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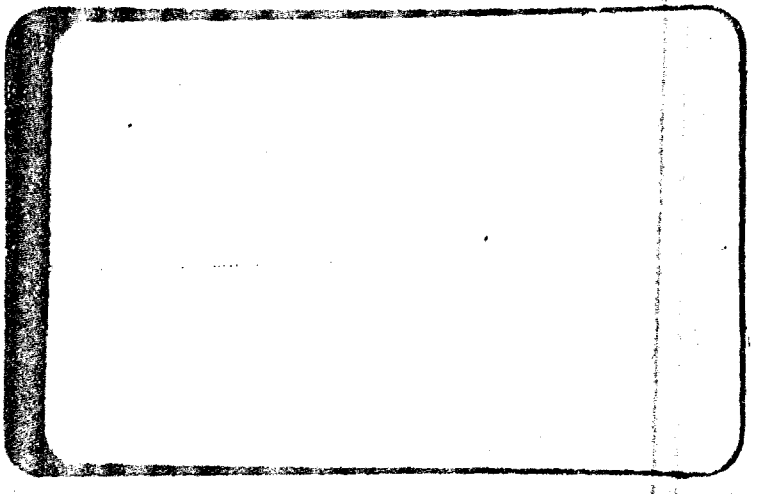

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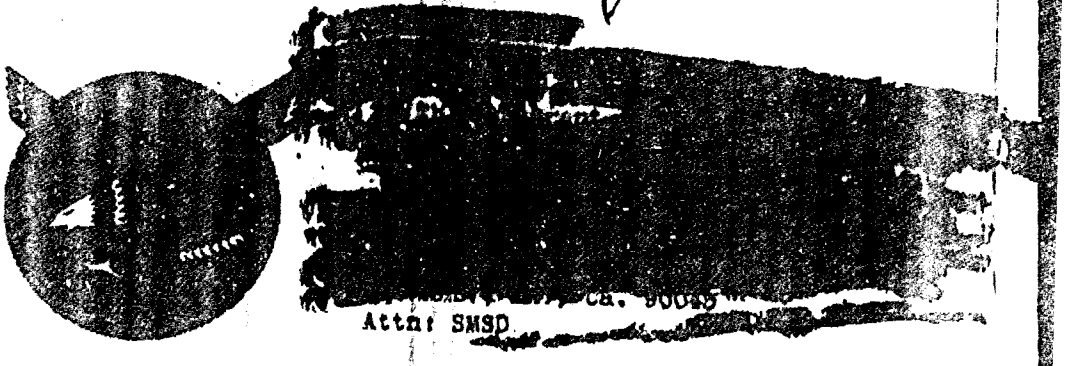

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VALIDATION PROCEDURE FOR THE ROUGH COMBUSTION CUTOFF CONTROL SYSTEM (ELECTRICAL)

"D" SERIES R & D

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RECD JUN 26 1958 ASTRONAUTICS

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SECTION I

INTRODUCTION

This manual provides instructions for validating the Rough Combustion Cut-off Control System (Electrical) at "D" Series R & D Sites. These instructions are applicable to the system as designed on the date of publication. Design changes may be required during, or after, system installation at the site. If changes are made which affect these instructions, this manual will also be revised.

The only permissible deviations to the procedures outlined in this document are those dictated by site installation difficulties. Such deviations shall be considered interim and must be forwarded to the Launching Controls Design Group for information and concurrence. Approved deviations will be automatically included in the next manual revision.

The test data sheet contained in this manual is a sample copy only and is not intended for actual test recording purposes. Separate copies of the test data sheet are furnished only to those departments whose activities require test data recording. These additional test data sheets are distributed under an identical cover sheet to the one on this manual except for the additional notation of "Test Data Sheet Only". Comparison of this special cover sheet with the one on the procedure correlates the two documents.

Personnel concerned with the use of this validation procedure can contribute to the effectiveness of any revisions by forwarding comments and suggestions to the Launching Controls Design Group, Building 4, Column F-1, Montgomery Site, Convair Astronautics.

N O T I C E

This document is intended for use as an acceptance validation procedure only. When this control system has been accepted (inspected, bought-off, sold, validated, etc.), no further requirement should exist for this document other than for reference purposes only. Continued checking of accepted systems occurs during the performance of Field Test Procedures, Countdowns, Composite System Checkouts, or Testing and Operating Procedures published by Groups having over-all system responsibility.

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SECTION II

REQUIREMENTS

2-1. REFERENCE DRAWINGS

27-69160	Diagram-Schematic, Rough Combustion Cutoff, Ground "B" Series
7-68519	Diagram-Wiring, Rough Combustion Cutoff, Blockhouse
7-68520	Diagram-Wiring, Rough Combustion Cutoff, Transfer Room
7-68068	Cabinet-Control, Rough Combustion Cutoff (Z-31 through Z-35)
7-68232	Panel-Accessory, Rough Combustion Cutoff
7-68081	Panel-Power, Rough Combustion Cutoff

2-2. EQUIPMENT REQUIREMENTS

Rough Combustion Cutoff Accessory Panel

Rough Combustion Cutoff Power Panel

Rough Combustion Cutoff Umbilical and Interconnecting Cables

All system components that are furnished, installed, and maintained by NAA

2-3. TEST EQUIPMENT

Multimeter

Audio Signal Generator

Cables and plugs sufficient to connect all items together

2-4. OPERATING REQUIREMENTS

Procedures shall be performed in the order specified.

All observations and results shall be as specified in this validation.

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All validation shall be done with line voltage of 115 volts AC ± 5 percent.

Check that the following cables are available:

RG 63/BU Coaxial Cable - from the accelerometer to the Cathode Follower - Power Supply.

RG 62/AU Coaxial Cable - from the Cathode Follower Supply to the Audio Warning Amplifier.

Shielded Cable (per MIL-C-7078) from the Audio Warning Amplifier to the impedance matching resistors.

Shielded Cable (per MIL-C-7078) from the impedance matching resistors to the RCC device, recording oscillograph and head set.

Suitable Power Cables and connections to the Sequence Recorders.

2-5. REFERENCES

Rough Combustion Cutoff System, Handbook of Service Instructions. N.A.A. Report R-192 (Revised 30 January 1957).

SECTION III

VALIDATION PROCEDURE

3-1. PURPOSE

This procedure determines that the electrical control equipment and circuitry of the Rough Combustion Cutoff System is functioning correctly and properly connected.

3-2. SYSTEM AND DOCUMENT FAMILIARIZATION

The Rough Combustion Cutoff System is an electronic safety device used during firing of the rocket engines. Combustion is considered rough whenever chamber pressure oscillations of high-amplitude occur within a certain band of frequencies. This system automatically terminates the firing of engines whenever rough combustion exceeds a preset time of duration.

The Rough Combustion Cutoff System consists of the four electronic signalling channels listed below. The basic components of each channel are identical except for the identification numbers shown in parenthesis. Channel No. 4 is a spare replacement channel.

Channel No. 1
- Accelerometer (M-01.)
- Part of the Cathode Follower Power Supply (Input No. 1)
- Audio Warning Amplifier (No. 1)
- Control Cabinet (Z32)
- Interconnecting Cables

Channel No. 2
- Accelerometer (M-02)
- Part of the Cathode Follower Power Supply (Input No. 2)
- Audio Warning Amplifier (No. 2)
- Control Cabinet (Z33)
- Interconnecting Cables

Channel No. 3
- Accelerometer (M-03)
- Part of the Cathode Follower Power Supply (Input No. 3)
- Audio Warning Amplifier (No. 3)
- Control Cabinet (Z34)
- Interconnecting Cables

Channel No. 4
(Spare channel-not connected to an Accelerometer)
Part of the Cathode Follower Power Supply (Input No. 4)
Audio Warning Amplifier (No. 4)
Control Cabinet (Z35)
Interconnecting Cables

This procedure presents detailed steps for the validating of Channel No. 1. Validation of the remaining three channels is accomplished by repeating the steps as directed in the procedure and substitution of the proper channel component numbers.

Abbreviations are used throughout the text to shorten the lengthy titles and nomenclature of system components. A cross reference list of these abbreviations follows:

ABBREVIATIONS	NOMENCLATURE
RCC Device	Rough Combustion Cutoff Device
AWA	Audio Warning Amplifier
BC	Binary Counter
SSC	Stepping Switch Counter
CFPS	Cathode Follower Power Supply
Z31	Rough Combustion Cutoff Control Cabinet
Z32	Rough Combustion Cutoff Control Cabinet
Z33	Rough Combustion Cutoff Control Cabinet
Z34	Rough Combustion Cutoff Control Cabinet
Z35	Rough Combustion Cutoff Control Cabinet

3-3. PREPARATION

The following system preparations must be accomplished before validation begins.

1. At each of the Control Cabinets (Z32, Z33, and Z34) located in the blockhouse:
   Check for 115 volts ac across terminals 15 and 16 of TB 99 (RCC Power Panels).
   Throw the Binary Counter Test-Run switches to the Run position.
   Throw the Binary Counter RCC Control switches to the center position.
   Throw the RCC Device Test-Run switches to the Run position.

2. At the Control Cabinet (Z31) located in the transfer room:
   Check for 115 Volts ac across terminals 5 and 8 of TB 105 (RCC accessory Panel).

3. At the Missile Power Control Panel throw the DC Power switch to ON.

4. At the Engine Control Panel turn the Ground Power switch to ON.

3-4. PROCEDURE

The two columns below, Operation and Observation, show the actions to be performed and the results that should be observed during validation of the electrical control system.

	OPERATION		OBSERVATION
1.0	At the RCC Power Panel throw the Power Switch to ON. (Z-32)	(a)	RCC Power Panel light (white) comes on.
1.1	At the RCC Device, throw the Power Switch to ON. (Z-32)	(a)	RCC device Power light (white) comes on. (Z-32)
1.2	At the BC, throw the Power Switch to ON. (Z-32)	(a)	BC Power light (white) comes on. (Z-32)
1.3	At the SSC, throw the Power Switch to ON. (Z-32)	(a)	SSC Power light (white) comes on. (Z-32)
1.4	At the RCC Accessory Panel connect a voltmeter across terminals 10 and 11 of TB 98. (Z-32)	(a)	Read 125 volts AC ± 5 percent.
1.5	At the CFPS, throw the Power Switch to ON. (Z-31)	(a)	CFPS Power light (white) comes on. (Z-31)
1.6	At the AWA (No. 1), throw the Power Switch to ON. (Z-31)	(a)	AWA (No. 1) Power light (white) comes on. (Z-31)
2.0	At the BC, throw the RCC Control Switch to INACTIVE. (Z-32)	(a)	BC Inactive light (green) comes on. (Z-32)

	OPERATION		OBSERVATION
2.1	At the RCC Device, throw the System Test Switch to TEST. (Z-32)	(a)	Count lights operate in sequence on the BC and the SSC. (Z-32)
		(b)	At the RCC Accessory Panel, the RCC signal light (red) comes on. (Z-32)
2.2	At the RCC Device, throw the Test Switch to RUN. (Z-32)	(a)	BC and SSC Count lights stop counting. (Z-32)
2.3	At the BC, press the RESET CONTROL button. (Z-32)	(a)	All BC and SSC lights go off. (Z-32)
2.4	At the SSC, press the LOCK CKT RESET button. (Z-32)	(a)	No observation required.
3.0	At the RCC Accessory Panel, disconnect all wires except K(G)226A1(from terminal 7 of TB 98. (Z-32)	(a)	No observation required.
3.1	At the RCC Accessory Panel, disconnect all wires except K(G)622B16 from terminal 9 of TB 98. (Z-32)	(a)	No observation required.
3.2	At the RCC Accessory Panel, connect an ohmmeter across terminals 7 and 9 of TB 98 and measure the resistance. Reverse the meter leads and again measure the resistance. (Z-32)	(a)	Measure 1500 ohms minimum.
3.3	At the BC, throw the RCC Control Switch to ACTIVE. (Z-32)	(a)	BC Inactive light (green) goes off. (Z-32)
		(b)	BC Active light (red) comes on. (Z-32)
3.4	At the AWA (No. 1), turn the voltage gain control to 50. (Z-31)	(a)	No observation required.
3.5	At the SSC, throw the Power Switch to OFF. (Z-32)	(a)	SSC Power light (white) goes off. (Z-32)

	OPERATION		OBSERVATION
3.6	At the RCC Device, turn the Equalization Controls to 0. (Z-32)	(a)	No observation required.
3.7	At the RCC Device, turn the Sensitivity Control to 1000. (Z-32)	(a)	No observation required.

NOTE

Two methods are presented below as step 3.8. Method 1 will be used if the missile and accelerometers are available in the test stand. If the missile and/or accelerometers are not available, perform step validation using Method 2.

3.8	(Method 1)		
	In the Missile Thrust Section, tap on the engine thrust mounts one to two inches from Accelerometer (M-01), Caution - Do not tap the Accelerometer.	(a)	At the RCC Accessory Panel, the tapping should be heard in the headphones. (Z-32)
		(b)	The BC Count lights may count these taps.
3.8	(Method 2)		
	Connect an ohmmeter between pin 93 of umbilical P1007 and P11 of the CFPS. (Z-31)	(a)	Meter indicates circuit continuity. The resistance measurement must not exceed 10 ohms.
4.0	At the RCC Device, turn the sensitivity control to 140. (Z-32)	(a)	No observation required.
4.1	At the CFPS, disconnect the No. 1 input cable, P11 from J11. (Z-31)	(a)	No observation required.
4.2	At the CFPS (input No. 1), substitute a signal generator for the accelerometer input cable. Adjust the Signal Generator output for 2000 cps and .6 Volts RMS. (Z-31)	(a)	BC Count lights become bright and steady. (Z-32)
		(b)	At the RCC Accessory Panel, the output of AWA (No. 1) should be heard in the headphones.

	OPERATION		OBSERVATION
4.3	At RCC Device, turn the Equalization controls to 1000. (Z-32)	(a)	BC Count lights stop counting. (Z-32)
4.4	At the RCC Device, adjust the right hand Equalization Control until BC Count light No. 512 begins to pulsate. Record setting on test data sheet. (Z-32)	(a)	BC Count light No. 512 starts pulsating. (Z-32)
4.5	Adjust the right hand Equalization Control to a higher setting. (Z-32)	(a)	BC Count lights stop counting. (Z-32)
4.6	At the RCC Device, adjust the left hand Equalization Control until BC Count light No. 512 begins to pulsate. Record setting on test data sheet. (Z-32)	(a)	BC Count light No. 512 starts pulsating. (Z-32)
4.7	Return the right hand Equalization Control to the setting recorded in step 4.4.	(a)	No observation required.
4.8	At the RCC Device, turn the Sensitivity Control to 0. (Z-32)	(a)	BC Count lights stop counting. (Z-32)
4.9	At the SSC, throw the Power Switch to ON. (Z-32)	(a)	SSC Power light (white) comes on. (Z-32)
4.10	At the RCC Device, slowly increase the Sensitivity Control until the RCC Signal light (red) of the RCC Accessory Panel comes on. Record the Sensitivity Control setting on the test data sheet. (Z-32)	(a)	BC Count lights come on. (Z-32)
		(b)	At the RCC Accessory Panel, the RCC signal light (red) comes on. (Z-32)
		(c)	At the RCC Accessory Panel, measure 28 Volts across terminals 6 (+) and 8 (-) of TB 98. (Z-32)

	OPERATION		OBSERVATION
5.0	Turn the Sensitivity Control to 0. (Z-32)	(a)	No observation required.
5.1	At the BC, throw the RCC Control Switch to INACTIVE. (Z-32)	(a)	BC Active light (red) goes off. (Z-32)
		(b)	BC Inactive light (green) comes on. (Z-32)
5.2	At the BC, press the RESET CONTROL button. (Z-32)	(a)	All BC and SSC Count lights go off. (Z-32)
5.3	At the SSC, press the LOCK CKT RESET button. (Z-32)	(a)	At the RCC Accessory Panel, the RCC Signal light goes off. (Z-32)
		(b)	At the RCC Accessory Panel, measure ZERO Volts across terminals 6 (+) and 8 (-) of TB 98. (Z-32)
5.4	At the RCC Accessory Panel, connect a jumper between terminals 5 and 7 of TB 98. (Z-32)	(a)	At the RCC Accessory Panel, measure 28 Volts DC between terminals 7 (+) and 8 (-) of TB 98. (Z-32)
5.5	At the BC, throw the RCC Control Switch to ACTIVE. (Z-32)	(a)	BC Inactive light (green) goes off. (Z-32)
		(b)	BC Active light (red) comes on. (Z-32)
5.6	At the RCC Device, turn the sensitivity control to the setting recorded in step 4.10. (Z-32)	(a)	No change in panel indications. (Z-32)
		(b)	At the RCC Accessory Panel, measure ZERO Volts between terminals 6 (+) and 8 (-) of TB 98. (Z-32)
5.7	At the RCC Device, turn the Sensitivity Control setting to 0. (Z-32)	(a)	No observation required.

	OPERATION		OBSERVATION
5.8	At the RCC Accessory Panel, remove the jumper from terminals 5 and 7 of TB 98 and reconnect it between terminals 5 and 9 of TB 98. (Z-32)	(a)	No observation required.
5.9	At the RCC Device, turn the Sensitivity Control to the setting recorded in step 4.10. (Z-32)	(a)	No change in panel indications. (Z-32)
		(b)	At the RCC Accessory Panel, measure ZERO volts between terminals 6 (+) and 8 (-) of TB 98. (Z-32)
6.0	At the RCC Device, turn the Sensitivity Control setting to 0. (Z-32)	(a)	No observation required.
6.1	At the RCC Accessory Panel, remove the jumper from terminals 5 and 9 of TB 98. (Z-32)	(a)	No observation required.
6.2	At the RCC Accessory Panel, reconnect all wires that were disconnected from terminals 7 and 9 of TB 98 in steps 3.0 and 3.1. (Z-32)	(a)	No observation required.
6.3	At the CFPS (input No. 1), disconnect the Signal Generator and reconnect Accelerometer input cable. (Z-31)	(a)	No observation required.
6.4	At the CFPS, throw the Power Switch to OFF. (Z-31)	(a)	CFPS Power light (white) goes off. (Z-31)
6.5	At the AWA (No. 1), throw the Power Switch to OFF. (Z-31)	(a)	AWA Power light (white) goes off. (Z-31)
6.6	At the SSC, throw the Power Switch to OFF. (Z-32)	(a)	SSC Power light (white) goes off. (Z-32)

	OPERATION		OBSERVATION
6.7	At the BC, throw the Power Switch to OFF. (Z-32)	(a)	BC Power light (white) goes off. (Z-32)
6.8	At the RCC Device, throw the Power Switch to OFF. (Z-32)	(a)	RCC Device light (white) goes off. (Z-32)
6.9	At the RCC Power Panel, throw the Power Switch to OFF. (Z-32)	(a)	RCC Power light (white) goes off. (Z-32)
6.10	At the Engine Control Panel, turn the Ground Power Switch to OFF.	(a)	BC Active light (red) comes on. (Z-32)
6.11	At the Missile Power Panel, throw the DC Power Switch to OFF.	(a)	No observation required.
7.0	At the RCC Accessory Panel, disconnect wire K (G) 681A16 from terminal 12 of TB 98.	(a)	No observation required.
7.1	Connect an ohmmeter between the disconnected end of wire K (G) 681A16 and terminal 16 of TB 98. (Z-32)	(a)	Measure 732 ± 10 ohms. (Z-32)
7.2	Reconnect wire K (G) 681A16 to terminal 12 of TB 98. (Z-32)	(a)	No observation required.
7.3	At the RCC Accessory Panel, disconnect wire K (G) 677A16 from terminal 13 of TB 98.	(a)	No observation required.
7.4	Connect the ohmmeter between the disconnected end of wire K (G) 677A16 and terminal 16 of TB 98. (Z-32)	(a)	Measure 3500 ± 1500 ohms. (Z-32)
7.5	Reconnect wire K (G) 677A16 to terminal 13 of TB 98. (Z-32)	(a)	No observation required.

	OPERATION		OBSERVATION
8.0	Repeat steps 1.0 through 7.5 using Channel No. 2 components. For step 3.8 Method 2 the ohmmeter should be connected between pin 94 of P1007 and P10 of the CFPS.	(a)	Step indications should be as shown.
9.0	Repeat steps 1.0 through 7.5 using Channel No. 3 components. For step 3.8 Method 2 the ohmmeter should be connected between pin 95 of P1007 and P14 of the CFPS.	(a)	Step indications should be as shown.
10.0	Repeat steps 1.0 through 3.6 and 4.0 through 7.5 using Channel No. 4 components.	(a)	Step indications should be as shown.

Satisfactory completion of the above procedure indicates the electrical control circuitry of the Rough Combustion Cutoff System "D" Series is valid. When no further testing is required, return switches to their normal positions, secure the power sources, and return the system to its normally secured state.

TEST DATA SHEET

Electrical System of ROUGH COMBUSTION CUTOFF
Top Drawing No. _____
Major Components Serial No.'s _____

Version No. _____
Location _____
Inspected By _____
Date Inspected _____
Inspection Approved By _____

Step No.	Validation Performed		Insp. Stamp
1.	System Power - - - - - - - - - - - -	AVAILABLE	
2.	Binary and Stepping Switch Counter Operation - - - - - - - - - - - -	SATISFACTORY	
3.	Channel No. 1 Operation - Accelerometer Through Audio Warning Amplifier - - - - - - - -	SATISFACTORY	
4.	Channel No. 1 Operation - Cathode Follower Power Supply Through Cutoff Circuit - - - - - - - - - -	SATISFACTORY	
	(4.4) Right Hand Equalization Control Setting _____		
	(4.6) Left Hand Equalization Control Setting _____		
	(4.10) Sensitivity Control Setting _____		
5.	Channel No. 1 Operation-Holdout Circuit - - - - - - - - - - - - -	SATISFACTORY	
6.	Shutdown Operation - - - - - - - -	SATISFACTORY	
7.	Resistance and Continuity Checks -	SATISFACTORY	

TEST DATA SHEET

Step No.	Validation Performed		Insp. Stamp
8.	Channel No. 2 Operation - - - - - -	SATISFACTORY	
	(4.4) Right Hand Equalization Control Setting _____		
	(4.6) Left Hand Equalization Control Setting _____		
	(4.10) Sensitivity Control Setting _____		
9.	Channel No. 3 Operation - - - - - -	SATISFACTORY	
	(4.4) Right Hand Equalization Control Setting _____		
	(4.6) Left Hand Equalization Control Setting _____		
	(4.10) Sensitivity Control Setting _____		
10.	Channel No. 4 Operation - - - - - -	SATISFACTORY	
	(4.4) Right Hand Equalization Control Setting _____		
	(4.6) Left Hand Equalization Control Setting _____		
	(4.10) Sensitivity Control Setting _____		