STROKE 7
TEST POINT 24**

94-22 STROKE 1 INCIDENT CURRENT

94-22 STROKE 1
TEST POINT 1

94-22 STROKE 1
TEST POINT 2

94-22 STROKE 1
TEST POINT 5

94-22 STROKE 1
TEST POINT 6

**94-22 STROKE 1
TEST POINT 5'** **94-22 STROKE 1
TEST POINT 6'**

**94-22 STROKE 1
TEST POINT 10**

**94-22 STROKE 1
TEST POINT 11**

**94-22 STROKE 1
TEST POINT 12** **94-22 STROKE 1
TEST POINT 13**

**94-22 STROKE 1
TEST POINT 14**

94-22 STROKE 1
TEST POINT 15

**94-22 STROKE 1
TEST POINT 20**

**94-22 STROKE 1
TEST POINT 21**

**94-22 STROKE 1
TEST POINT 22**

**94-22 STROKE 1
TEST POINT 23**

**94-22 STROKE 1
TEST POINT 24**

94-22 STROKE 2 INCIDENT CURRENT

94-22 STROKE 2
TEST POINT 1

**94-22 STROKE 2
TEST POINT 2**

94-22 STROKE 2
TEST POINT 5

94-22 STROKE 2
TEST POINT 6

**94-22 STROKE 2
TEST POINT 5'**

**94-22 STROKE 2
TEST POINT 6'**

**94-22 STROKE 2
TEST POINT 10** **94-22 STROKE 2
TEST POINT 11**

**94-22 STROKE 2
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94-22 STROKE 2
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**94-22 STROKE 2
TEST POINT 15**

**94-22 STROKE 2
TEST POINT 20** **94-22 STROKE 2
TEST POINT 21**

**94-22 STROKE 2
TEST POINT 22**

**94-22 STROKE 2
TEST POINT 23** **94-22 STROKE 2
TEST POINT 24**

**94-22 STROKE 3
TEST POINT 23**

**94-22 STROKE 3
TEST POINT 24**

94-24 STROKE 1 INCIDENT CURRENT

94-24 STROKE 1 TEST POINT 1

94-22 STROKE 3 INCIDENT CURRENT

94-22 STROKE 3
TEST POINT 1

94-22 STROKE 3
TEST POINT 2

**94-22 STROKE 3
TEST POINT 5**

94-22 STROKE 3
TEST POINT 6

**94-22 STROKE 3
TEST POINT 5'**

**94-22 STROKE 3
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**94-22 STROKE 3
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**94-22 STROKE 3
TEST POINT 15**

**94-22 STROKE 3
TEST POINT 20** **94-22 STROKE 3
TEST POINT 21**

**94-22 STROKE 3
TEST POINT 22**

94-24 STROKE 1
TEST POINT 2

94-24 STROKE 1
TEST POINT 5

94-24 STROKE 1
TEST POINT 6

**94-24 STROKE 1
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**94-24 STROKE 1
TEST POINT 6'**

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TEST POINT 11**

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**94-24 STROKE 1
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**94-24 STROKE 1
TEST POINT 22**

**94-24 STROKE 1
TEST POINT 23** **94-24 STROKE 1
TEST POINT 24**

94-24 STROKE 2 INCIDENT CURRENT

**94-24 STROKE 2
TEST POINT 1**

94-24 STROKE 2
TEST POINT 2

94-24 STROKE 2
TEST POINT 5

94-24 STROKE 2
TEST POINT 6

**94-24 STROKE 2
TEST POINT 5'** **94-24 STROKE 2
TEST POINT 6'**

**94-24 STROKE 2
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**94-24 STROKE 2
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**94-24 STROKE 2
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**94-24 STROKE 2
TEST POINT 22**

**94-24 STROKE 2
TEST POINT 23**

**94-24 STROKE 2
TEST POINT 24**

94-24 STROKE 3 INCIDENT CURRENT

**94-24 STROKE 3
TEST POINT 1**

**94-24 STROKE 3
TEST POINT 2**

**94-24 STROKE 3
TEST POINT 5**

94-24 STROKE 3
TEST POINT 6

**94-24 STROKE 3
TEST POINT 5'**

**94-24 STROKE 3
TEST POINT 6'**

**94-24 STROKE 3
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TEST POINT 11**

**94-24 STROKE 3
TEST POINT 12**

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**94-24 STROKE 3
TEST POINT 15**

**94-24 STROKE 3
TEST POINT 20** **94-24 STROKE 3
TEST POINT 21**

**94-24 STROKE 3
TEST POINT 22**

**94-24 STROKE 3
TEST POINT 23** **94-24 STROKE 3
TEST POINT 24**

94-24 STROKE 4 INCIDENT CURRENT

94-24 STROKE 4 TEST POINT 1

**94-24 STROKE 4
TEST POINT 2**

94-24 STROKE 4
TEST POINT 5

94-24 STROKE 4
TEST POINT 6

**94-24 STROKE 4
TEST POINT 5'** **94-24 STROKE 4
TEST POINT 6'**

**94-24 STROKE 4
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**94-24 STROKE 4
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**94-24 STROKE 4
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**94-24 STROKE 4
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**94-24 STROKE 4
TEST POINT 21**

**94-24 STROKE 4
TEST POINT 22**

**94-24 STROKE 4
TEST POINT 23**

**94-24 STROKE 4
TEST POINT 24**

94-24 STROKE 6 INCIDENT CURRENT

94-24 STROKE 6 TEST POINT 1

94-24 STROKE 6
TEST POINT 2

**94-24 STROKE 6
TEST POINT 5**

94-24 STROKE 6
TEST POINT 6

**94-24 STROKE 6
TEST POINT 5'**

**94-24 STROKE 6
TEST POINT 6'**

**94-24 STROKE 6
TEST POINT 10** **94-24 STROKE 6
TEST POINT 11**

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**94-24 STROKE 6
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TEST POINT 21**

**94-24 STROKE 6
TEST POINT 22**

**94-24 STROKE 6
TEST POINT 23** **94-24 STROKE 6
TEST POINT 24**

94-24 STROKE 7 INCIDENT CURRENT

94-24 STROKE 7
TEST POINT 1

94-24 STROKE 7
TEST POINT 2

94-24 STROKE 7
TEST POINT 5

**94-24 STROKE 7
TEST POINT 6**

**94-24 STROKE 7
TEST POINT 5'**

**94-24 STROKE 7
TEST POINT 6'**

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TEST POINT 10**

**94-24 STROKE 7
TEST POINT 11**

**94-24 STROKE 7
TEST POINT 12** **94-24 STROKE 7
TEST POINT 13**

94-24 STROKE 7 TEST POINT 14

94-24 STROKE 7
TEST POINT 15

**94-24 STROKE 7
TEST POINT 20**

**94-24 STROKE 7
TEST POINT 21**

**94-24 STROKE 7
TEST POINT 22**

**94-24 STROKE 7
TEST POINT 23**

**94-24 STROKE 7
TEST POINT 24**

94-24 STROKE 8
INCIDENT CURRENT

94-24 STROKE 8 TEST POINT 1

**94-24 STROKE 8
TEST POINT 2**

**94-24 STROKE 8
TEST POINT 5**

94-24 STROKE 8
TEST POINT 6

**94-24 STROKE 8
TEST POINT 5'**

**94-24 STROKE 8
TEST POINT 6'**

**94-24 STROKE 8
TEST POINT 10** **94-24 STROKE 8
TEST POINT 11**

**94-24 STROKE 8
TEST POINT 12**

**94-24 STROKE 8
TEST POINT 13**

94-24 STROKE 8
TEST POINT 14

**94-24 STROKE 8
TEST POINT 15**

**94-24 STROKE 8
TEST POINT 20** **94-24 STROKE 8
TEST POINT 21**

**94-24 STROKE 8
TEST POINT 22**

**94-24 STROKE 8
TEST POINT 23** **94-24 STROKE 8
TEST POINT 24**

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