



STANDARD OVERHAUL PRACTICES MANUAL

HOW TO PROGRAM PROGRAMMABLE CIRCUIT DEVICES

**PART NUMBER
NONE**

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Page 1
Jul 01/2009



STANDARD OVERHAUL PRACTICES MANUAL

Revision No. 6
Jul 01/2009

To: All holders of HOW TO PROGRAM PROGRAMMABLE CIRCUIT DEVICES 20-11-08.

Attached is the current revision to this STANDARD OVERHAUL PRACTICES MANUAL

The STANDARD OVERHAUL PRACTICES MANUAL is furnished either as a printed manual, on microfilm, or digital products, or any combination of the three. This revision replaces all previous microfilm cartridges or digital products. All microfilm and digital products are reissued with all obsolete data deleted and all updated pages added.

For printed manuals, changes are indicated on the List of Effective Pages (LEP). The pages which are revised will be identified on the LEP by an R (Revised), A (Added), O (Overflow, i.e. changes to the document structure and/or page layout), or D (Deleted). Each page in the LEP is identified by Chapter-Section-Subject number, page number and page date.

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20-11-08

TRANSMITTAL LETTER

Page 1

Jul 01/2009

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STANDARD OVERHAUL PRACTICES MANUAL

Location of Change

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NO HIGHLIGHTS

20-11-08

HIGHLIGHTS

Page 1

Jul 01/2009



STANDARD OVERHAUL PRACTICES MANUAL

Subject/Page	Date	Subject/Page	Date	Subject/Page	Date
TITLE PAGE					
O 1	Jul 01/2009				
2	BLANK				
20-11-08 TRANSMITTAL LETTER					
O 1	Jul 01/2009				
2	BLANK				
20-11-08 HIGHLIGHTS					
O 1	Jul 01/2009				
2	BLANK				
20-11-08 EFFECTIVE PAGES					
1	Jul 01/2009				
2	BLANK				
20-11-08 CONTENTS					
1	Nov 01/2006				
2	BLANK				
20-11-08 REVISION RECORD					
1	Jul 01/2005				
2	Jul 01/2005				
20-11-08 RECORD OF TEMPORARY REVISIONS					
1	Jul 01/2005				
2	Jul 01/2005				
20-11-08 INTRODUCTION					
1	Jul 01/2005				
2	BLANK				
20-11-08 SUBJECT					
1	Jul 01/2005				
2	Mar 01/2007				
3	Mar 01/2007				
4	Nov 01/2006				

A = Added, R = Revised, D = Deleted, O = Overflow

20-11-08

EFFECTIVE PAGES

Page 1

Jul 01/2009



STANDARD OVERHAUL PRACTICES MANUAL

TABLE OF CONTENTS

<u>Paragraph Title</u>	<u>Page</u>
HOW TO PROGRAM PROGRAMMABLE CIRCUIT DEVICES	1
INTRODUCTION	1
DEFINITIONS	1
MATERIALS	1
EQUIPMENT	1
PREPARATION OF THE PROGRAMMER	2
LOADING PROGRAM DATA FROM MASTER DEVICE INTO PROGRAMMER RAM	3
PROGRAMMING THE BLANK DEVICE	4
VERIFICATION OF THE PROGRAMMED DEVICE	4
PART MARKING	4

All revisions to this manual will be accompanied by transmittal sheet bearing the revision number. Enter the revision number in numerical order, together with the revision date, the date filed and the initials of the person filing.

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STANDARD OVERHAUL PRACTICES MANUAL

INTRODUCTION

1. General

- A. The instructions in this manual tell how to do standard shop procedures during maintenance functions from simple checks and replacement to complete shop-type repair.
- B. This manual is divided into separate sections:
 - (1) Title Page
 - (2) Transmittal Letter
 - (3) Highlights
 - (4) Effective Pages
 - (5) Contents
 - (6) Revision Record
 - (7) Record of Temporary Revisions
 - (8) Introduction
 - (9) Procedures
- C. Refer to SOPM 20-00-00 for a definition of standard industry practices, vendor names and addresses, and an explanation of the True Position Dimensioning symbols used.
- D. The data is general. It is not about all situations or specific installations. Use it as a guide to help you write minimum standards.
- E. If the component overhaul instructions are different from the data in this subject, use the component overhaul instructions.

20-11-08

INTRODUCTION

Page 1

Jul 01/2005



STANDARD OVERHAUL PRACTICES MANUAL

HOW TO PROGRAM PROGRAMMABLE CIRCUIT DEVICES

1. INTRODUCTION

- A. The data in this subject gives general procedures to put programs into Boeing-supplied programmable circuit devices. Use this data as a guide to help you write minimum requirements.
- B. This procedure uses vendor-proprietary equipment to read the program data from one device and put this data into another device. Refer to the vendor's operation manual for details about the equipment.
- C. The data about part marking comes from Boeing Process Specification BAC5868.
- D. Refer to SOPM 20-00-00 for a list of all the vendor names and addresses.

2. DEFINITIONS

- A. Checksum – See sumcheck.
- B. Device – Term used in this subject to refer to the circuit component which is programmed by this procedure.
- C. EEPROM – Electrically erasable programmable read-only memory, a programmable circuit device which can be completely or partially erased electrically in the circuit or on a programmer.
- D. EPROM – Erasable programmable read-only memory, a programmable circuit device, usually one which is erased with ultraviolet light.
- E. LCC – Leadless chip carrier, a device package which is a 4-sided ceramic block that has pads on the bottom for surface-mount applications.
- F. Master device – A device which already contains a program, and which is to be used with the programmer to make a copy of the program and put it into a blank, unprogrammed device.
- G. PLCC – Plastic leaded chip carrier, a device package with J-shaped leads which extend down on all 4 sides, for surface-mount applications.
- H. PMC – Programmable micro circuits, another name for EEPROM or EPROM.
- I. RAM – Random access memory: Memory storage space or capacity, as in a computer or equivalent equipment.
- J. Sumcheck – A 4- or 8-digit hexadecimal number which is related to a set of data, such as a program to be put into a programmable circuit device. The programmer equipment gives the sumcheck for the data when it reads it from a device, and again when it puts the data into another device. You compare the sumchecks from the two operations to make sure the copy of the data is equivalent to the source data. Memory devices usually have 8-digit sumchecks. Logic devices have 4-digit sumchecks.

3. MATERIALS

- A. Labels – BAC27TEX2007 or Brady WH-673 (1 inch by 0.5 inch), V85480
- B. Marking pen – Sanford Sharpie, fine or extra fine, V86874
- C. Ink – Wornow R, V79436

4. EQUIPMENT

- A. Programmer – Data I/O UniSite Model US-BAC, V54193
 - (1) UniSite 68 programmer with 4 megabyte RAM
 - (2) Site 48 programming fixture
 - (3) PinSite fixtures PLCC and LCC, as applicable

20-11-08



STANDARD OVERHAUL PRACTICES MANUAL

(4) Application software with Boeing-specified enhancements

(5) UniSite System Configuration

(a) Algorithm version: 3.30 or later

(b) System version: 3.30 or later

(c) ROM version: 2.1 or later

B. ASCII Terminal or PC

C. Data source – Boeing-supplied circuit device with sumcheck data, or 2 user-supplied circuit devices, of the type necessary for the application

D. Unprogrammed or erased circuit devices

5. PREPARATION OF THE PROGRAMMER

CAUTION: MANY OF THESE PROGRAMMABLE CIRCUIT DEVICES ARE EASILY DAMAGED BY ELECTROSTATIC DISCHARGE. DO NOT TOUCH THE DEVICES UNLESS THEY HAVE SUFFICIENT PROTECTION. REFER TO SOPM 20-12-02 FOR MORE DATA.

A. Connect and prepare the programmer and other equipment, such as modules, accessories, software and terminal. Refer to the vendor's programmer manual for details.

B. Make sure the software version of the programmer is the same or newer than the version shown on the Boeing data sheet for the circuit device, or as shown in Paragraph 4., EQUIPMENT.

C. For the master device, make the correct selection of manufacturer and part number. Refer to the vendor's programmer manual for details.

D. Make sure the displayed manufacturer and part number date agree with the data on the device itself.

E. Set the programmer to send the data to RAM, to examine the data for illegal bits and for blanks, and to make 2 passes through the verification process.

F. Set the Vcc low and high verification voltages for the device to be programmed (Table 1).

Table 1: Device Verification Voltages

Basic Device Type ^{*[1]}	Nominal Verification Vcc Voltage ^{*[2]}		Basic Device Type ^{*[1]}	Nominal Verification Vcc Voltage ^{*[2]}	
	Low	High		Low	High
1010	4.5	5.5	2764	4.4	5.8
1020	4.5	5.5	2764A	4.4	5.8
10H8	4.5	5.5	27128	4.4	5.8
10L8	4.5	5.5	27128A	4.4	5.8
12H6	4.5	5.5	27C16	4.4	5.8
12L6	4.5	5.5	27C32	4.4	5.8
14H4	4.5	5.5	27C64	4.4	5.8
14L4	4.5	5.5	27C010	4.4	5.8
16A4	4.5	5.5	27C101	4.4	5.8
16C1	4.5	5.5	27C128	4.4	5.8
16H2	4.5	5.5	27C256	4.4	5.8

20-11-08



STANDARD OVERHAUL PRACTICES MANUAL

Table 1: Device Verification Voltages (Continued)

Basic Device Type ^{*[1]}	Nominal Verification Vcc Voltage ^{*[2]}		Basic Device Type ^{*[1]}	Nominal Verification Vcc Voltage ^{*[2]}	
	Low	High		Low	High
16L2	4.5	5.5	27C512	4.4	5.8
16L8	4.5	5.5	28C16	4.5	5.8
16LC8	4.5	5.5	28C64	4.5	5.8
16R4	4.5	5.5	28L22	4.5	5.8
16RC4	4.5	5.5	57C128	4.4	5.8
16R6	4.5	5.5	5C060	4.4	5.8
16R8	4.5	5.5	5C090	4.4	5.8
16V8	4.5	5.5	5C180	4.4	5.8
16X4	4.5	5.5	6641	4.5	5.8
20G10	4.5	5.5	8748	4.4	5.8
20L8	4.5	5.5	8749	4.4	5.8
20R8	4.5	5.5	8751	4.4	5.8
20V8	4.5	5.5	87C51	4.4	5.8
22V10	4.5	5.5	EP600	4.4	5.8
2716	4.4	5.75	EP9000	4.4	5.8
2732A	4.4	5.75	EP1800	4.4	5.8

^{*[1]} Generic device numbers only. The complete part number can have more prefix or suffix characters because of manufacturer, part configuration, operating speed, revision level, package style, etc.

^{*[2]} Actual voltages can have tolerance of ± 0.1 volt.

6. LOADING PROGRAM DATA FROM MASTER DEVICE INTO PROGRAMMER RAM

A. Method 1 – Operator-supplied spare devices

- (1) Install one of the two programmed devices in the programmer. Load the RAM with the data from the device. When the operation is complete, make a note of the sumcheck as shown on the display screen. Remove the device from the programmer.
- (2) Install the other programmed device in the programmer. Load the RAM with the data from this device. When the operation is complete, make a note of the sumchecks.
- (3) Compare the two sumchecks.
 - (a) If the sumchecks are the same, use one of the two devices to program blank devices per Paragraph 7. below.
 - (b) If the two sumchecks do not agree, do the above procedures again. If the sumchecks do not agree, one of the devices could contain defects. Try a different device and do the procedure again.

B. Method 2 – Boeing-supplied master device

- (1) Install the device in the programmer.

20-11-08



STANDARD OVERHAUL PRACTICES MANUAL

- (2) Load the RAM with the data from the device. When the operation is complete, make a note of the sumcheck.
- (3) Compare this sumcheck with the sumcheck given by the device data sheet.
 - (a) If the sumchecks agree, use this device to program blank devices per Paragraph 7. below.
 - (b) If the sumchecks do not agree, make sure the device is correctly installed, then do the load procedure again. If the sumchecks do not agree after that, try another device of the same type.

7. **PROGRAMMING THE BLANK DEVICE**

- A. Install the device to be programmed in the programmer. Start the program procedure. Refer to the programmer vendor's instructions for details.
- B. After the device is programmed, compare the shown sumcheck with the sumcheck from the applicable procedure of Paragraph 6.
 - (1) If the sumchecks agree, continue to VERIFICATION, Paragraph 8.
 - (2) If the sumchecks do not agree, make sure the device is correctly installed, then try again. If the sumchecks do not agree after the third try, the device or the data could be bad. Remove it and try another one.

8. **VERIFICATION OF THE PROGRAMMED DEVICE**

- A. With the device installed in the programmer, start the verification procedure. Refer to the programmer vendor's instructions for details.
- B. After the verification procedure is complete, compare the shown sumcheck with the sumcheck from the applicable procedure of Paragraph 6.
 - (1) If the sumchecks agree, remove the device from the programmer and give it protection from electrostatic discharge per SOPM 20-12-02. Identify the device by part number per Paragraph 9.
 - (2) If the sumchecks do not agree, make sure the device is correctly installed, then try the verification procedure again. If the sumchecks do not agree after the third try, the device or the data could be bad.

9. **PART MARKING**

- A. When you mark a Boeing programmable circuit device, use this format:
Line 1: "BOEING PMC ASSY"
Line 2: Boeing part number
Line 3: Date, in the form yyww, where yy is the last 2 digits of the year and ww is the week of the year (numbered from 01 to 52)
- B. Write the data on the label with the marking pen, or use a rubber stamp and ink as specified. Let the marking pen ink dry at 60-80°F for at least 15 minutes. Cure the Wornow R ink at 165-185°F for 80-100 minutes. Overcoat of the markings is not required.

20-11-08