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NORTH AMERICAN ROCKWELL CORPORATION

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(THRU)
None (CODE)
(CATEGORY)
FACILITY FORM 602

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87		109	July 2, 1969
88		110	July 2, 1969
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225		256	March 10, 1969
226		256a	Deleted
227		257	March 10, 1969
228		257a	Deleted
229		258	August 16, 1968
230		258a	Deleted
231		259	March 10, 1968
232		260	March 24, 1969
233		261	August 16, 1968
234		262	April 11, 1969
235		263	June 27, 1969
236		263a	Deleted
237		264	May 9, 1969
238		264a	Deleted
239		265	June 27, 1969
240		266	March 10, 1969
241		266a	Deleted
242		267	March 10, 1969
243		267a	Deleted
244		268	May 16, 1969
245a	September 3, 1968	268a	Deleted
246		269	June 13, 1969
247		269a	Deleted
248		270	January 6, 1969
249		271	July 2, 1969
250		271a	Deleted
251		272	June 27, 1969
252		272a	Deleted
253		273	March 10, 1969
254	April 11, 1969	274	June 13, 1969
255	May 9, 1969	274a	April 11, 1969
255a	Deleted	275	November 15, 1968
		276	August 16, 1968

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276a	Deleted	B-4	September 13, 1969
277	January 27, 1969	B-4a	September 13, 1968
278	May 16, 1969	B-5	September 13, 1968
278a	Deleted	B-6	September 13, 1968
279	May 16, 1969	B-7	September 13, 1968
279a	April 11, 1969	B-8	September 13, 1968
279b	March 10, 1969	B-9	September 13, 1968
280	February 14, 1969	B-10	September 13, 1968
281	October 25, 1968	B-11	September 13, 1968
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157	1001-0220	7-25-68	254,257, 258,259, 260,261, 262,264, 268,269, 270,272, 273,274,	LA0101-007A, MA0106-039A, MA0108-009G, MA0108-014A, MA0109-006B, MA0109-010B, MA0109-013C, MA0109-014A, MA0109-015, MA0109-017B, MA0110-010D, MA0110-015E, MA0110-029D, LA0111-006C, LA0111-008, MA0111-011A, LA0111-014, MA0112-031, MA0120-003C, MA303-1009A, MA0606-038E,

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182	1001-5732	8-12-68	278	[illegible]
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188	1001-	8-12-68	272	[illegible]
190	1001-	8-12-68	269	[illegible]

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191	1001-	8-27-68	245a	Deviation 455
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88R1	1001-0197R1	8-26-68	279b	ST021DGB0002
167	1001-	7-26-68	273	MA0621-001C
194	1001	10-9-68	262	MA0115-005C
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112	1001-0202	12-21-67	279	MB0170-063C
141	1001-	10-29-68	271	MA0610-001D
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196	1001-0262	10-2-68	169, 169a 169b	Deviation 440R1
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146R1	1001-0232R1	11-14-68	268	MA0606-047C
207	1001-	11-13-68	279a	MO0103-001F
212	1001-	10-27-68	256,269	MA0106-45F-MD-2 MA0606-52A-MD-1

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206	5445	12-10-68	4	MSFC-SPEC-106B
209	6002	11-21-68	6, 262	MSFC-STD-105A MD-2, MA0116-029E
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86	1001-0185	10-10-67	257	MA0107-007H
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94	1001-0182	10-10-67	268	MA0606-042B, AMENDMENT MD-1B
96	1001	10-16-67	279b	MQ0701-005F
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230	1001-0232R2	5-1-69	268	MA0606-047C, Amend. MD-1
243	1001-0247R2	4-21-69	271	MA0609-009, Amend. MD-1
237R1	1001-0286R1	5-29-69	269	MA0606-054A
249	1001-	5-12-69	274	MB0110-008B
251	1001-0294	5-20-69	263	MA0303-1004H
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119R2	4885R3	6-11-69	2,4,5,8,65, 65a, 65b, 107, 109, 110, 156, 156a	BB-N 411b (1) Bureau of Mines Publication No. 1, MIL-N-6011, MIL-P-25508D, MIL-P-27201A, MIL-P-27401B, MIL-P-27407 (1) MSFC-SPEC-234A, MSFC-SPEC-365A, MSFC-SPEC-364B, MSFC-SPEC-399, Bureau of Mines Spec, Helium, Type A, Deviations 337, 338, 445 & 446.
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FOREWORD

This is one of the basic documents listed in Article II, Exhibit A of Contract NAS7-200. It is revised to provide a single source of information to reflect the latest contract status of the specifications listed herein.

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TECHNICAL REPORT INDEX/ABSTRACT

ACCESSION NUMBER							DOCUMENT SECURITY CLASSIFICATION Unclassified	

TITLE OF DOCUMENT

APPLICABLE SPECIFICATIONS AND DEVIATIONS FOR SATURN S-II STAGE AND GROUND SUPPORT EQUIPMENT

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AUTHOR(S)

JOHNSTONE, R.R.

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DESCRIPTIVE TERMS

SATURN S-II SPECIFICATIONS; SATURN S-II SPECIFICATION DEVIATIONS

ABSTRACT

THIS VOLUME LISTS ALL DOCUMENTS RELATIVE TO THE SPECIFICATIONS FOR THE SATURN S-II STAGES AND GROUND SUPPORT EQUIPMENT.

INTRODUCTION

This volume lists all documents relative to the Saturn S-II Stage and Saturn S-II ground support equipment.

Appendixes A and B contain cross reference indexes of deviations from military documents. Appendix C presents a list of applicable documents and related NR specifications. Appendix D presents a list of NR material and process specifications, applicable to the S-II, which supersede other counterpart NR multiple application specifications. (These appendixes exist only for reference purposes and do not form a part of SID 61-367C.) SCN 73R1

I. S-II STAGE DOCUMENTS AND DEVIATIONS

S-II STAGE DOCUMENTS

The following are design, method and material documents for the Saturn S-II Stage. S-II stage documents are also listed with their related NAA specifications in Appendix C of this report.

All subsidiary specifications referenced in the primary specifications specified herein are applicable only to the extent referenced in the primary specification and shall be limited to the subject matter of the particular paragraph or phrase in the subsidiary specification to which the primary specifications refer.

SPECIFICATIONS

Federal

BB-N-411b(1) January 19, 1966	Nitrogen, Technical	SCN 119R2
OO-P-416A December 11, 1956	Plating, Cadmium (Electrodeposited)	
WW-T-700/6C August 21, 1969	Tube, Aluminum Alloy, Drawn, Seamless, 6061 and 6062	
Bureau of Mines Publication No. 1 August 1963	Helium, Grade A	SCN 119R2

Military

MIL-B-5087A(1) January 29, 1958	Bonding, Electrical (for Aircraft)	
MIL-P-5514D September 16, 1959	Packings, Installation and Gland Design Hydraulic, General Specification for	
MIL-C-5541(1) March 28, 1950	Chemical Films for Aluminum and Aluminum Alloys	
MIL-E-5556A July 23, 1954	Enamel, Camouflage, Quick-Drying	
MIL-H-5606A(1) May 17, 1961	Hydraulic Fluid, Petroleum Base, Aircraft and Ordnance	SCN 119R2

MIL-E-6051C 17 June 1960	Electrical-Electronic System Compatibility and Interference Control Requirements for Aeronautical Weapon System
MIL-I-6181D 25 November 1959	Interference Control Requirements, Aircraft Equipment
MIL-W-6858B 2 November 1960	Welding, Resistance: Aluminum, Magnesium, Nonhardening Steels or Alloys, Nickel Alloys, Heat-Resisting Alloys, and Titanium Alloys; Spot and Seam
MIL-W-6873A 19 January 1959	Welding: Flash, Carbon, and Alloy Steels
MIL-T-7081C 3 April 1959	Tube: Aluminum Alloy, Seamless, Round, 6061, and 6062; Aircraft Hydraulic Quality
MIL-B-7883(1) 28 January 1954	Brazing of Steels, Copper, Copper Alloys, and Nickel Alloys
MIL-I-8500B 10 October 1960	Interchangeability and Replaceability of Component Parts for Aircraft and Missiles
MIL-P-8585A 17 October 1957	Primer Coating, Zinc Chromate, Low-Moisture-Sensitivity
MIL-A-8625A 14 December 1954	Anodic Coatings for Aluminum and Aluminum Alloys
MIL-T-8808A 1 April 1958	Tubing, Steel, Corrosion-Resistant (18-8 Stabilized), Aircraft Hydraulic Quality
MIL-V-8813 20 November 1957	Valves: Aircraft, Hydraulic Pressure Relief, Type II Systems
MIL-F-8815 18 March 1960	Filter and Filter Elements, Fluid Pressure, Hydraulic Line, 15 Micron Absolute, Type II Systems
MIL-R-11468 27 September 1951	Radiographic Inspection: Soundness Requirement for Arc and Gas Welds in Steel
MIL-R-11469 24 September 1951	Radiographic Inspection: Soundness Requirements for Steel Castings
MIL-R-11471(2) 26 February 1960	Radiographic Inspection of Metals

MIL-P-19692A December 1, 1960	Pumps, Hydraulic, Variable Delivery, General Specification for	
MIL-H-25475A January 19, 1961	Hydraulic Systems, Missile, Design, Installation Tests, and Data Requirements General Requirements for	

Military

MIL-P-25508D March 16, 1962	Propellant, Oxygen, Type II	SCN 119R2
MIL-P-25732A January 6, 1959	Packing, Preformed, Petroleum Hydraulic Fluid Resistant, 275° F.	
MIL-P-27201A September 1, 1964	Propellant, Hydrogen	SCN 119R2
MIL-P-27401B September 19, 1962	Propellant Pressurizing Agent, Nitrogen	
MIL-P-27407(1) January 8, 1965	Propellant Pressurizing Agent, Helium	
MIL-C-27500 (USAF) (4) July 8, 1966	Cable, Electrical, Shielded and Unshielded, Aircraft, and Missile	
MIL-D-70327(1) July 1, 1959	Drawings, Engineering and Associated Lists	

Army Ballistic Missile Agency

ABMA-C-4 June 25, 1958	Cleaning and Conditioning of Metallic and Nonmetallic Surfaces
ABMA-PD-R-27A August 14, 1959	Radiographic Inspection: Soundness Requirements for Fusion Welds in Aluminum and Magnesium Missile Components
ABMA-PD-W-45A September 22, 1959	Welding, Fusion, Shielded Arc, Missile Components, Aluminum and Magnesium, Manual or Automatic
ABMA-PD-E-53 February 11, 1960	Electrical Wiring Procedures
ABMA-PD-W-153 May 26, 1958	Certification of Welding Operators for Fusion Welding Guided Missile Airframes
ABMA-PD-R-187 November 7, 1958	Relays, Hermetically Sealed, Missile Equipment

ABMA-PD-W-488A September 15, 1959	Welding, Stud, Aluminum Alloy, Process for
ABMA-PD-C-711A December 15, 1959	Cable and Harness Assemblies, Electrical, Missile Systems: General Specification

Marshall Space Flight Center

MSFC-SPEC-106B September 16, 1966 Amendment 1 October 6, 1967	Testing Compatibility of Materials for Liquid Oxygen Systems

New page

MSFC-SPEC-143B February 10, 1964	Fittings, Flared Tube, Pressure Connections
MSFC-SPEC-164(1) June 15, 1963	Cleanliness of Components for Use in Liquid Oxygen, Fuel, and Pneumatic Systems, Specification for
MSFC-SPEC-234A July 27, 1967	Nitrogen, Space Vehicle
MSFC-SPEC-356A April 15, 1967	Hydrogen, Liquid
MSFC-SPEC-364B April 15, 1967	Helium
MSFC-SPEC-399 April 24, 1964	Oxygen, Type II, Grade C
MSFC-PROC-158A April 12, 1962	Soldering and Electrical Connections (High Reliability), Procedures for
MSFC-PROC-252 September 19, 1962	Weight and Balance Requirements, Procedure for
MSFC-PROC-293 May 27, 1963	Coating, Conformal, (Polyurethane) Printed Circuit Assemblies, Procedure for
MS005.0 May 17, 1961	Fabrication of Type 17-7 PH Stainless Steel
MS005.1A April 15, 1961	Fabrication of Type 410 Stainless Steel Sheet, Plate and Strip
MS200.2 January 6, 1961	Internal Protection of Stainless Steel Pipe and Tubing During Fusion Welding
MS260.0 March 6, 1961	Insert, Helical Coil Thread, Installation of
MS260.2 October 1960	Installation of Jo-Bolt Blind Locking Fasteners
MS700.0 January 12, 1961	Acceptance of Spooled Aluminum Alloy Welding Wire for Launch Vehicle Application
MS750.0A April 22, 1961	Non-Metallic (Asbestos) Gaskets

SCN 119R2

STANDARDS

Federal

FED-STD-151A May 6, 1959	Metals; Test Methods

Military

MIL-STD-130B 24 April 1962	Identification Marking of U.S. Military Property

New page

MIL-STD-171A 11 October 1960	Finishing of Metal and Wood Surfaces
MIL-STD-453(1) 29 October 1962	Inspection, Radiographic
MIL-STD-1247 12 March 1963	Identification of Pipe, Hose, and Tube Lines for Aircraft, Missiles, Space Vehicles, and Associated Support Equipment and Facilities
MS33540C 17 March 1959	Safety Wiring, General Practices for

Army Ballistic Missile Agency

ABMA-STD-3(1) 27 June 1958	Etching of Aluminum Before Spot Welding
ABMA-STD-428B 8 April 1960	Printed Circuit Design and Construction Standard

Marshall Space Flight Center

MSFC-STD-100 16 May 1961	Castings, Aluminum and Magnesium Alloy, Radiographic Inspection of, Acceptance Standard for
MSFC-STD-105A AMEND 2 SEPTEMBER 7, 1968	Synthetic Rubber, Age Control of, Standard for
MSFC-STD-162 26 July 1961	Mechanical Symbols
MSFC-STD-349 15 November 1963	Electrical and Electronic Reference Designations, Standards for
NASA Standard SE-008-001-1 June 1965	Project Apollo Coordinate System Standards

SCN 209

DRAWINGS

Army Ballistic Missile Agency

10419900 22 June 1960	Environmental Protection of Vehicle and Support Equipment Components and Assemblies, Procedure for
10419901 26 February 1960	Cleaning and Passivation of Bellows and Ducts, Procedure for

10419925 17 June 1960	Containers, Propellant, Specification for
10509301 25 July 1960	Riveting Fabrication and Inspection, Standard for
10509302 16 May 1960	Packaging and Packing of Parts, Repair Parts, and Components for Space Vehicles, General Specification for
10509306(1) 18 April 1961	Radiographic Inspection Procedures and Acceptance Standards for Fusion Welded Joints in Stainless and Heat Resistant Steel, Specification for
10509307A 3 June 1961	Brazing, Silver, Specification for
10509308 2 June 1960	Welding, Carbon, Low Alloy and Stainless Steel, (Manual or Automatic), Specification for
10509313 28 June 1960	Lubricant, Antiseize and Sealing, Liquid Oxygen Systems, Specification for
10509318 9 July 1960	Hose Assemblies, Flexible, High-Pressure, Specification for

Marshall Space Flight Center

0299 16 July 1962	Preliminary Saturn C-5 Three-Stages to Escape Velocity Configuration (Suborbital Start)
10M01071 6 March 1961	Environmental Protection When Using Electrical Equipment Within the Areas of Saturn Complexes Where Hazardous Areas Exist, Procedure for
10M04106 Rev. H	Preliminary Saturn V LOR Configuration
20M85015 16 November 1961	Procedure for Cleaning, Testing, and Handling of Onboard Hydraulic System Components and MIL-H-5606 Hydraulic Fluid
10443376 15 September 1961	Standard for Electrical and Electronic Symbols
40M35014A 8 December 1964	Schematic of Saturn V S-II Emergency Detection System
85M06078A 18 November 1963	Launch and Checkout Computer Program Configuration and Control Plan

PUBLICATIONS

Military

MIL-HDBK-5 5 March 1959 August 1962	Strength of Metal, Aircraft Elements (S-II-1 thru S-II-3) (S-II-4 thru S-II-10)
MIL-HDBK-5A 8 February 1966	Strength of Metal, Aircraft Elements (S-II-11 and Subs)

National Aeronautics and Space Administration and Marshal Space Flight Center

M-AERO-D-1-63 29 April 1963	Saturn V Performance Summary and Trajectory Data Based on Specification Weights
M-AERO-G-24-62 4 September 1962	Revision of Natural Environmental Design Criteria, Inflight Wind Conditions, for the Saturn C-5 Vehicles
MSFC SL-9-62 8 November 1962	Structural Loads for the Saturn C-5 LOR Vehicle (Suborbital Start) (for S-II-1 through S-II-3)
MSFC 62/3 15 July 1962	Branch Working Paper
NASA-TM-X-52023 1964 Revision	Terrestrial Environment (Climatic) Criteria Guidelines for Use in Space Vehicle Development
NPC 200-2 20 April 1962	Quality Assurance Provisions for Space System Contractors
SLL-64-26 5 June 1964	Structural Loads for the Saturn V LOR Vehicle (for S-II-4 and subsequent)

GENERAL DOCUMENTS

Bureau of Mines

SCN 119R2

U.S. Air Force

Volume I 1 April 1960	General Range Safety Plan (Consisting of:) Missile Handling
Volume II 6 December 1960	General Range Safety Plan (Consisting of:) Operations Requirements
Exhibit 80-7 26 April 1960	Airborne Flight Termination Systems (Range Safety)

Supersedes Page 8 of January 27, 1967

ARP 598 1 March 1960	Procedure for the Determination of Particulate Contamination of Hydraulic Fluids by the Particle Count Method
ARP 599 19 August 1960	A Dynamic Test Method for Determining the Degree of Cleanliness of the Downstream Side of Filter Elements
ARP 604 31 May 1961	Hose Assemblies, Aircraft and Missiles, High-Temperature, High-Pressure (250,000 Cycles)

Non-Government Documents

The following non-Government documents of the issue shown, or (if undated) in effect on or before 21 May 1962, are part of this specification:

Rocketdyne, North American Aviation, Inc.

R-2158S 5 December 1961	Model Specification...Pounds, Thrust, Oxygen/Hydrogen Liquid-Propellant-Rocket Engine, Rocketdyne Model J-2

Space and Information Systems Division, North American Rockwell, Corp.

SID 62-1254B 8 May 1968	Wiring, Saturn S-II, Installation of, General Specification for	SCN 178

Douglas Aircraft Company

7865719W	Firing Unit, Electronic, Exploding Bridge Wire

Supersedes page 9 of March 7, 1968

DEVIATIONS TO S-II STAGE DOCUMENTS

The following deviations are presented in alpha-numerical order by document. Appendix A contains cross reference indexes of the deviations.

Deviation 298

Requirement: ABMA-Dwg.-10419900, dated 22 June 1960.

Deviation: The requirements of this drawing shall not be applicable to the S-II Stage Engine Actuation System, components, and subassemblies.

Reason: The requirements of the S-II Stage Engine Actuation System, components, and subassemblies are governed by MSFC Dwg. 20M85015.

Effectivity: Battleship Test Vehicle, Electromechanical Mockup, and the three engine actuation systems to be delivered to MSFC; S-II-T, S-II-1, and subs.

Deviation 150 Cleaning and Passivation

Requirement: ABMA-DWG-10419901, dated 27 February 1960, Cleaning and Passivation of Bellows and Ducts, Procedure for.

Deviation: Delete the requirement for compliance with ABMA-DWG-10419901 in its entirety as applicable to the accumulator reservoir manifold assembly (ARMA), servoactuator, main pump, auxiliary motor-pump, quick-disconnect couplings, and bleed valve on the engine actuation system.

Reason: No bellows or ducts are utilized in the design or fabrication of the particular components cited.

Effectivity: S-II-T, S-II-D, S-II-1 and subs; Battleship test vehicle, Electromechanical Mockup, and the three engine actuation systems to be delivered to MSFC.

Deviation 151 Propellant Containers

Requirement: ABMA-DWG-10419925, dated 17 June 1960, Containers, Propellant, Specification for.

Deviation: Delete the requirement for compliance with Drawing ABMA-DWG-10419925 in its entirety as applicable to the accumulator reservoir manifold assembly (ARMA), servoactuator, main pump, auxiliary motor-pump, quick-disconnect couplings, and bleed valve for the engine actuation system.

Reason: No propellant containers are utilized in the design or fabrication of the particular components cited.

Effectivity: S-II-T, S-II-D, S-II-1 and subs; Battleship test vehicle, Electromechanical Mockup, and the three engine actuation systems to be delivered to MSFC.

Deviation 123 Riveting

Requirement: ABMA-DWG-10509301, dated 25 July 1960, Riveting Fabrication and Inspection, Standard for.

Deviation: Delete the requirement for compliance with ABMA-DWG-10509301 in its entirety as applicable to the main pump and bleed valve of the engine actuation system.

Reason: This process and procedure is not utilized in the design, fabrication or inspection of the particular components cited.

Effectivity: S-II-T, S-II-D, S-II-1 and subs; Battleship test vehicle, Electromechanical Mockup, and the three engine actuation systems to be delivered to MSFC.

Deviation 153 Lubricant

Requirement: ABMA-DWG-10509313, dated 28 June 1960, Lubricant, Antiseize and Sealing, Liquid Oxygen Systems, Specification for.

Deviation: Delete the requirement for compliance with ABMA-DWG-10509313 in its entirety as applicable to the accumulator reservoir manifold assembly (ARMA), servoactuator, main pump, auxiliary motor-pump, quick-disconnect couplings, and bleed valve for the engine actuation system.

Reason: The engine actuation system is not a LOX system; therefore antiseize and sealing lubricants are not utilized in the design or fabrication of the particular components cited.

Effectivity: S-II-T, S-II-D, S-II-1 and subs; Battleship test vehicle, Electromechanical Mockup, and the three engine actuation systems to be delivered to MSFC.

Deviation 319

Requirement: ABMA-DWG-10509318, dated 9 July 1960, Paragraph 3.6.1 Wire Braid. - There shall be no missing, kinked, or broken strands of wire braid reinforcing. There shall be no more than one crossover of 2 parallel strands per 6 inches of hose length.

Deviation: There shall be no missing, kinked, or broken strands of wire braid reinforcing. There shall be no more than two crossovers of two parallel strands per six inches of hose length.

Reason: The B revision to ABMA-DWG-10509318 now permits two crossovers of parallel strands per six inches of hose length instead of current limitation of one crossover of two parallel strands per six inches of hose length.

Effectivity: EMM, Battleship, Stages; S-II-T/D, S-II-1 and Subs.

Deviation 69 Cleaning and/or Conditioning

Requirement: ABMA-PD-C-4, dated 25 June 1958, paragraph 3.2. Cleaning and/or conditioning processes. "Cleaning and/or conditioning may be accomplished in accordance with any of the following processes. . . "

Deviation: Cleaning and/or conditioning shall be performed in accordance with NAA process specifications that provide materials and processes which are not injurious to parts.

Reason: NAA has existing facilities and procedures that provide assurance equivalent to Specification ABMA-C-4 and alternate methods, if required.

Deviation 146 Cable and Harness Assemblies

Requirement: ABMA-PD-C-711A, dated 15 December 1959, Cable and Harness Assemblies, Electrical, Missile System: General Specification.

Deviation: Delete the requirement for compliance to Specification ABMA-PD-C-711A in its entirety as applicable to accumulator reservoir manifold assembly (ARMA), servoactuator, main pump, auxiliary motor-pump, quick-disconnect couplings, and bleed valve on the engine actuation system.

Reason: No cable or harness assemblies are utilized in the design or fabrication of the particular components cited.

Effectivity: S-II-T, S-II-D, S-II-1 and subs; Battleship test vehicle, Electromechanical Mockup, and the three engine actuation systems to be delivered to MSFC.

Deviation 8 Insulation Resistance

Requirement: ABMA-PD-C-711A, 15 December 1959, paragraph 3.5.2. The insulation resistance of assemblies shall not be less than the following:

a. Assemblies not exceeding 100 feet: 100 megohms

b. Assemblies between 100 and 300 feet: 75 megohms

c. Assemblies exceeding 300 feet: 50 megohms

Deviation: The insulation resistance of assemblies consisting of 100 conductors or less shall not be less than the following:

a. Assemblies not exceeding 100 feet: 100 megohms

b. Assemblies between 100 and 300 feet: 75 megohms

c. Assemblies exceeding 300 feet: 50 megohms

Reason: Insulation resistance decreases as the total number of conductors increases.

Deviation 143 Electrical Wiring Procedures

Requirement: ABMA-PD-E-53, dated 11 February 1960, Electrical Wiring Procedures.

Deviation: Deleted the requirement for compliance with ABMA-PD-E-53 in its entirety as applicable to accumulator reservoir manifold assembly (ARMA), servoactuator, main pump, auxiliary motor-pump, quick disconnect couplings, and bleed valve on the engine actuation system.

Reason: This process and procedure are not utilized in the design, fabrication, or inspection of the particular components cited.

Effectivity: S-II-T, S-II-D, S-II-1 and subs; Battleship test vehicle, Electromechanical Mockup, and the three engine actuation systems to be delivered to MSFC.

Deviation 118 SCOPE

Requirement: ABMA-PD-E-53, 11 February 1960, paragraph 1.1. "This specification covers the fabrication of.... Alternate procedures proposed by the contractors require the prior written approval of the procuring agency."

Deviation: The Contractor requests approval for the use of the resistance welding method for the fabrication of electronic modules and electrical connections.

Reason: Welded electronic modules and electrical connections provide greater reliability coupled with weight and space saving.

Effectivity: Battleship Test Vehicle, Electromechanical Mockup, S-II-S and subs., and associated ground support equipment.

SCN 114

Deviation 336 Electrical Wiring Procedures

Requirements: ABMA-PD-E-53, Electrical Wiring Procedures, Paragraph 3.1.4 calls for use of MIL-Y-1140 tape (Lacing Cord).

Deviation: Paragraph 3.1.4. In place of MIL-Y-1140 tape, authorize use of MIL-T-713, Type P, Class 2 tape for use on the S-II Propellant Utilization Computor with the following part numbers and effectivities:

PART NUMBER	VEHICLE
ME901-0206-0019	S-II-1, 2 and 3
ME901-0206-0018	S-II-4 and Subs

Effectivity: Saturn S-II and Subs.

Deviation 70 Connectors

Requirement: ABMA-PD-E-53, dated 11 February 1960, paragraph 3.1.6. "Connectors shall be in accordance with MIL-C-5015, Type E or MIL-C-26482."

Deviation: Connectors shall be in accordance with MIL-C-5015, Type R, or MIL-C-0026482.

New Page

Reason: MIL-C-5015, Type E, and MIL-C-26482 are inactive for new design. The use of MIL-C-0026482 incorporating removable crimp-type contacts for better mechanical strength and electrical continuity is preferred. MIL-C-5015, Type R, replaces Type E and is superior to Type E relative to meeting environmental requirements.

Deviation 71 Insulation Sleeving

Requirement: ABMA-PD-E-53, 11 February 1960, paragraph 3.1.9. "Insulation sleeving shall be in accordance with MIL-I-7444."

Deviation: Insulation sleeving shall be in accordance with MIL-I-7444 or MIL-I-18057.

Reason: MIL-I-18057 extends temperature range of sleeving.

Deviation 106 Insulation Sleeving

Requirement: ABMA-PD-E-53, 11 February 1960, paragraph 3.1.9. "Insulation sleeving shall be in accordance with Specification MIL-I-7444."

Deviation: Insulation sleeving shall be in accordance with Specification MIL-I-7444. Where a heat-shrinkable tubing is desired, a thermally stabilized, irradiated polyolefin sleeving or a modified polytetrafluoroethylene sleeving (both to Specification MB0150-007) shall be used. For high temperature use up to an operating temperature of 650 C where a low dielectric strength and low voltage application is required, an uncoated braided, glass yarn sleeving (to Specification NA2-41101) may be used.

Reason: The heat-shrinkable tubing can be installed more quickly and affords equivalent protection. Application of Specification MIL-I-7444 sleeving requires the use of a dilator fluid which is both toxic and flammable. For this reason, the use of this type of sleeving requires an adequate ventilation system to be installed.

The glass yarn sleeving is capable of withstanding greater temperatures than the teflon sleeving.

Deviation 72 Shield Termination

Requirement: ABMA-PD-E-53, 11 February 1960, paragraph 3.2.3 and Figure 1. "Figure 1 shows shields interconnected with jumper wires in series, leading to common ground wire."

Deviation: Groups of ground jumpers shall be connected individually to the common ground wire, or by common shield ground jumpers interconnected in closed end connectors (bomb tails). Figure 1 should show jumper wires to their respective ferrules.

Reason: Individual grounding provides for more economical and efficient maintenance and repair.

Deviation 73 Shield Separation

Requirement: ABMA-PD-E-53, 11 February 1960, paragraph 3.2.3.1. "The strands of the shield wire shall be separated . . . as shown in Figure 2."

Deviation: The shield should be separated from the conductor by use of a two-piece ferrule installation.

Reason: The method per ABMA-PD-E-53 results in a bulky and expensive installation.

Deviation 74 Lacing and Sleeving

Requirement: ABMA-PD-E-53, 11 February 1960, paragraph 3.2.3.2. "The loose end of the shield . . . and a second wrapping of lacing . . . shall be wrapped around the entire assembly. The wrapping shall consist of a spot tie of at least four turns."

Deviation: Two-piece ferrule installation shall be used instead of lacing and sleeving.

Reasons: Lacing and sleeving are slow-production processes with costs greater than those acquired with ferrules. In addition, more time is required by Inspection and Quality Control personnel to qualify the lacing and sleeving methods.

Deviation 75 Grounding to Structure

Requirement: ABMA-PD-E-53, 11 February 1960, paragraph 3.2.3.3. "When the cable, harness, or wire bundle . . . are to be grounded . . . individual shields will be terminated. The complete assembly shall be shown in Figure 8.

Deviation: Two-piece ferrules shall be used for grounding to structure.

Reason: The method per ABMA-PD-E-53 is too costly. If repairs have to be made, it would be necessary to re-encapsulate the installation.

Deviation 76 Two-piece Ferrules

Requirement: ABMA-PD-E-53, 11 February 1960, paragraph 3.2.3.5.1. "A single-piece ferrule . . . may be used. If the ferrule assembly is not insulated, place a piece of sleeving over the assembly."

Deviation: Two-piece ferrules, such as Burndy grounding sheath connectors, shall be used.

Reasons: Single-piece ferrules require slow, and costly assembly methods. In addition, inspection practices require more time than when two-piece ferrule construction is used.

Deviation 265 Lacing of Wire Bundles, Harnesses, and Cables

Requirement: ABMA-PD-E-53, Paragraph 3.2.7. "All wire bundles, harnesses and cables should be continuously laced when the length is sufficient to accommodate two complete stitches. Spot ties may be substituted for a continuous lace within subassemblies when the lacing length is less than four complete stitches."

Deviation: Paragraph 3.2.7: spot tying of all wire bundles, harnesses and cables on stage equipment for use on the Electromechanical Mockup and the Battleship test vehicle shall be acceptable.

Reason: Deliverable stage equipment related to the EMM on Battleship test vehicle.

Deviation 182 Electrical Quick Disconnects

Requirement: ABMA-PD-E-53 references, MIL-C-26482 (ASG), Notice 2, dated 9 February 1961.

Deviation: Delete the requirements of MIL-C-26482 (ASG), Notice 2, dated 9 February 1961. Electrical quick disconnects shall be fabricated in accordance with MIL-C-26482C, Amendment 1, dated 20 February 1963.

Reason: The superseding issue (MIL-C-26482C, Amendment 1) is not materially different from the contractual document (MIL-C-26482 (ASG), Notice 2) and is therefore acceptable to S&ID.

Effectivity: This deviation shall apply to the Electromechanical Mockup, the Battleship test vehicle, and to stages S-II-T, S-II-D, S-II-1, and subs.

Deviation 145 Sealed Relays

Requirement: ABMA-PD-R-187, dated 7 November 1958, Relays, Hermetically Sealed, Missile Equipment.

Deviation: Delete the requirement for compliance to Specification ABMA-PD-R-187 in its entirety as applicable to accumulator reservoir manifold assembly (ARMA), servoactuator, main pump, auxiliary motor-pump, quick-disconnect couplings, and bleed valve on the engine actuation system.

Reason: No hermetically sealed relays are utilized in the design of fabrication of the particular components cited.

Effectivity: S-II-T, S-II-D, S-II-1 and subs; Battleship test vehicle, Electromechanical Mockup, and the three engine actuation systems to be delivered to MSFC.

Deviation 17 Ceramic Insulation

Requirement: Specification ABMA-PD-R-187, 7 November 1958, paragraph 3.4.2. "Ceramic insulating material shall conform to grade L3B of Specification JAN-I-30. All external ceramic surfaces shall be glazed in accordance with Specification JAN-I-10."

Deviation: Ceramic insulating material shall conform to grade L311, or better, of Specification MIL-I-10A. All external ceramic surfaces shall be glazed in accordance with Specification MIL-I-10A.

Reason: JAN-I-30 does not exist, and JAN-I-10 has been superseded by Specification MIL-I-10A.

Deviation 21 Metals

Requirements: ABMA-PD-R-187, 7 November 1958, paragraph 3.4.4. "Metals shall be non-magnetic and corrosion-resistant alloys."

Deviation: Metals shall be corrosion-resistant alloys.

Reason: The requirement to use only nonmagnetic metals would preclude the operation of standard relays.

Deviation 32 Terminal Strength

Requirement: ABMA-PD-R-187, November 1958, paragraph 3.7.1.2. "At the point where the lead from the external circuit connects to it, the terminal shall be capable of having force gradually applied in the direction most likely to cause damage and increased gradually to 5 pounds and held at that value for at least 30 seconds without loosening or causing other damage to the terminals."

Deviation: "At the point where the lead from the external circuit connects to it, the terminal shall be capable of having force gradually applied in the direction most likely to cause damage and increased gradually to 5 pounds for leads of 0.035-inch diameter and larger, or to 2.5 pounds for leads smaller than 0.035-inch diameter. The force shall be held at said value for at least 30 seconds without loosening or causing other damage to the terminals."

Reason: A 5-pound pull test is too severe for leads smaller than 0.035 inch in diameter, using existing headers.

Deviation 23a Contact Bounce

Requirement: ABMA-PD-R-187, 7 November 1958, paragraph 3.7.2.3. "The duration of contact bounce (see 6.6.6) shall not exceed 500 microseconds."

Deviation: The duration of contact bounce shall not exceed two (2) milliseconds for 2-amp relays and 10-amp relays. SCN 24

Effectivity: All S-II Stages

Deviation 192 Relay Color Coding

Requirement: ABMA-PD-R-187, Paragraph 3.10.2.

"Terminal marking. - Relay header beads shall be permanently color-coded, using bright colors, in accordance with the following:

(a) Normally closed contact - brown
(b) Normally open contact - green

(c) Moveable contact - yellow
(d) Pin 19 - blue (see individual specification sheet)
(e) Pin 20 - white (see individual specification sheet)
(f) Pin 21 - white, if applicable (see individual specification sheet)."

Deviation: Relay headers for airborne relays used in potted assemblies may be marked with only one colored bead and one colored dot in lieu of the required eight colored beads.

Reason: The requested deviation demonstrates the system which is in standard use at S&ID. The original requirement is more complicated and does not adequately identify the terminals. To identify the terminals readily, a blue bead marking terminal and a red dot between Pins 1 and 6 are used to orient the relay with the diagram on the case. In the identification of terminals, this system lessens the chance of error due to poor color perception. S-II airborne and GSE relays which use the deviated color coding are potted in modules; therefore, the relay header color coding system is invisible and unimportant in all areas subsequent to module assembly at S&ID. The specification controlling S-II relays has been changed to reflect the use of deviated color coding in potted assemblies only.

Effectivity: This deviation shall apply to the Battleship test facility, the Electromechanical Mockup, S-II-S, S-II-T, S-II-1, and subsequent flight stages.

Deviation 283 Aluminum Specifications

Requirement: ABMA-PD-W-45A, dated 22 September 1959, paragraph 2.1, references the following specifications:

QQ-A-255	QQ-A-283	QQ-A-357
QQ-A-261	QQ-A-287	QQ-A-359
QQ-A-266	QQ-A-315	QQ-A-362
QQ-A-267	QQ-A-318	QQ-A-411
QQ-A-268	QQ-A-325	QQ-A-561
QQ-A-270	QQ-A-327	MIL-A-19070
QQ-A-277	QQ-A-355	MIL-A-19842
QQ-A-282	QQ-A-356	

Deviation: The above specifications have been replaced, respectively, by the following:

QQ-A-250/3c	QQ-A-250/12c	QQ-A-200/1a
QQ-A-200/2b	QQ-A-250/13c	QQ-A-250/2b
QQ-A-225/4b	QQ-A-225/7a	QQ-A-250/5c

QQ-A-200/3b	QQ-A-250/8c	QQ-A-225/1b
QQ-A-225/6b	QQ-A-225/8b	QQ-A-250/1c
QQ-A-200/8b	QQ-A-250/11c	QQ-A-250/7c
QQ-A-200/11b	QQ-A-250/4c	QQ-A-250/9d
QQ-A-225/9b	QQ-A-225/2b	

Reason: The old aluminum specifications for wrought products were cancelled on 16 December 1963. The "slash number" specifications were released to supersede the cancelled ones. The new "slash number" specifications cover the same alloys as the old specifications. Therefore, the weldability is the same. Since ABMA-PD-W-45A is concerned with welding only, the change to the new specifications is entirely inconsequential to the intent of the documents.

Deviation 144 Certification for Fusion Welding

Requirement: ABMA-PD-W-153, dated 26 May 1958, Certification of Welding Operators for Fusion Welding Guiding Missile Airframes.

Deviation: Delete the requirement for compliance with ABMA-PD-W-153 in its entirety as applicable to the accumulator reservoir manifold assembly (ARMA), servoactuator, main pump, auxiliary motor-pump, quick-disconnect couplings, and bleed valve on the engine actuation system.

Reason: This process and procedure are not utilized in the design, fabrication, or inspection of the particular components cited.

Effectivity: S-II-T, S-II-D, S-II-1 and subs; Battleship test vehicle, Electromechanical Mockup, and the three engine actuation systems to be delivered to MSFC.

Deviation 135 Aluminum Welding Studs

Requirement: ABMA-PD-W-488A, dated 15 September 1959, Welding, Stud, Aluminum Alloy, Process for.

Deviation: Delete the requirement for compliance with ABMA-PD-W-488A in its entirety as applicable to the servoactuator in the engine actuation system.

Reason: This process and procedure are not utilized in the design, fabrication, or inspection of the particular component cited.

Effectivity: S-II-T, S-II-D, S-II-1 and subs: Battleship test vehicle, Electromechanical Mockup, and the three engine actuation systems to be delivered to MSFC.

Deviation 289

Requirement: ABMA-PD-W-488A, dated 15 September 1959, Table 1, referenced in paragraph 3.3.1, references the following specifications: QQ-A-255, QQ-A-318, MIL-A-19070, MIL-A-19842, QQ-A-327.

Deviation: The above specifications have been replaced, respectively, by the following specifications: QQ-A-250/3c, QQ-A-250/8c, QQ-A-250/7c, QQ-A-250/9d, QQ-A-250/11c.

Reason: The old aluminum specifications were cancelled on 16 December 1963. New "slash number" specifications were released to supersede the cancelled ones. The new "slash number" specifications cover the same alloys as the old specifications. Therefore, the weldability is unaffected. Since ABMA-PD-W-488A is concerned with stud welding only, these changes are inconsequential to its intent.

Effectivity: All Stages.

Deviation 140 Aluminum Welding Preparation

Requirement: ABMA-STD-3(1), dated 27 June 1958, Etching of Aluminum Before Spot Welding.

Deviation: Delete the requirement for compliance with ABMA-STD-3(1) in its entirety as applicable to the bleed valve on the engine actuation system.

Reason: This process and procedure are not utilized in the design, fabrication, or inspection of the particular component cited.

Effectivity: S-II-T, S-II-D, S-II-1 and subs; Battleship test vehicle, Electromechanical Mockup, and the three engine actuation systems to be delivered to MSFC.

Deviation 148 Printed Circuits

Requirement: ABMA-STD-428B, dated 8 April 1960, Printed Circuit Design and Construction Standard.

Deviation: Delete the requirement for compliance to Standard ABMA-STD-428B in its entirety as applicable to accumulator reservoir manifold assembly (ARMA), servoactuator, main pump, auxiliary motor-pump, quick-disconnect couplings, and bleed valve on the engine actuation system.

Reason: No printed circuits are utilized in the design or fabrication of the particular components cited.

Effectivity: S-II-T, S-II-D, S-II-1 and subs; Battleship test vehicle, Electromechanical Mockup, and the three engine actuation systems to be delivered to MSFC.

Deviation 10 Terminal Pad Size; Disconnect Pad; Component Part Termination

Requirement: ABMA-STD-428B, 8 April 1960, paragraphs 3.7.10.1, 3.7.10.2, and 3.7.10.3:

Paragraph 3.7.10.1 - "Standard terminal pad for solder connection:. . shall be 0.060 inch greater than required lead access hole. . . minimum pad of 0.030 inch."

Paragraph 3.7.10.2 - "Pads that might be subject. . . shall be 0.20 inch greater in diameter. For plated-through or unplated. . . pad shall be 0.030 inch greater diameter than the hole."

Paragraph 3.7.10.3 - "The component part termination hole should be. . . 0.015 inch. . . 2 or miniaturization 0.10 inch copper. . . provided component lead diameter is no greater than 0.020 inch."

Deviation: Only plated-through holes shall be used with no discontinuities in either copper or gold in hole walls. Pads or width of copper from inside diameter of hole to periphery of terminal point shall be not less than 0.010 inch.

Reason: When using plated-through holes, the quality and reliability of the solder joint is dependent on ability to obtain complete flow-through and complete filling of the hole (by capillary action). Reliability of the solder joint is not dependent on excess horizontal surface area to be soldered. Small-diameter holes with small-diameter component leads indicate that continuous 0.010 pad edge would be satisfactory.

Deviation 9a Plating

Requirement: ABMA-STD-428B,. 8 April 1960, paragraph 3. 8. 4. "The surface finish on all boards shall be gold-plating Sel-Rex bright or hard gold or equivalent 0. 000100-inch minimum to approximately 0. 000150-inch maximum . . . ."

Present Deviation: Circuitry and all plated-through holes shall be electrodeposited tin-lead (Sn 63 ± 5 percent) with a thickness of 0. 0003 to 0. 0007-inch reflow using a hot wax process. Etched edges of circuits need not be plated.

Deviation: Circuitry and all plated-through holes shall be electrodeposited tin-lead (Sn 60 ± 10 percent) with a minimum thickness of 0. 0003 inch. Etched edges of circuits need not be plated.

Reason:

Reference:

(a) Autonetics QRS Lab. Lab Memo PC-12-3-14, dated 12-17-63, "Delamination of the Printed Circuit Board Base Material During the Solder Reflowing Operation"

(b) Autonetics QRS Lab. Lab Memo PC-9-3-6, dated 9-10-63, "Fused Vs. Unfused Solder Plated Printed Circuits"

(c) Autonetics QRS Lab. Lab Memo PC-11-3-12, dated 11-7-63, "Fused Vs. Unfused Solder Plated Circuit Boards; Supplementary Report"

(d) Autonetics M&P Lab. TR-63-332, dated 16 May 1963, "Metallographic Investigation of Solder-Copper Reactions on Solder Coated Copper Circuitry"

(e) Tin Research Institute, Greenford, Middlesex, England, "The Solderability of Some Tin, Tin Alloy and Other Metallic Coatings," by C. J. Thwaites, April 1960

Tests by NAA and vendors indicate that solder plating of this type is superior to gold plating in solderability, conductivity, and reliability. The hot wax reflow process has a detrimental effect on the epoxy coating, and the advantages of a longer shelf life (if any) are therefore outweighed by this detrimental effect. The hot wax process actually decreases the reliability of the board. Solderability is not affected by deletion of the process.

This requirement to improve the solder quality and reduce the number of soldered hole imperfections in a component assembled printed circuit board is justified in view of the test data accumulated by numerous electronic firms employed in aerospace projects. However, due to the reflow requirements, the rejection rate for circuit boards shipped into this facility is so high that very few boards have passed inspection. The discoloration spots found around terminal areas and circuitry accounts for the majority of the rejections and is considered by NASA to be a defect that impairs the reliability and usefulness of the circuit board. These spots are a direct result of the board being exposed to high temperatures during the reflow operation. Tests conducted by NAA on the discoloration spots show that although the appearance of the board has been affected, the electrical properties, when compared with boards without spots, have not changed. The elimination of the reflow operation will resolve the problem of the discoloration spots; however, there are some doubts that unfused and fused solder plating are equal in solderability.

A survey of literature has been conducted to determine if unfused solder plate can be used in production facilities without impairing the solderability of terminal areas during component assembly. In Reference (a), the conclusions were, "The delamination is a function of the hot oil bath, the base material and the circuit design." Test procedures in this report indicated that reflow operations were varied in temperature, time and quenching medium without eliminating the susceptibility of some boards to delaminate. The investigation did not reveal any method of fusing circuit boards without some minor delamination being produced. The solderability of fused and unfused boards was evaluated in Reference (b) and Reference (c). The results of the tests performed disclosed no differences between the fused and unfused solder plate when tested for solderability, and recommendation was that the fusing operation should be eliminated. By eliminating this operation, side benefits such as less holes out of tolerance, no exposures of boards to trichloroethylene solvent, and less warpage, could be realized. In a report, Reference (d), on copper reaction with solder plating to determine the interfaced solid-state diffusion during aging, the following observations were noted. "The interface phases in the reflowed samples were approximately twice as thick as those in the unfused samples." When the interface phases penetrate the solder plating, the solderability of that surface is materially reduced. The Tin Research Institute, Reference (e), released a report on Solderability of Tin Alloys, noting that, "As-deposited solder coatings of 0.0003-inch-thick minimum provided adequate soldering properties when stored either in a storeroom or hot steam atmosphere."

Effectivity: This deviation is applicable to Saturn S-II Stages S-II-S and subsequent.

Deviation 149 Printed Circuit Soldering

Requirement: ABMA-STD-428B references, ABMA-DWG-8931071, dated 8 April 1960, Printed Circuit Soldering and Inspection Procedures.

Deviation: Delete the requirement for compliance with Drawing ABMA-DWG-8931071 in its entirety as applicable to the accumulator reservoir manifold assembly (ARMA), servoactuator, main pump, auxiliary motor-pump, quick-disconnect couplings, and bleed valve for the engine actuation system.

Reason: No printed circuits are utilized in the design or fabrication of the particular components cited.

Effectivity: S-II-T, S-II-D, S-II-1 and subs; Battleship test vehicle, Electromechanical Mockup, and the three engine actuation systems to be delivered to MSFC.

Deviation 14 Certification of Components

Requirement: AFMTC Regulation 80-7, dated 26 April 1960, paragraph 4c: "The proposal will include certification by the launching agency that all components of the flight termination system will function under all environmental conditions to which they will be subjected, (i.e., extremes of altitude, temperature, pressure, and acceleration). In the case of ballistic missiles, this certification need apply only to environmental conditions encountered during the powered phases of flight."

Deviation: NAA/S&ID shall not be required to furnish certification of the EBW Detonators, EBW Firing Units, Safety and Arming Devices, Destruct Controllers, and Timing Devices, provided that the aforementioned ordnance items are installed so that they are not subjected to environments greater than those to which they have been qualified. Certification shall be the responsibility of MSFC.

Reason: The contractor has been directed by NASA letter M-S-II/NAA-L-113 to use these components; therefore, NAA/S&ID has no control over the design of these components. MSFC should assume responsibility for certification.

Deviation 15 Primer Circuitry

Requirement: AFMTC Regulation 80-7, dated 26 April 1960, Paragraph 5f. "Primer Circuitry must be properly shielded, filtered, grounded and/or otherwise isolated to preclude extraneous voltages. Electrical shorts must be maintained across all primers until the destructor is armed. For ground safety purposes and to facilitate simultaneous multiple missile checkout, provisions must be made to open the primer circuit at any time during the prelaunch phase."

Deviation: NAA/S&ID shall not be required to apply or maintain electrical shorts across the primers until the destructor is armed or make provisions to open the primer circuit at any time during the prelaunch phase.

Reason: The inherent nature of the EBW system makes it impractical and unnecessary to short across primers or open primer circuits at any time during the prelaunch phase.

Deviation 11 Safe/Arm Device Simulator

Requirement: AFMTC REG 80-7, 26 April 1960, paragraph 5h. The simulator will provide (1) termination of the primer circuit with an impedance equal to the nominal impedance of the destructor primers; (2) a primer circuit current monitoring device capable of indicating a minimum of one milliampere; (3) an aural or visual alarm if the primer circuit current exceeds the maximum allowable continuous current which will not actuate the detonator.

Deviation: The simulator shall provide a monitor to indicate breakdown of the exploding bridge wire (EBW) firing unit gap tube. In conjunction with the simulator, a monitor of the voltage on the EBW firing unit energy-storage capacitor shall be used. These monitors shall initiate an aural or visual alarm if the EBW firing unit exhibits a condition in opposition to commands.

Reason: Regulation 80-7 simulator requirement is not applicable to an EBW detonator because the type and range of sensitivity of an EBW detonator varies greatly from that of a conventional electric primer.

Deviation 129 High Temperature, High Pressure Hoses

Requirement: ARP 604A, dated 31 May 1961, Hose Assemblies, Aircraft and Missiles, High-Temperature, High-Pressure (250,000 Cycles).

Deviation: Delete the requirement for compliance with ARP 604A in its entirety as applicable to the accumulator reservoir manifold assembly, servoactuator, main pump, auxiliary motor-pump, quick disconnect couplings, and bleed valve.

Reason: Hose assemblies are not utilized in the design, fabrication, or inspection of the particular components cited.

Effectivity: S-II-T, S-II-D, S-II-1 and subs, Battleship test vehicle, Electromechanical Mockup, and the three engine actuation systems to be delivered to MSFC.

Deviation 292

Requirement: ARP 604A, dated 31 May 1961, paragraph 4.3.1.3, Oil Aging: "In all the tests using oil-aged samples, the hose assemblies should be filled, with no pressure, with a high temperature test fluid and soaked in an air oven at a temperature of 400 F for seven days."

Deviation: In all of the tests using oil-aged samples, the hose assemblies shall be filled with no pressure, with hydraulic fluid and soaked in an air oven at a temperature of 275 F for 8 hours.

Reason: The 400 F and seven day requirements greatly exceed the environmental conditions encountered in the engine actuation system.

Effectivity: All Stage.

Deviation 293

Requirement: ARP 604A, dated 31 May 1961, paragraph 4.3.1.4, Air Aging: "Air-aged samples shall be kept in air at a temperature of 400 F for 7 days."

Deviation: Air-aged samples shall be kept in air at a temperature of 275 F for 8 hours.

Reason: The 400 F and 7-day requirements greatly exceed the environmental conditions encountered in the engine actuation system.

Effectivity: All Stage.

Deviation 294a

Requirement: ARP 604A, dated 31 May 1961, paragraph 4.4.8, Impulse Test. The Table under Section C contains the following:

Size	Minimum Number of Impulse Cycles
-8	250,000
-10	100,000
-12	100,000

Deviation: Substitute 50,000 cycles for these three items.

Reason: The above cycles are far in excess of the cycles actually encountered in operation.

Effectivity: This deviation is effective on the Battleship; Electromechanical Mockup; and the three engine actuation systems to be delivered to MSFC: S-II-T; S-II-S/D; and S-II-1 and subsequent.

Deviation 304a

Requirement: ARP 604A, dated 31 May 1961, paragraph 4.4.9 (a), (c), (d), (e), and (f) as follows:

(a) The test assemblies shall be soaked, with no pressure or flexing at a temperature of -67°F ±2°F for a minimum of one hour.

(c) Flexing shall begin while the test assemblies are pressurized to the operating pressure with the temperature still at -67°F for a minimum of 2000 cycles.

(d) With the pressure reduced to zero psi, flexing shall continue for 500 cycles at -67°F.

(e) Increase the temperature to 400°F and flex for 500 cycles with the pressure at zero psi. The pressure shall then be increased to the operating pressure with the temperature held at 400°F. Flexing shall continue until an accumulated total of 40,000 cycles is reached.

(f) Steps a, c, d, and e shall be repeated for a total of 10 test sequences, i.e., 400,000 flexing cycles.

Deviation:

(a) The test assemblies shall be soaked, with no pressure or flexing, at a temperature of -67°F ±2°F for a minimum of one hour.

(c) Flexing shall begin while the test assemblies are pressurized to the operating pressure with the temperature still at -67°F for a minimum of 1000 cycles.

(d) With the pressure reduced to zero psi, flexing shall continue for 250 cycles at -67°F

(e) Increase the temperature to 400°F and flex for 250 cycles with the pressure at zero psi. The pressure shall then be increased to the operating pressure with the temperature held at 400°F. Flexing shall continue until an accumulated total of 20,000 cycles is reached.

(f) Steps a, c, d, and e shall be repeated for a total of 5 test sequences, i.e., 100,000 flexing cycles.

Reason: The 400,000 flexing cycles are far in excess of the cycles encountered in operation, and the 5 test sequences are more realistic than the 10 test sequences.

Effectivity: This deviation is effective on the Battleship; Electromechanical Mockup and the three engine actuation systems to be delivered to MSFC; S-II-T; S-II-S/D; and S-II-1 and subsequent.

Deviation 154 Inflight Wind Conditions

Requirement: M-AERO-G-24-62, dated 4 September 1962, Revision of Natural Environmental Design Criteria, Inflight Wind Conditions, for the Saturn C-5 Vehicles.

Deviation: Delete the requirement for compliance to Specification M-AERO-G-24-62 in its entirety as applicable to the accumulator reservoir manifold assembly (ARMA), servoactuator, main pump, auxiliary motor-pump, quick-disconnect couplings, and bleed valve for the engine actuation system.

Reason: This specification is not applicable to the design, fabrication, or inspection of the particular components cited.

Effectivity: S-II-T, S-II-D, S-II-1 and subs; Battleship test vehicle, Electromechanical Mockup, and the three engine actuation systems to be delivered to MSFC.

Deviation 323 Anodic Coating

Requirement: MIL-A-8625A, dated December 14, 1954, Paragraph 1.2. Classification - "Anodic coatings shall be of one grade only and of the following two types as specified:

Type I - Chromic-acid coatings
Type II - Sulphuric-acid coatings"

Deviation: Anodic coating per Aerospace Material Specification, AMS2468A, may also be used.

Reason: Specification AMS2468A allows (1) hard anodic coating without sealing to provide the maximum degree of abrasion resistance, (2) drawing callout of coating thickness to improve producibility.

Effectivity: All ME273-0055 Type I, II and III disconnect couplings.

Deviation 125 Electrical Bonding

Requirement: MIL-B-5087A(1), dated 29 January 1958, Bonding, Electrical (for Aircraft).

Deviation: Delete the requirement for compliance to Specification MIL-B-5087A(1) in its entirety as applicable to the quick-disconnect couplings and bleed valve of the engine actuation system.

Reason: Electrical bonding as defined in this specification MIL-B-5087A(1) is not required in the design or fabrication of the particular components cited.

Effectivity: S-II-T, S-II-D, S-II-1 and subs; Battleship test vehicle, Electromechanical Mockup, and the three engine actuation systems to be delivered to MSFC.

Deviation 20 Bonding Jumpers

Requirement: MIL-B-5087A(1), 29 January 1958, paragraph 3.1.1. "Bonding jumpers shall conform to Standard MS25083."

Deviation: Round bonding jumpers shall conform to Standard MS25083.

Reason: The requirement above is restrictive and, therefore, eliminates use of flat braided copper strap for bonding jumpers. A flat strap generally has lower RF impedance than a round conductor of the same cross-sectional area.

Deviation 1 Purposes of Bonding

Requirement: MIL-B-5087 A (1), 29 January 1958, paragraph 3.2. "The bonding shall be so designed and so executed as to achieve the following results: Provide power-current and, where applicable, fault-current return paths."

Deviation: Bonding shall not be used for the purpose of power-current return. Power current return shall be accomplished by negative and neutral insulated cables to the power source. The cables shall be bonded to the vehicle structure at one point only.

Reason: To avoid interference in sensitive systems caused by electrical coupling with other systems using the missile airframe, in common, as negative and neutral returns.

Deviation 103 Induction Brazing

Requirement: MIL-B-7883(1), 28 January 1954, paragraph 4.2.3. "The mating surfaces shall be coated with flux. . . ."

Deviation: The mating surfaces shall be coated with flux (unless brazing is to be performed in a vacuum or an inert atmosphere). . . .

Reason: Cleanliness requirements for tubing and plumbing systems preclude the use of flux. Flux in plumbing systems could not be removed with solvent after brazing.

Deviation 104 Stainless Steel

Requirement: MIL-B-7883(1), 28 January 1954, paragraph 6.5. ". . . . the joint should be cleaned and degreased immediately prior to brazing. . . ."

Deviation 348 Drawing Title Block Changes

Requirement: MIL-D-70327(1), 1 July 1959, invokes MIL-STD-2B, Paragraph 5.3.1, ''Title. Title block shall conform to Figure 7 and shall be located in the lower right corner of each drawing, as shown in Figure 3. Arrangement and usage of individual blocks shall conform to the following:''

Deviation: The positions of the Code Identification Number (Block F) and the Drawing Size (Block G) shall be reversed.

Effectivity: This deviation shall be effective on new drawings prepared for Saturn S-II stages after January, 1968. Current stocks of old vellums will be used to depletion.

Deviation 349 Drawing Revision Block Changes SCN 201R2

Requirement: MIL-D-70327(1), 1 July 1959, invokes MIL-STD-2B, Paragraph 5.3.2.2, ''Contents. The SYM, DESCRIPTION, DATE, and APPROVED Columns shall be included on all drawings. The ZONE heading may be shown on all Revision Blocks. The ZONE Column need be added only when zoning is used.'' (See Figure 9.)

Deviation: The location of the LETTER Column, which replaces the SYM Column, shall be adjacent to the left side of the DESCRIPTION Column, and the ZONE Column location shall be adjacent to the left side of the LETTER Column.

Effectivity: This deviation shall be effective on new drawings prepared for Saturn S-II stages after January 1968. Current stocks of old vellums will be used to depletion.

Deviation 350 Drawing Parts List Change

Requirement: MIL-D-70327(1), 1 July 1959, invokes MIL-STD-2B, Paragraph 5.3.3.1, ''Columnar Tabulation. A list of materials or parts list shall provide a column for, and a tabulation of, the following: quantity required, item nomenclature or description, and item identification number.''

Deviation: Columnar Tabulation - A list of materials or parts list shall provide a column for, and a tabulation of the following: quantity required, item nomenclature or description, and identification number, and shall be identified as a parts list.

Effectivity: This deviation shall be effective on new drawings prepared for Saturn S-II stages after January 1968. Current stocks of old vellums will be used to depletion.

Deviation: The components of a joint shall be protected after cleaning. Small components shall be enclosed in a Polyamide bag. Tubing 24 inches or less shall be enclosed in a heat-sealed Polyethylene sleeve, and tubing in excess of 24 inches shall be enclosed in a Polyethylene bag and taped in place until joint assembly.

Reason: With fluxless brazing, parts which have been fabricated (in some cases with braze-alloy-preforms in place), cleaned, and packaged by the vendor, cleanliness requirements are so severe that additional handling would actually contaminate the parts.

Deviation 105 Stainless Steel

Requirement: MIL-B-7883(1), 28 January 1954, paragraph 6.5. "....braze alloy conforming to Class 5 of QQ-S-561 should be used."

Deviation: ....braze alloy conforming to Specification AMS 4778 shall be used.

Reason: Specification QQ-S-561 does not permit vacuum or controlled atmosphere brazing for plumbing systems; it requires flux, which is difficult to remove and is reactive to S-II propellants. Specification AMS 4778 has been tested and found suitable for cryogenic applications.

Deviation 281 Schematic Drawing Numbering

Requirement: MIL-D-70327(1) dated 16 March 1959, paragraph 3.1.3, "Drawing sizes shall be in accordance with MIL-STD-2." MIL-STD-2b, dated 25 August 1960, paragraph 5.3.1.8.4. - "Multisheet, Block L. - Block L is reserved for sheet numbers of multisheet and book form drawings. The total number of sheets shall be numbered on consecutive order (Sheet 2, 3, etc.). (See Figure 8).

Deviation: Block L is reserved for sheet numbers of multisheet and book form drawings. The total number of sheets shall be shown only on Sheet 1 (example: Sheet 1 of 4). Remaining sheets shall be numbered on consecutive order (Sheet 2, 3, etc.). An acceptable alternate method of numbering is to point-number the sheets (example: 1, 1.1, 1.2, 2.2).

Reason: Saturn stage harnesses are prepared as book form drawings and when additions or deletions are required, the point-numbering procedure will eliminate the need for renumbering every sheet of the book form drawing. Each of the book form drawings will be furnished with an index of pages which will provide the necessary page control.

Effectivity: This deviation shall be effective on S-II-F and Subs.

SCN 201R2

Deviation 450 Drawing Title Block Changes

Requirement: MIL-D-70327(1), 1 July 1959, invokes MIL-STD-2B, Paragraph 5.3.1, ''Title. Title block shall conform to Figure 7 and shall be located in the lower right corner of each drawing, as shown in Figure 3. Arrangement and usage of individual blocks shall conform to the following:''

Deviation: The positions of the Code Identification Number (Block F) and the Drawing Size (Block G) shall be reversd.

Effectivity: This deviation shall be effective on new drawings prepared for Saturn S-II GSE after January, 1968. Current stocks of old vellums will be used to depletion.

Deviation 451 Drawing Revision Block Changes

Requirement: MIL-D-70327(1), 1 July 1959, invokes MIL-STD-2B, Paragraph 5.3.2.2, ''Contents. The SYM, DESCRIPTION, DATE, and APPROVED Columns shall be included on all drawings. The ZONE heading may be shown on all Revision Blocks. The ZONE Column need be added only when zoning is used.'' (See Figure 9.)

Deviation: The location of the LETTER Column, which replaces the SYM Column, shall be adjacent to the left side of the DESCRIPTION Column, and the ZONE Column location shall be adjacent to the left side of the LETTER Column.

Effectivity: This deviation shall be effective on new drawings prepared for Saturn S-II GSE after January, 1968. Current stocks of old vellums will be used to depletion.

Deviation 452 Drawing Parts List Change

Requirement: MIL-D-70327(1), 1 July 1959, invokes MIL-STD-2B, Paragraph 5.3.3.1, ''Columnar Tabulation. A list of materials or parts list shall provide a column for, and a tabulation of, the following: quantity required, item nomenclature or description, and item identification number.

Deviation: Columnar Tabulation - A list of materials or parts list shall provide a column for, and a tabulation of the following: quantity required, item nomenclature or description, and identification number, and shall be identified as a parts list.

Effectivity: This deviation shall be effective on new drawings prepared for Saturn S-II GSE after January, 1968. Current stocks of old vellums will be used to depletion.

New Page

Deviation 114 Abbreviations

Requirements: MIL-D-70327(1), 1 July 1959, paragraph 3.1.11, "Abbreviation shall be in accordance with MIL-STD-12B."

Deviation: (a) Abbreviations for hydrogen, nitrogen, and oxygen shall be as follows:

Liquid hydrogen	- LH_2
Gaseous hydrogen	- GH_2
Liquid nitrogen	- LN_2
Gaseous nitrogen	- GN_2
Liquid oxygen	- LOX

(b) When vertical dimension limitations will not permit the use of the subscript numeral, the numeral shall appear on the base plane line with the upper case letters, but the numeral shall be smaller in size unless the vertical space limitations compels the use of a letter height which is the minimum height allowable for legibility considerations. When the minimum height lettering is required, the numeral shall be the same height as that of the upper-case letters.

Reason: (a) The abbreviations are part of preferred usage indicated in MSFC Memo No. M-ASTR-EA-372-63, dated 17 April 1963, which was attached to and part of Technical Directive No. M-SAT-S-II, No. 78-63, dated 2 May 1963. This deviation will afford uniformity of usage and is in accordance with Contractors "Design Requirements Manual."

(b) The dimensions and arrangement change as listed in (b) above is required for visual readout and is the result of space limitations of certain items such as small parts, placards, and instrument and readout panels.

Deviation 141 Camouflage Finish

Requirement: MIL-E-5556A, dated 23 July 1954, Enamel, Camouflage, Quick-Drying.

Deviation: Delete the requirement for compliance to Specification MIL-E-5556A in its entirety as applicable to accumulator reservoir manifold assembly (ARMA), servoactuator, main pump, auxiliary motor-pump, quick-disconnect couplings, and bleed valve on the engine actuation system.

Reason: Camouflage color finishes are not a design requirement for the particular components cited.

Effectivity: S-II-T, S-II-D, S-II-1 and subs; Battleship test vehicle, Electromechanical Mockup, and the three engine actuation systems to be delivered to MSFC.

Deviation 124 Filters

Requirement: MIL-F-8815, dated 18 March 1960, Filter and Filter Elements, Fluid Pressure, Hydraulic Line, 15-Micron Absolute, Type II Systems.

Deviation: Delete the requirement for compliance to Specification MIL-F-8815 in its entirety as applicable to the auxiliary motor-pump, quick disconnect couplings, and bleed valve of the engine actuation system.

Reason: No hydraulic filters are utilized in the design or fabrication of the particular components cited.

Effectivity: S-II-T, S-II-D, S-II-1 and subs; Battleship test vehicle, Electromechanical Mockup, and the three engine actuation systems to be delivered to MSFC.

Deviation 13 Hydraulic Pressure

Requirement: MIL-H-25475A, 19 January 1961, paragraph 1.2. "Class — 3000, where the cutout pressure at the main pressure controlling device is 3000 psi."

Deviation: The equipment shall be designed to provide a capability to operate at 3650 psi.

Reason: The hydraulic system has been changed to provide a greater capability for possible increases in servoactuator loads.

Deviation 296

Requirement: MIL-H-25475A, dated 19 January 1961, paragraph 2.1 SPECIFICATIONS, "MIL-F-5504, Filters and Filter Elements, Fluid Pressure, Hydraulic Micronic Type".

Deviation: Delete the requirements of MIL-F-5504 as applicable to MIL-H-25475A for the Engine Actuation System.

Reason: Engine Actuation System filter requirements are specified by MIL-F-8815, dated 18 March 1960, "Filter and Filter Elements, Fluid Pressure, Hydraulic, Line Micron Absolute, Type II Systems".

Effectivity: S-II-T, S-II-D, S-II-1 and Subs: Battleship Test Vehicle, Electro-mechanical Mockup, and the three Engine Actuation Systems to be delivered to MSFC.

Deviation 2 Proposal Data (for Navy only)

Requirement: MIL-H-25475A, 19 January 1961, paragraph 3.3.1.2. "The data submitted for approval of proposed hydraulic systems shall be in accordance with... and shall include...."

Deviation: Entire paragraph.

Reason: Not applicable to NASA requirements.

Deviation 3 Prototype Data (for Navy only)

Requirement: MIL-H-25475A, 19 January 1961, paragraph 3.3.1.4. "The data submitted for approval of the prototype hydraulic system shall be in accordance with 3.3.1.3 (a), (c), and (d)."

Deviation: Entire paragraph.

Reason: Not applicable to NASA requirements.

Deviation 4 Production Data (for Navy only)

Requirement: MIL-H-25475A, 19 January 1961, paragraph 3.3.1.7. "The data submitted for approval of production hydraulic systems shall be in accordance with . . . the production hydraulic system shall also be submitted for approval."

Deviation: Entire paragraph.

Reason: Not applicable to NASA requirements.

Deviation 24 Ground Test Data

Requirement: MIL-H-25475A, 19 January 1961, Paragraph 3.4.8.2. "The following data shall be attached in a permanent manner on the missile near the ground test connections:

Set ground test reservoir gas pressurizing valve to. . . ."

Deviation: The data shall not be attached in a permanent manner on the missile near the ground test connections.

Reason: "The data is too complex and detailed to be included in a permanent manner on the Stage. However, high pressure warnings, as specified by MIL-A-5498, will be attached on the ARMA in a permanent manner. Other required data will be included in an operating procedures manual. Information referencing the operating procedures manual will be attached in a permanent manner on the Stage near the ground test connections."

Deviation 25 Power Source for Prelaunch Operations

Requirement: MIL-H-25475A, 19 January 1961, Paragraph 3.5.2. "In order to maintain the missile reliability at the highest possible level, hydraulic operations required only during prelaunch or ground handling operations shall not use the hydraulic power source(s) contained within the missile."

Deviation: The stage-mounted auxiliary motor pump shall be used as the prelaunch hydraulic power source.

Reason: Hydraulic ground support equipment will not be available on the launch pad.

Deviation 26 Military Specifications and Standards

Requirement: MIL-H-25475A, 19 January 1961, Paragraph 3.7.1. "All hydraulic system components shall comply with the applicable specifications and standards as listed in the appendix to this specification."

Deviation: Hydraulic system components shall not comply with the applicable specifications as listed in the appendix to Specification MIL-H-25475A.

Reason: The majority of the documents referenced in Appendix "A" to MIL-H-25475 are related to aircraft and do not lend themselves to the S-II Stage applications. Many of the items covered by these documents are defined so broadly and with such wide tolerances that the items manufactured by different suppliers are considerably different and consequently affect interchangeability and quality of the product. Among the faults are inadequate workmanship requirements - the lack of which will impair program reliability. Many of the referenced documents have been replaced by specific NASA/MSFC documents and by documents prepared by NAA/S&ID in accordance with instructions contained in MIL-H-25475 and MIL-STD-143. Therefore, the unique materials, parts, and processes required in the fabrication of the S-II Stage obviate full compliance with the requirements of the documents specified in Appendix "A" of MIL-H-25475.

Deviation 107 Servo Valves

Requirement: MIL-H-25475A, 19 January 1961, paragraph 3.7.5.1..... "There shall be metallic filters of 0.008 to 0.012-inch openings as integral parts of each servo valve, so located as to filter all flow into the valve...."

Deviation: ....There shall be metallic filters of 0.008 to 0.012-inch openings as integral parts of each servo valve, so located as to filter all flow into the valve. A filter integral with the servo valve shall not be required when there is a filter located in the servoactuator so that all flow into the servo valve is filtered...."

Reason: All fluid to the servo valve is filtered by a 15-micron filter located in the servoactuator.

Reason: The groove depth and width specified in Specification MIL-P-5514 does not allow for increased thickness due to the addition of teflon cap strips. Teflon cap strips eliminate spiral failure and "nibbling" that occurs when standard O-rings are subjected to low amplitude oscillations. The use of this type of seal is justified on the basis of past experience.

Effectivity: S-II-T, S-II-D, S-II-1 and subs; Battleship test vehicle, Electromechanical Mockup, and the engine actuation systems, 1 and subs, to be delivered to MSFC.

Deviation 108a Packings

Requirement: MIL-H-25475A, 19 January 1961, paragraph 3.7.6. "Specification MIL-P-5514 shall be used as a guide for packing installations."

Deviation: Specification MIL-P-5514 shall be used as a guide for conventional O-ring packing installations. However, if teflon cap-strips are used with O-rings, the groove depth and width may be revised to allow for the cap strip thickness and elimination of back-up rings.

Deviation 5 Accumulator Instructions

Requirement: MIL-H-25475A, 19 January 1961, paragraph 3.8.2.2. "Instructions for servicing... shall be provided immediately adjacent to the accumulator."

Deviation: The instructions for servicing shall be provided in a checkout manual.

Reason: Instructions can be indicated in more detail, with less chance for error, in the checkout manual.

Deviation 6 Fittings

Requirement: MIL-H-25475A, 19 January 1961, paragraph 3.8.8. "MS or AN straight-threaded, flared, or flareless-type hydraulic fittings shall be used."

Deviation: MC straight-threaded flared-type or flareless-type hydraulic fitting shall be used.

Reason: Compliance with NASA request.

Deviation 7 Materials

Requirement: MIL-H-25475A, 19 January 1961, paragraph 3.8.20.1. "Tubing shall be... steel conforming to specification MIL-T-6845."

Deviation: MSFC Specifications 131 and 134 shall be used.

Reason: NASA request.

Deviation 264 Tubing for Hose Assemblies

Requirement: MIL-H-25475A, dated 19 January 1961, Paragraph 3.8.20.1. "Tubing shall be... steel conforming to Specification MIL-T06845."

Deviation No. 7 to SID 61-361: "MSFC Specification 131 and 134 shall be used."

Deviation: Tubing utilized in the engine actuation system hose assemblies shall be in accordance with Specification MIL-T-8606, Composition 321, Type I. Tubing which requires mechanical flaring shall conform to NAA Specification MB0160-007D.

Reason: Tubing in conformance with MSFC Specification 131 or 134 is unobtainable, and tubing in conformance to NAA Specification MB0160-007F cannot be available in time for delivery.

Effectivity: This deviation shall apply to the first engine actuation system to be delivered to MSFC (pursuant to SID 64-550, dated 18 September 1964, and identified by Drawing V7-890100-21).

Deviation 268 Rigid Tubing

Requirement: MIL-H-25475A, dated 19 January 1961, Paragraph 3.8.20.1. "Tubing shall be... steel conforming to Specification MIL-T-6845."

Deviation No. 7 to SID 61-361: "MSFC Specifications 131 and 134 shall be used."

Deviation: Engine actuation system rigid tubing (including tubing in hose assemblies) shall conform to NAA Specification MB0160-007F.

Reason: Tubing in conformance with MSFC Specification 131 or 134 is unobtainable.

Effectivity: This deviation shall apply to the Electromechanical Mockup, Battleship test vehicle, S-II-D, S-II-T, S-II-1 and subsequent flight stages, and the second and third engine actuation systems to be delivered to MSFC (pursuant to SID 64-550, dated September 18, 1964, and identified by Drawing V7-890100-11).

Deviation 290

Requirements: MIL-H-25475A, dated 19 January 1961, paragraph 3.8.20.1. "Materials. - Tubing shall be either corrosion-resistant steel conforming to Specification MIL-T-6845, or aluminum alloy conforming to Temper 0 of Specification WW-T-787 or Condition T6 of Specification MIL-T-7081. The type . . .".

Deviation: Tubing shall be either corrosion-resistant steel conforming to Specification MIL-T-6845, or aluminum alloy conforming to Temper 0 of Specification WW-T-700/4c, or Condition T6 of Specification MIL-T-7081. The type . . . .

Reason: Specification WW-T-787 was cancelled by the Government in December 1963 and superseded by Specification WW-T-700/4. Specification WW-T-700/4c is a replica of Specification WW-T-787 and satisfies all the technical requirements of Specification WW-T-787.

Effectivity: All Stage.

Deviation 29

Requirements: MIL-H-25475A, 19 January 1961, Paragraph 3.8.20.9. "Tube flares when used shall conform to Standard MS33584 or MS33583."

Deviation: MC-type tube flares shall be used to be compatible with mating MC fittings.

Reason: Original contract negotiations resulted, in part, in NASA/MSFC direction to use MC fittings in lieu of MS fittings in the design of the engine actuation (hydraulic) systems. The special hydraulic system requirements of the S-II Program are not adequately covered by Specification MIL-H-25475A. Consequently, strict compliance with the NASA/MSFC direction to use MC fittings makes it mandatory to use MC tube flares. This mandate enhances system reliability when operating under the high pressures used in the high-pressure engine actuation systems.

Deviation 159 Proof Pressure

Requirements: MIL-H-25475A, dated 19 January 1961, paragraph 3.8.22.1. "No part of a hydraulic system shall fail, take any permanent set, or be damaged in any manner, when subjected to applicable proof pressure. All hydraulic systems shall satisfy this requirement when subjected to the appropriate proof pressure as listed in Table I."

Deviation: S-II hydraulic engine actuation systems will not be subjected to proof pressures as listed in Table I. Each stage hydraulic system will, however, be subjected to a pressure equivalent to the system high pressure relief valve cracking pressure, subsequent to initial installation of the system on the stage.

Reason: Proof pressures listed in Table I are applicable to system components only. No listing is provided for the installed system.

Effectivity: This deviation is applicable to S-II stages S-II-S and subsequent.

Deviation 28a Burst Pressure

Requirement: MIL-H-25475A, paragraph 3.8.22.2. "No part of a hydraulic system shall rupture when subjected to applicable burst pressure. All hydraulic systems shall satisfy this requirement when subjected to the applicable burst pressures listed in Table I."

Deviation: Hydraulic systems shall not be subjected to applicable burst pressure listed in Table I. Burst pressures shall only be applied during qualification testing of components.

Reason: Hydraulic systems that have been subjected to burst pressures cannot be utilized as flight systems. The burst pressures listed in Table I are applicable to system components only.

Deviation 27 Operating Pressures

Requirement: MIL-H-25475A, 19 January 1961, Table I. "Closed- or open-center system (variable volume pump).... (c) Maximum system relief valve setting, at maximum system flow -3850 psi."

Deviation: Maximum system relief valve setting at maximum system flow shall be above 3850 psi.

Reason: A system operating pressure capability of 3650 psi is necessary to compensate for possible servoactuator load increases. (Ref. CCN S00004.)

Deviation 110 Scraper Rings

Requirement: MIL-C-5503B, 7 March 1956, paragraph 3.3.6. "Scraper rings in accordance with Drawing AN6231 shall be provided for piston rods. . . ."

Deviation: Revise to read: Scraper rings in accordance with Drawing MS28776 or of the spring-loaded teflon type shall be provided for piston rods. . . .

Reason: Drawing MS28776 supersedes Drawing AN6231. The use of teflon scraper rings is desirable to avoid the use of dissimilar metals, to reduce piston breakout friction, and to obtain efficient rod wiper action.

NOTE: Specification MIL-C-5503B is referenced in Specification MIL-H-25475A.

Deviation 112a Surface Coatings

Requirement: MIL-H-25475A references MIL-H-8775B, paragraph 3.2.1.1 "All copper alloys shall be suitably protected with a coating selected from Table I. . . . All aluminum alloys shall be anodized in accordance with Specification MIL-A-8625. . . ."

Deviation: Add the following: Surface coatings shall not be required on the servovalve flexure sleeve and piston rod bearings. Anodic coatings shall not be required on the dynamic pressure feedback cylinder.

Reason: These parts will be fabricated of beryllium copper (EM207) and aluminum bronze (AM4635). Surface coatings would interfere with proper operation. Flexure or abrasion of these parts can cause harmful contaminants. Corrosion will be minimal, since these parts mate with corrosion-resistant steel or anodized aluminum and are in constant contact with hydraulic fluid. These materials have been used successfully in similar applications, and plating is not required.

Effectivity: S-II-T, S-II-D, S-II-1 and subs; Battleship test vehicle, Electromechanical Mockup, and engine actuation systems 1 and subs to be delivered to MSFC.

Deviation 34 Ferrous Alloys

Requirement: MIL-H-25475A references MIL-H-8775B, 8 November 1961, paragraph 3.2.1.3. "Ferrous alloys shall have a chromium content of not less than 12 percent, or shall be suitably protected against corrosion as specified in 3.2.1, 3.2.1.1, and Table I."

Deviation: Ferrous alloys shall have a chromium content of not less than 12 percent, or shall be suitably protected against corrosion as specified in 3.2.1, 3.2.1.1, and Table I. Lockup valve and high-pressure relief valve parts used in the accumulator reservoir manifold assembly (ME282-0028), when made of ferrous metals which are to be completely submerged in hydraulic fluid, shall not require a 12-percent chromium content or a protective coating.

Reasons: The 12 percent chromium content would increase wear during cycling and cause leakage. Use in solenoid parts would necessitate a larger and heavier solenoid. As for coating, the small amount of corrosion which would occur would be less detrimental than peeling or flaking of the plating. The latter condition would increase leakage as well as fluid contaminant levels.

Deviation 111a Type II Components

Requirement: MIL-H-25475A references MIL-H-8775B Paragraph 3.2.1.3, Type II components, "Ferrous alloys shall have a chromium content of not less than 12 percent, or shall be suitably protected against corrosion as specified in 3.2.1, 3.2.1.1, and Table I. . . ."

Deviation: Add the following: The following parts and materials used in the torque motor shall not be plated:

Part	Material
Magnets	Alnico VI
Polepieces	AL 4750
Armature	AL 4750

Reason: Plating on these parts would adversely affect the torque motors' magnetic circuit. Air gaps would have to be increased to allow for the thickness of the plating. These parts are located within the sealed tailstock chamber, thus minimizing corrosion tendencies. These materials have been used successfully in many similar applications.

Effectivity: S-II-T, S-II-D, S-II-1 and subs; Battleship test vehicle, Electromechanical Mockup, and engine actuation systems 1 and subs to be delivered to MSFC.

Deviation 116a Plastic Parts

Requirement: MIL-H-25475A references MIL-H-8775B, dated 8 November 1961, paragraph 3.2.2. "Plastic parts. - The use of plastic parts shall be subject to the approval of the procuring activity for the specific application involved."

Deviation: The Contractor requests approval to use plastic materials in the following applications:

a.	Coil forms	Diallyl phthalate (Durez 18783)
b.	Potting compound	PR-1538
c.	Potentiometer slide	Teflon
d.	Locking inserts	Teflon
e.	Bearing liner	Fabroid (Teflon and fiberglass)

Reason: The use of plastics in the above cited applications is required in the construction of the servoactuator. The use of plastics in these specific applications is justified on the basis of past experience.

Effectivity: S-II-T, S-II-D, S-II-1 and Subs; Battleship Test Vehicle, Electromechanical Mockup, and the Engine Actuation Systems, 1 and subs., to be delivered to MSFC.

Deviation 115a

Requirement: MIL-H-25475A references MIL-H-8775B paragraph 3.3.9. "Spring pins. - The use of spring pins is undesirable. However, they shall not be used in any applications that conflict with the intent of Standard MS33547, unless specifically approved by the procuring activity."

Deviation: The contractor requests approval to use a spring pin in the following application: a 0.093-inch-diameter stainless steel spring pin used at the junction of a potentiometer and mechanical feedback cam.

Reason: The spring pin is used to maintain a zero-backlash connection in feedback mechanisms. Its use is justified on the following counts:

1. Past experience in identical usage

2. The pin is unable to back out.

3. The load-carrying capacity is 30 times the maximum expected load requirement of the joint.

Effectivity: S-II-T, S-II-D, S-II-1 and subs; Battleship test vehicle, Electromechanical Mockup, and engine actuation systems 1 and subs to be delivered to MSFC.

Deviation 117a Nameplates

Requirement: MIL-H-25475A references MIL-H-8775B, paragraph 3.10.1. "Nameplate. - ...Nameplates which are attached by use of adhesives will require prior approval of the procuring activity...."

Deviation: The contractor requests approval for use of an adhesive-backed nameplate in the following application: the servoactuator may be identified by means of an adhesive-backed nameplate to Specification MIL-P-19834, Type I.

Reason: The use of adhesive-type nameplates will eliminate stress risers in the actuator body associated with the required methods of attachment. The adhesive-type nameplate is used on other components of the Saturn S-II stage.

Effectivity: S-II-T, S-II-D, S-II-1 and subs; Battleship test vehicle, Electromechanical Mockup, and engine actuation systems 1 and subs, to be delivered to MSFC.

Deviation 119 Interference Control

Requirement: MIL-I-6181D, dated 25 November 1955, Interference Control Requirements, Aircraft Equipment.

Deviation: Delete the requirement for compliance to Specification MIL-I-6181D in its entirety as applicable to the accumulator reservoir manifold assembly (ARMA), main pump, auxiliary motor-pump, quick disconnect couplings, and bleed valve of the engine actuation system.

Reason: Interference control requirements are not applicable to individual hydraulic components, but to the complete, installed system. Requirements for the system will be defined in an S&ID document.

Effectivity: S-II-T, S-II-D, S-II-1 and subs; Battleship test vehicle, Electromechanical Mockup, and the three engine actuation systems to be delivered to MSFC.

Deviation 282

Requirement: MIL-I-6181D, dated 25 November 1959, Interference Control Requirements Aircraft Equipment.

Deviation: Delete the requirement for compliance with MIL-I-6181D in its entirety as applicable to the following S-II Stage electrical packages:

a. Electrical sequence controller (207A2)
b. Propellant electronic package (aft skirt) (214)
c. Propellant electronic package (fwd skirt) (220)
d. Separation controller package (206A31A2)
e. Battery heater power control assembly (207A1A17, 207A4A3).
f. Module assembly-electrical controller 1C (207A5, 207A6) SCN 252R1 to 367B

Reason: The test per MIL-E-6051C as defined by the Electro-Interference Test Plan for the Saturn S-II System (SID 63-400) will establish the compatibility between stage electrical systems. In the event that some interference does create an incompatibility, the problem will be resolved on an individual package and circuit basis, with a minimum increase in stage weight and circuit complexity.

Existing data on relay switching of any load current indicates that the conducted and radiated interference levels of MIL-I-6181D will be exceeded by 10 to 25 db for each case.

The listed packages contain a total of 208 relays for each flight stage. Analysis indicates that an average of 2-1/2 filters are needed for each relay to meet MIL-I-6181D specifications. This is a total of 520 filter units. The addition of this quantity of filters with the associated increase in package size would increase the stage weight between 100 and 125 pounds. The added circuit complexity would also reduce circuit reliability necessitating redundant circuits and an even further increase in stage weight.

Effectivity: This deviation shall apply respectively to the above items:

a. for V7-1, 2, 4, and subsequent
b. for V7-1, 2, 4, and subsequent
c. for V7-1, 2, 4, and subsequent
d. for V7-1, 2, 5, and subsequent
e. (1) 207A1A17 for V7-1, 2
   (2) 207A4A3, for V7-1, 5, and subsequent
   (3) 207A5, for V7-1, 7 and subsequent
   (4) 207A6, for V7-1, 7 and subsequent
f. for V7-1, 7 and subsequent

SCN 252 to 367B

SCN 252R1 to 367B

Deviation 315 Interference Control Requirements

Requirement: MIL-I-6181D, Figures 7, 8, and 16.

Deviation	Deviation limit maximum
Broadband conducted Figure 8 at 0.15 mc	115 db
Broadband conducted Figure 8 at 0.3 mc	105 db
Narrowband conducted Figure 7 at 0.15 mc	62.5 db
Narrowband conducted Figure 7 at 0.3 mc	56.5 db
Broadband radiated Figure 16 at 0.15 mc	77 db
Broadband radiated Figure 16 at 0.2 mc	75 db
Broadband radiated Figure 16 at 0.3 mc	73 db
Broadband radiated Figure 16 at 170 mc	55 db
Broadband radiated Figure 16 at 240 mc	56 db

Deviation	Deviation limit maximum
Broadband conducted Figure 8 from 0.15 to 0.3 mc	130 to 121 db respectively (Figure 1)
Narrowband conducted Figure 7 from 0.15 to 0.3 mc	72.5 to 66.5 db respectively (Figure 2)
Broadband radiated Figure 16 from 0.15 to 0.3 mc	92 to 88 db respectively (Figure 3)
Broadband radiated Figure 16 from 170 to 220 mc	85 to 86 db respectively (Figure 3)

Reason: Change is required for the power static inverter, MC495-0006, utilized in the LH_2 chilldown (recirculation) system. RFI filter rearrangements, which were feasible in the design, were tried during qualification tests. The final design, with the out of specification condition, is the maximum filtering possible in the unit without a major redesign. S&ID reviewed the data of Report FA1818, dated 12-6-65, and has compared the out-of-specification EMI measurement frequencies with all the frequencies associated with the Saturn V system. There were no instances where the out-of-specification EMI frequencies coincided with the Saturn V frequencies. In addition, the voltage levels of the out-of-specification EMI are low and should not interfere with the S-II stage or any of the other stages of the Saturn V system. System requirements will be adhered to.

Effectivity: V7-1 No. 5 through V7-1 No. 14 (S-II-1 through S-II-10).

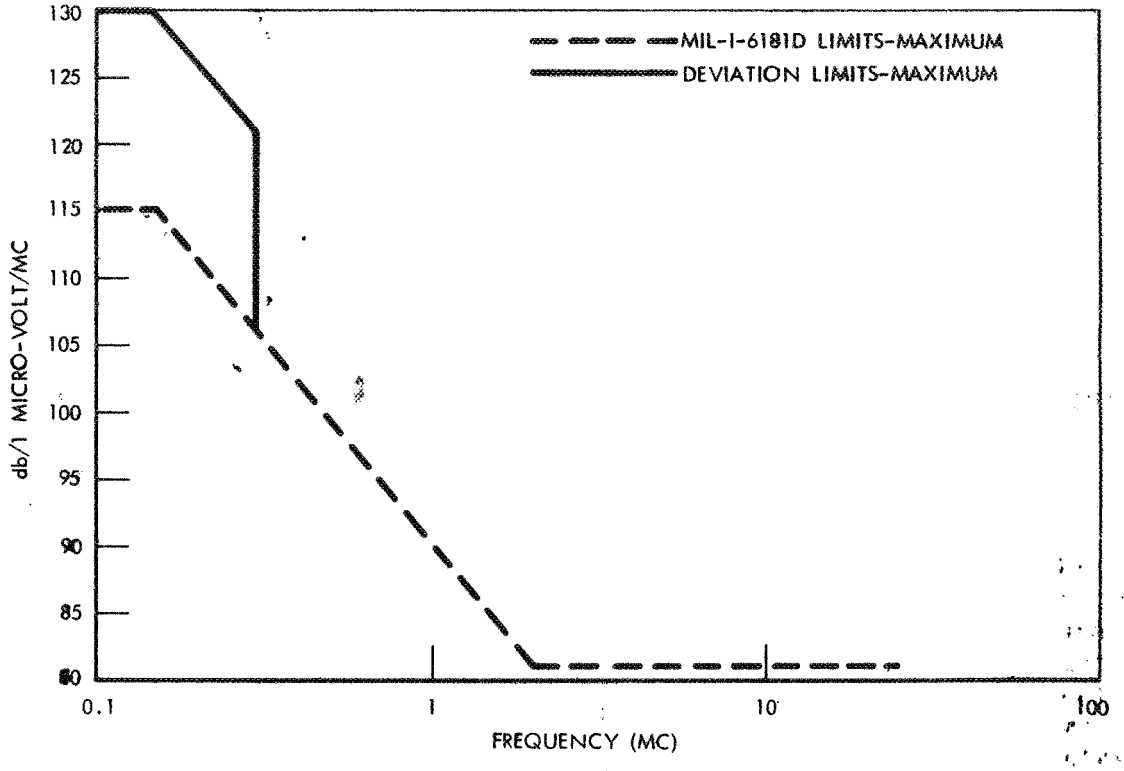


Figure 1. Broadband and Pulsed CW Conducted Interference Using Stabilization Network

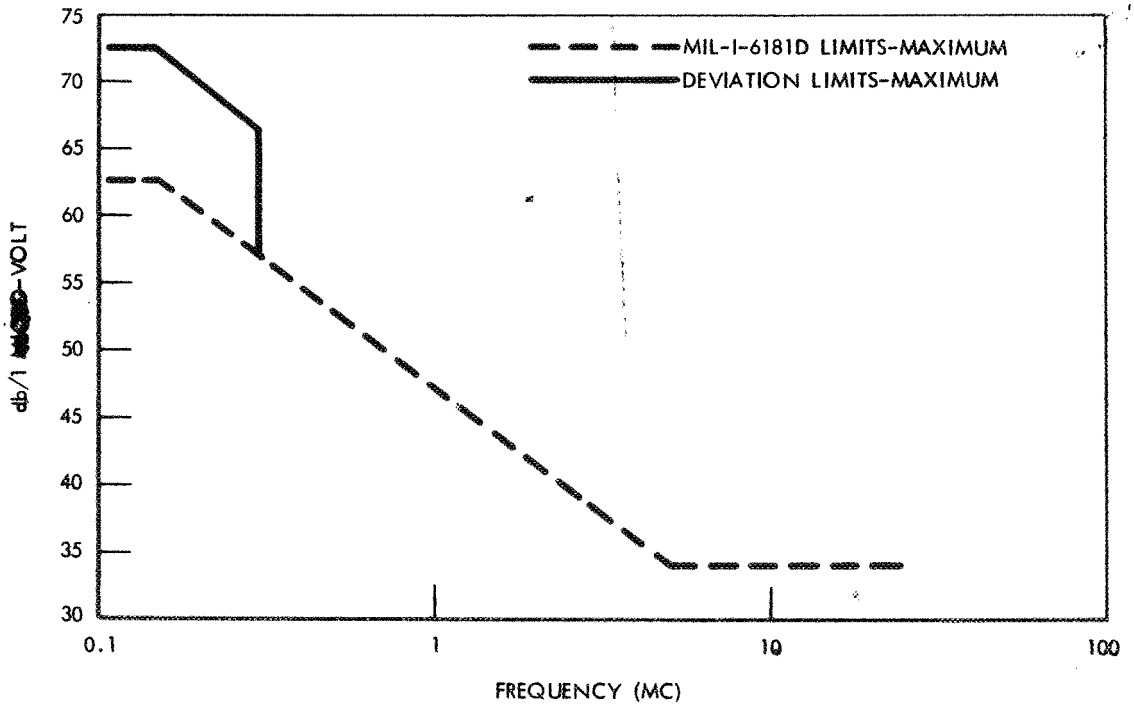


Figure 2. Narrowband CW Conducted Interference Limits Using Stabilization Network

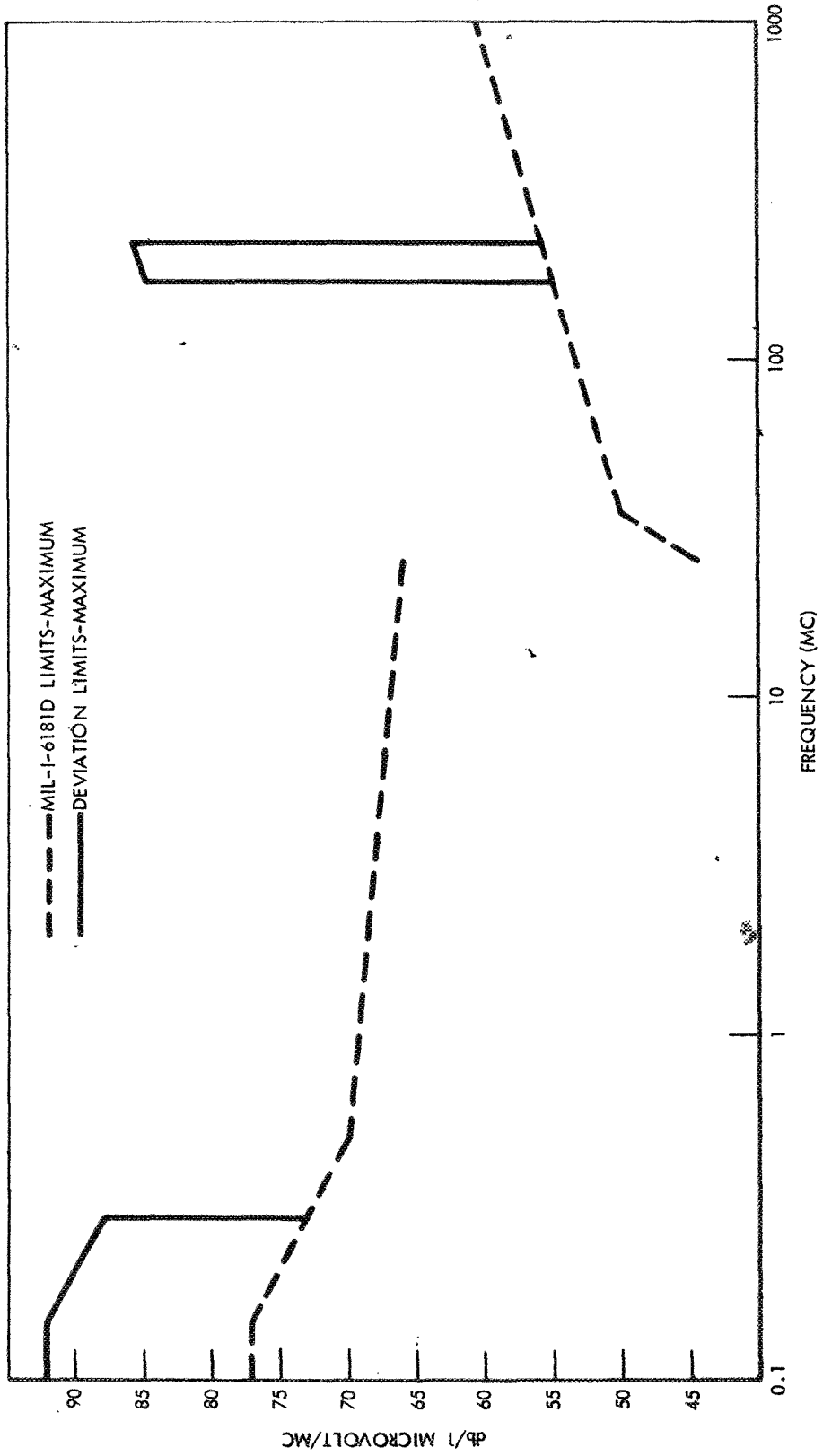


Figure 3. Broadband and Pulsed CW Radiated Interference Limits

Deviation 16lc Manual Switching Limitations

Requirement: MIL-I-6181D, 25 November 1959, Paragraph 3.2.2. "Interference resulting from manual operation of switches, but not including any electrical or electromechanical operations resulting from the manual switching, may deviate from the limits as indicated below. Ignition components used only during engine starting may deviate from the limits by 20 db. Other short duration interference may deviate from the limits as indicated below. Approval shall be obtained from the procuring activity before using these deviations.

Maximum duration	Maximum recurrence	Deviation permitted
1 second---	Once in 3 minutes---	20 db
3 seconds--	Twice per normal operational period	No limitation"

Deviation: No-limitation deviations are permissible for the following components:

Specification	Title		
1. MC452-0026	Switch, Power Transfer, Motorized (Class I and III)		
Function	Maximum Duration	Maximum Recurrence	Deviation Permitted
a. Transfer instrumentation DC bus to internal power	0.2 second	Twice per normal operation period (includes checkout)	No limitation
b. Transfer instrumentation DC bus to external power	0.2 second	Once per normal operational period (includes checkout)	No limitation
c. Propellant management system on	0.2 second	Twice per normal operational period (includes checkout)	No limitation
d. Propellant management system off	0.2 second	Once per normal operational period (includes checkout)	No limitation

Specification	Title
1. MC452-0026	Switch, Power Transfer, Motorized (Class I and II)

Function	Maximum Duration	Maximum Recurrence	Deviation Permitted
e. Transfer main DC bus to internal power	0.2 second	Twice per normal operational period (includes checkout)	No limitation
f. Transfer main DC bus to external power	0.2 second	Once per normal operational period (includes checkout)	No limitation
g. Transfer recirculation DC bus to internal power	0.2 second	Twice per normal operational period (includes checkout)	No limitation
h. Transfer recirculation DC bus to external power	0.2 second	Once per normal operational period (includes checkout)	No limitation

For additional functional information, refer to S&ID drawings V7-954012 and V7-954013 "Advanced Schematic Diagram, Electrical Power System."

Reason: The above functions fall within the no-limitation deviation permitted by Paragraph 3.2.2 of Specification MIL-I-6181; however, NASA approval is required before these deviations can be utilized in the operation of the S-II stage.

Numbers called out are actually part numbers, not specification numbers; the numbers are obsolete. Calling out the specification number will avoid unnecessary revisions. The function of Item 2h has been reduced to once per normal operational period.

The following backup information is presented to justify the use of these deviations:

Figures 1, 2, and 3 present the broadband conducted interference data for the switch motor circuits with and without an RFI filter. Figure 4 shows the schematic diagram of the switch circuits with a filter installed. The maximum deviation from specification requirements without the filter installed is approximately 40 db.

Figure 5 presents broadband conducted interference data for typical 200-ampere contacts. It should be noted that this data shows interference levels in excess of 50 db above specification limits. The 100-ampere contacts exhibit almost identical interference levels.

The interference generated from the power contacts occurs at the same time as the motor circuit interference and is considerably more intense. Filtering of the power contact is not practical since the weight and size of such a filter would be considerably larger than the basic switch and the filter would introduce more voltage drop and thermal dissipation problems.

Since the motor circuit and the power circuit share the same negative return circuit, there would be little to gain from filtering the motor circuits.

It has been standard practice in all or most missile and space booster programs to date to permit a deviation for power transfer switches. It should be noted that the IU, S-IC, S-IVB and Apollo Command Module do not require the use of radio noise filters for their power transfer switches.

The addition of a radio noise filter will lower the reliability of the switch by introducing 3 inductors which could fail "open" and four capacitors which could fail "shorted" to cause the switch to malfunction. Several additional solder connections are also introduced. Addition of the filter also causes the transient voltage, generated when the motor switch opens, to exceed fifty volts. Without the filter, the transient voltage is approximately 45 volts. With the filter installed, the transient voltage is approximately 100 volts and the duration is 150 microseconds. The transient voltage is suppressed by inserting a diode in series with the negative lead as shown in Figure 4. This diode introduces another failure mode.

Addition of the filter to the motor circuits will guarantee meeting the conducted interference limits for the motor circuit but will not guarantee meeting radiated interference limits. As shown in Figure 6, the radiated interference exceeds the specification limits between 30 mc and 140 mc with the filter installed. The radio noise generated in the motor and at the switch contacts is radiated to the power contacts and in turn radiated from the power terminals on the outside of the switch. It is impractical to shield the motor contacts from the power contacts in a switch of this design without considerable redesign and compromising of the effectiveness of the motor contact operation. This statement is also true for all other known approaches used by other companies.

The weight of the switches will be increased by 0.3 to 0.5 pound or 1.6 pounds/stage with motor lead filter.

Effectivity: This deviation shall apply to the Battleship Test Vehicle and the following S-II Stages: S-II-F, S-II-T, S-II-D, and S-II-1 and subs, and the Electromechanical Mockup.

DEVIATION 341 RF POWER CONTROL ASSEMBLY

REQUIREMENT

Specification MIL-I-6181D, Interference Control Requirements, Aircraft Equipment, dated 25 November 1959, paragraph 3.2.2, Short Duration Interference: Interference resulting from manual operation of switches, but not including any electrical or electro-mechanical operations resulting from the manual switching, may deviate from the limits indicated below. Ignition components used only during engine starting may deviate from the limits by 20 db. Other short-duration interference may deviate from the limits indicated below. Approval shall be obtained from the procuring activity before using these deviations.

Maximum Duration	Maximum Recurrence	Deviation Permitted
1 Second	Once in three minutes	20 db
3 Seconds	Twice per normal operational period	No limitation

DEVIATION

NR/SD shall be permitted to apply the "no limitation" deviation to the requirements of MIL-I-6181D, paragraph 3.2.2, as these requirements relate to the RF Power Control.

REASON

The RF Power Control was EMI design-certification tested by NR/SD. The equipment met the requirements of MIL-I-6181D in all respects, including the requirements of generated EMI and susceptibility to EMI, while operating in the steady-state condition. Interference levels in excess of Figures 8, 10, and 16, MIL-I-6181D, interference limits for broadband-conducted and radiated interference respectively, were measured during ON-OFF switching. However, this unit is switched only once per operational flight. Therefore, the "no limitation" deviation of paragraph 3.2.2 is applicable.

EFFECTIVITY

S-II-1 and subs

DEVIATION 345 TDM INPUT C/O SWITCHING CHASSIS ASSEMBLY

REQUIREMENT

Short-duration interference (MIL-I-6181D, paragraph 3.2.2), interference resulting from manual operation of switches, but not including any electrical or electro-mechanical operations resulting from the manual switching, may deviate from the limits as indicated below. Ignition components used only during engine starting may deviate from the limits by 20 db. Other short-duration interference may deviate from the limits as indicated below. Approval shall be obtained from the procuring activity before using these deviations.

Maximum Duration	Maximum Recurrence	Deviation Permitted
1 Second	Once in three minutes	20 db
3 Seconds	Twice per normal operational period	No limitation

DEVIATION

NR/SD shall be permitted to apply the "no limitation" deviation to the requirements of MIL-I-6181D, paragraph 3.2.2, as these requirements relate to the TDM Input C/O Chassis Assembly.

REASON

The TDM Input C/O Switching Chassis Assembly was EMI design-certification tested by NR/SD. The equipment met the requirements of MIL-I-6181D in all respects, including the requirements of generated EMI and susceptibility to EMI, while operating in the steady-state condition. Interference levels in excess of Figures 8, 10 and 16, MIL-I-6181D, interference limits for broadband-conducted and radiated interference respectively, were measured during ON-OFF switching. However, this unit is switched only twice per operational flight. Therefore, the "no limitation" deviation of paragraph 3.2.2 is applicable.

EFFECTIVITY

S-II-1 and subs

DEVIATION 346 TOA SWITCH CHASSIS

REQUIREMENT

Short-duration interference (MIL-I-6181D, paragraph 3.2.2), interference resulting from manual operation of switches, but not including any electrical or electro-mechanical operations resulting from the manual switching, may deviate from the limits as indicated below. Ignition components used only during engine starting may deviate from the limits by 20 db. Other short-duration interference may deviate from the limits as indicated below. Approval shall be obtained from the procuring activity before using these deviations.

Maximum Duration	Maximum Recurrence	Deviation Permitted
1 Second	Once in three minutes	20 db
3 Seconds	Twice per normal operational period	No limitation

DEVIATION

NR/SD shall be permitted to apply the "no limitation" deviation to the requirements of MIL-I-6181D, paragraph 3.2.2, as these requirements relate to the TOA Switch Chassis, NR P/N V7-750312.

REASON

The TOA Switch Chassis, NR Part No. V7-750312 was EMI design-certification tested by NR/SD. The equipment met the requirements of MIL-I-6181D in all respects, including the requirements of generated EMI and susceptibility to EMI while operating in the steady-state condition. Interference levels in excess of Figures 8, 10 and 16, MIL-I-6181D, interference limits for broadband-conducted and radiated interference respectively, were measured during ON-OFF switching. However, this unit is switched only once per operational flight. Therefore, the "no limitation" deviation of paragraph 3.2.2 is considered applicable.

EFFECTIVITY

P/N V7-750312

DEVIATION 342 TAPE RECORDER CONTROL RELAY ASSEMBLY

REQUIREMENT

The assembly shall comply with the susceptibility, broadband-conducted and broadband-radiated requirements of specification MIL-I-6181D, Interference Control Requirements, Aircraft Equipment, dated 25 November 1959, paragraph 4.3.4, 4.3.1 and 4.3.2, respectively.

DEVIATION

The broadband-conducted and broadband-radiated requirement of paragraphs 4.3.1 and 4.3.2, respectively, of specification MIL-I-6181D, as these requirements related to the Tape Recorder Control Relay Assembly, shall not apply during the switching interval.

REASON

The Tape Recorder Control Relay Assembly was EMI design-certification tested by NR/SD. This unit met all of the susceptibility requirements of paragraph 4.3.4 of MIL-I-6181D. It met all the conducted and radiated requirements of paragraph 4.3.1 and 4.3.2 during steady-state operation. It exceeded the limits of paragraph 4.3.1 and 4.3.2 during switching operations only.

The Tape Recorder Control Relay Assembly contains several relays which are switched only five times throughout the normal flight. Although these relays are switched several times during an operational period, MIL-E-6051C EMC testing of the S-II stage has proved that the assembly does not cause EMC problems on the stage. Therefore, since the S-II stage met all of the requirements of MIL-E-6051C with this unit installed and in operation, the requested nonapplication of paragraph 4.3.1 and 4.3.2 of MIL-I-6181D during switching is appropriate.

EFFECTIVITY

S-II-1 and subs

DEVIATION 343 T/M CALIBRATOR RELAY ASSEMBLY

REQUIREMENT

The assembly shall comply with the susceptibility, broadband-conducted and broadband-radiated requirements of specification MIL-I-6181D, Interference Control Requirements, Aircraft Equipment, dated 25 November 1959, paragraphs 4.3.3, 4.3.1 and 4.3.2, respectively.

DEVIATION

The broadband-conducted and broadband-radiated requirements of paragraphs 4.3.1 and 4.3.2, respectively, of specification MIL-I-6181D, as these requirements relate to the T/M Calibrator Relay Assembly, shall not apply during the switching interval.

REASON

The T/M Calibrator Relay Assembly was EMI design-certification tested by NR/SD. This unit met all of the susceptibility requirements of paragraphs 4.3.1 and 4.3.2 of MIL-I-6181D during steady-state operation. It exceeded the limits of paragraph 4.3.1 and 4.3.2 during switching operations only.

This assembly contains several relays which are switched several times during prelaunch checkout, twice during SI-C boost, four times during S-II powered flight and twice after S-II/S-IVB separation. Although these relays are switched several times during an operational period. EMC testing of the S-II Stage per MIL-E-6051C has proved that the assembly does not cause any EMC problems on the stage. Therefore, since the Control Relay Assembly functioned without adverse effects during the S-II stage MIL-E-6051C EMC test, the requested nonapplication of paragraphs 4.3.1 and 4.3.2 of MIL-I-6181D is appropriate.

EFFECTIVITY

S-II-1 and subs

DEVIATION 344 TELEMETRY TIMER

REQUIREMENT

The Telemetry Timer shall comply with the susceptibility, broadband-conducted and broadband-radiated requirements of specification MIL-I-6181D, Interference Control Requirements, Aircraft Equipment, dated 25 November 1959, paragraph 4.3.4, 4.3.1 and 4.3.2, respectively. In addition, paragraph 3.2.2 states "Short-Duration Interference: Interference resulting from manual operation of switches, but not including any electrical or electro-mechanical operations resulting from the manual switching, may deviate from the limits as indicated below. Ignition components used only during engine starting may deviate from the limits by 20 db. Other short-duration interference may deviate from the limits as indicated below. Approval shall be obtained from the procuring activity before using these deviations."

Maximum Duration	Maximum Recurrence	Deviation Permitted
1 Second	Once in three minutes	20 db
3 Seconds	Twice per normal operation period	No limitation

DEVIATION

NR/SD shall be permitted to apply the no limitation deviation to the requirements of MIL-I-6181D, paragraph 3.2.2, as they relate to the telemetry timer, NR Part No. ME456-0037, and during steady-state operation by its similarity to NASA Part No. 40M37452.

REASON

During normal operation of the S-II stage, the telemetry timer is switched only twice. Also, the Telemetry Timer NR Part No. ME456-0037 is similar to NASA Part No. 40M37452, with the exception of a relay which was added to the NR/SD assembly. The NASA unit was susceptibility tested by NASA and was considered qualified to requirements of MIL-I-6181D. In addition, the NR Part No. ME456-0037 was operated during all S-II EMC tests. The results of this testing proved the Telemetry Timer operated without adversely ffecting the S-II stage. Therefore, the request to apply the "no limitation" deviation of MIL-I-6181D to the switching operation of the Telemetry Timer, and to further qualify the unit by similarity to the NASA unit, is appropriate.

EFFECTIVITY

ME456-0037

Deviation 324

Requirement: Specification MIL-I-6181D, dated November 25, 1959: Paragraph 4.3.1 Conducted Interference. Radio interference voltages, in the frequency range of 0.15 to 25 mc, generated by the equipment or system in excess of the values indicated in Figures 7, 8, 9, and 10 shall not appear on any conductor, external to the system, which could conduct interference to other equipment. Typical test setups for these measurements are shown in Figures 11 and 12. Measurements may be omitted on leads deemed by the procuring activity to be incapable of conducting interference into other equipment.

Paragraph 4.3.2 Radiated Interference. Radiated interference fields in excess of the values given in Figures 14, 15, 16, and 17 shall not radiate from any unit, cable (including control, pulse, IF, video, antenna transmission, and power cables), or interconnecting wiring over the frequency range of 0.15 to 10,000 mc for CW and pulsed CW interference, and 0.15 to 400 mc for broadband impulse interference. This requirement includes the transmitter fundamental frequency radiating from cases or cabling, oscillator radiation, other spurious emanations, and broadband interference. This does not include radiation emanating from antennas. Test setups are illustrated in Figures 3, 4, 5, and 6.

Deviation: NAA/S&ID shall be permitted to deviate from the conducted and radiated interference requirements of MIL-I-6181D to the extent listed in the following tabulation.

A. For the 28 vdc return (J5-A) increase the maximum level of conducted interference by 10 db above 1 Microamp/Mc from 2.5 to 20 Mc.

B. For the ± 1 volt slew command (J5-Z) increase the maximum level of conducted interference by 10 db above 1 Microamp/Mc from 3.0 to 7.0 Mc.

C. For the valve power amplifier outputs (typically J6-A, B, & C) increase the maximum level of conducted interference by 12 db above 1 Microamp/Mc from 2.0 to 7.0 Mc.

D. For the fixed phase valve inputs (typically J6-R & P) increase the maximum level of conducted interference by 6 db above 1 Microamp/Mc from 2.0 to 8.0 Mc

E. For the 115 VAC signal conditioning return (J7-D) increase the maximum level of conducted interference by 5 db above 1 Microamp/Mc from 1.5 to 2.5 Mc.

F. For the F/M T/M LOX Wiper (J7-a) increase the maximum level of conducted interference by 6 db above 1 Microamp/Mc from 3.0 to 5.0 Mc.

G. For the F/M T/M LOX 5 VDC return (J7-b) increase the maximum level of conducted interference by 5 db above 1 Microamp/Mc from 3.0 to 5.0 Mc.

H. For the F/M T/M LH_2 Wiper (J7-h) increase the maximum level of conducted interference by 5 db above 1 Microamp/Mc from 3.0 to 5.0 Mc.

I. For the F/M T/M LH_2 5 VDC return (J7-i) increase the maximum level of conducted interference by 5 db above 1 Microamp/Mc from 3.0 to 5.0 Mc.

J. For the 28 VDC input lines (J8-A, C, & E) increase the maximum level of conducted interference by 10 db above 1 Microvolt/Mc from 1.5 to 7.0 Mc.

K. For the 28 VDC return lines (J8-B, D, & F) increase the maximum level of conducted interferency by 10 db above 1 Microvolt/Mc from 1.5 to 4.5 Mc.

L. For broad band and pulsed CW radiated interference increase the maximum level by 10 db above 1 Microvolt/Mc from 0.15 to 0.5 Mc.

Reason: Results of EMI testing of the P.U. Computer has shown that an out-of-specification limits situation exists on a number of input and output lines to the unit. The magnitude of the requested deviation is no more than 12 db and is for the most part in the Saturn V non-critical frequency range of 1-8 mc. This deviation will include the worst case condition indicated by previous test results.

Further efforts to bring the unit into the required MIL-I-6181D limits will cause further delay, excessive testing effort, and will have prohibitive schedule impact. EMC tests on the S-II-1 and S-II-2 stages indicate that exceeding the limits of MIL-I-6181D does not affect the operation of the vehicle.

Effectivity: 1B32082-505 S/N 00004, S/N 00008 through S/N 00010 (ME901-0206-0019) S-II-1, 2, & 3
1B32082-503 S/N 00011, ans subs (ME901-0206-0018) S-II-4 and subs.

Add: Deviation 351 Battery ME461-0015 SCN 138

Requirement: MIL-I-6181D Interference Control Requirements, Aircraft Equipment, dated 25 November 1959; the applicable portions of Paragraph 3.2.2 Short Duration Interference, reading - "Interference resulting from manual operation of switches but not including any electrical or electromechanical operations resulting from the manual switching, may deviate from the limits as indicated below. Other short duration interference may deviate from the limits as indicated below. Approval shall be obtained from the procuring activity before using these deviations."

"Maximum Duration	Maximum Recurrence	Deviation Permitted
1 Second	Once in 3 minutes	20 db"

Deviation: NR/SD shall be permitted to apply the 20 db deviation of MIL-I-6181D, paragraph 3.2.2, to the battery NR Part Number ME461-0015.

Effectivity: Quality Maintenance Units, S-II-3 and Subs.

Deviation 130 Liquid or Gaseous Nitrogen

Requirement: MIL-N-6011, dated 14 March 1950.

Deviation: Delete the requirement for compliance to Specification MIL-N-6011 in its entirety as applicable to the servoactuator, main pump, auxiliary motor-pump, quick-disconnect couplings, and bleed valve of the engine actuation system.

Reason: Liquid or gaseous nitrogen is not utilized in the design, fabrication, or inspection of the particular components cited.

Effectivity: S-II-T, S-II-D, S-II-1 and subs; Battleship test vehicle, Electromechanical Mockup, and the three engine actuation systems to be delivered to MSFC.

Deviation 126 Hydraulic Pumps

Requirement: MIL-P-19692A, dated 1 December 1960.

Deviation: Delete the requirement for compliance to Specification MIL-P-19692A in its entirety as applicable to the accumulator reservoir manifold assembly (ARMA), the servoactuator, quick disconnect couplings, and bleed valve of the engine actuation system.

Reason: This specification is not utilized in the design, fabrication, or inspection of the particular components cited.

Effectivity: S-II-T, S-II-D, S-II-1 and subs; Battleship test vehicle, Electromechanical Mockup, and the three engine actuation systems to be delivered to MSFC.

Deviation 22 Rated Discharge Pressure

Requirement: MIL-P-19692A, 1 December 1960, paragraph 3.2.2.2. "The value of the rated discharge pressure shall be stated in the Model Specification and shall be one of the values listed in Table I."

Deviation: The rated discharge pressure of the pump shall be 3650 (+150, -0) psi.

Reason: A system operating pressure capability of 3650 psi is necessary to compensate for possible servoactuator load increases.

Deviation 168a Mounting Flange

Requirements: MIL-P-19692A, 1 December 1960, paragraph 3.4.3. "Mounting: All pumps shall incorporate a standard mounting flange, which shall be in accordance with either Standard AND10261 or AND10262, as specified in the model specification."

Deviation: The main pump shall incorporate a mounting flange compatible with the J-2 engine accessory drive pad. The auxiliary pump shall employ a mounting pad in accordance with the dimensions shown on Standard AND10260.

Reason: The main pump attaches to the J-2 engine accessory drive pad, which has a nonstandard accessory drive pad, with a 12-stud pattern. The main pump mounting flange must be compatible with the J-2 engine accessory drive pad. The dimensions of AND10260 are better suited to the auxiliary pump than those of AND10261.

Effectivity: This deviation is effective on the Battleship; Electromechanical Mockup, and the three engine actuation systems to be delivered to MSFC; S-II-T; S-II-S/D; and S-II-1 and subsequent.

Deviation 169a Drain Bosses

Requirements: MIL-P-19692A, 1 December 1960, Paragraph 3.4.3.2: "The mounting flange drain bosses specified on Standards AND10261 and AND10262, as applicable, shall be required and all of them may be tapped at the option of the pump manufacturer. By agreement between the pump manufacturer and the purchaser, only certain of the bosses shall be tapped for external connection; in such case, the boss or bosses to be so tapped, shall be specifically designated on the installation drawing of the pump which accompanies the model specification."

Deviation: The requirements of MIL-P-19692A, Paragraph 3.4.3.2, shall not apply to the mounting flange drain bosses for the main pump and the auxiliary motor pump.

Reason: It is necessary to provide and locate sufficient drain ports so that one of the ports will always provide drainage regardless of the attitude of the S-II vehicle.

Effectivity: This deviation is effective on the Battleship Electromechanical Mockup; and the three engine actuation systems to be delivered to MSFC; S-II-T; S-II-S/D; S-II-1 and subsequent.

Deviation 170a Replaceable Coupling Shaft

Requirements: MIL-P-19692A, 1 December 1960, Paragraph 3.4.4. "Drive Coupling - A replaceable part of the pump assembly, incorporating a shear section, shall be interposed between the pump drive shaft and the engine accessory drive shaft by which the pump is to be driven. This shear coupling part shall be held in place by a positive retainer. Requirements for coupling lubrication shall be included in the installation instructions for the pump."

Deviation: The requirements of Paragraph 3.4.4 shall not apply to the main pump and the auxiliary motor pump.

Reason: The accessory drive shaft utilized in the J-2 engine is unconventional in that it relies on the engine mounted pump for support. Therefore, if a conventional shear coupling was employed between the pump and accessory shafts, and if this coupling sheared, the accessory drive shaft would be supported and could cause extensive damage to the engine. To avoid this problem, the main pump is designed with the shear action in the internal drive shaft which shears in the event of pump failure, thus protecting the engine accessory drive from overload damage. The pump on the auxiliary motor pump is driven by an electric motor thus making the requirement for a shear section.

Effectivity: This deviation is effective on the Battleship; Electromechanical Mockup; the three engine actuation systems to be delivered to MSFC; S-II-T; S-II-S/D; S-II-1, and subsequent.

Deviation 171a Port Sizes

Requirements: MIL-P-19692A, 1 December 1960, Paragraph 3.4.5 "Ports. Port sizes shall be in accordance with MS33524; port configuration shall be specified in the model specification."

Deviation: The requirements of MIL-P-19692A, Paragraph 3.4.5, shall not apply to the main pump and auxiliary motor pump. The port sizes of the pumps shall be as follows:

Nomenclature	Main Pump	Auxiliary Motor Pump
Pressure Port	-8 (1/2 in.)	-6 (3/8 in.)
Suction Port	-10 (5/8 in.)	-6 (3/8 in.)
Case Drain Port	-4 (1/4 in.)	-4 (1/4 in.)
Seal Drain Port	-4 (1/4 in.)	-4 (1/4 in.)

Reason: MS33524 is applicable to non-self-priming pumps whereas the S-II engine actuator system pumps are self-priming type. Also, because of relatively shorter line length and higher pressures in the S-II engine actuation system, pressure losses are less.

Effectivity: This deviation is applicable to the Battleship; Electromechanical Mockup; the three engine actuation systems to be delivered to MSFC; S-II-T; S-II-S/D; S-II-1, and subsequent.

Deviation 120 Scope

Requirement: MIL-R-11469, dated 24 September 1960, Radiographic Inspection: Soundness Requirements for Steel Castings.

Deviation: Delete the requirement for compliance to MIL-R-11469 in its entirety as applicable to the accumulator reservoir manifold assembly (ARMA) and the bleed valve of the engine actuation system.

Reason: This process and procedure is not utilized in the design, fabrication, or inspection of the particular components cited.

Effectivity: S-II-T, S-II-D, S-II-1 and subs; Battleship test vehicle, Electromechanical Mockup, and three engine actuation systems to be delivered to MSFC.

Deviation 286

Requirement: MIL-STD-1247, dated 12 March 1963, paragraph 5.7.1.- "Tapes shall be placed at both ends of a line. Spacing between tapes within a group shall be a minimum of one inch."

Deviation: Tapes shall be placed at both ends of a line.

Reason: In order to identify properly a line assembly, as many as five decals are required for one complete identification. The requirement also prohibits the application of tapes on a radius or bend. Due to the spacing callout, it is impossible to identify line assemblies with decals that could otherwise be identified.

Effectivity: This deviation shall be effective on S-II-S, S-II-F, S-II-D, S-II-T, S-II-1, and Subs.

Deviation 288

Requirement: MIL-STD-1247, dated 12 March 1963, Figure 6, Note 2. - "Tag material to be annealed aluminum alloy, 0.025 ± 0.003-in. thick, per QQ-A-561."

Deviation: Tag material to be annealed aluminum alloy, 0.025 ± 0.003-in. thick, per QQ-A-250/1c.

Reason: Specification QQ-A-561 was cancelled by the Government on 16 December 1963. Specification QQ-A-250/1 was released to supersede it. Since both specifications reference the same alloy, the change is inconsequential to the identification tags of MIL-STD-1247.

Effectivity: All stages.

Deviation 177 Marking of Wire Cable Assemblies

Requirement: MIL-STD-130B, dated 24 April 1962, Paragraph 5.2.1.1. "Whenever space permits, the following additional information shall be included unless specifically exempted by the procuring activity:

Design Activity Identification (Para. 3.13)
Stock Number (Para. 3.17)
Special Characteristics (Para. 3.15)."

Deviation: Wire and cable assemblies shall be marked with identifying number and reference designation only.

Reason: Paragraph 5.2.1.1 requires specific exemption to exclude requirement of markings, design activity, identification, nomenclature, stock number, and special characteristics. Space limitations on identification tags for cable assemblies dictate request for exemption. S&ID specification MA0303-027 outlines the procedure preferred by S&ID.

Effectivity: This deviation shall apply to the Electromechanical Mockup, the Battleship test vehicle, engine actuation systems 1 and subs, to be delivered to MSFC, and stages S-II-T, S-II-1, and subs.

Deviation 318 Compatibility of Dissimilar Metals

Requirement: MIL-STD-171A, Paragraph 4.7: Compatibility of Dissimilar Metal Couplings. - Permissible couple series are shown in Table I by the graphs in the right column. Members of groups connected by lines will form permissible couples, where corrosion as a result of galvanic action is least likely. Compatible couples between groups have been specified in Table I based on a potential difference of 0.25 volt maximum.

Deviation: The potential difference may be 0.60 volt maximum for instrumentation assemblies that are installed within environmental controlled containers.

Reason: An investigation made by the Saturn S-II instrumentation branch has revealed that certain instrumentation assemblies have connectors that have tin plated contacts and a mating connector which has gold plated contacts. The dissimilarity of these particular metals permits a potential difference of 0.60 volts only if these metals are subjected to an environment that creates an electrolyte between these two metals; when a conductive path is formed, corrosion and coupling results.

Corrosion and coupling does not occur when these instrumentation assemblies are installed within containers that are completely purged (inert atmosphere and temperature controlled). Drawings will implement utilization of connectors that have gold-plated contacts for vehicles S-II-6 and subsequent.

Deviation 100 General Painting Requirements

Requirement: MIL-STD-171A, dated 11 October 1960, paragraph 5.2.1. .....Pretreatment coating according to Specification MIL-C-15328 shall be applied as directed by Specification MIL-C-8507, as applicable.....

Deviation: .....Pretreatment coating according to Specification MIL-C-8514 shall be applied as directed by Specification MIL-C-8507, as applicable.....

Reason: MIL-C-8514, "Wash Primer" is preferred to Specification MIL-C-15328 because of the following superior properties: less blush, less settling and smoother film. Specification MIL-C-8514 is an approved specification and is second tier to Specification MIL-P-8585A that is a contractual specification called out in the S-II Stage program.

Deviation 321 6061 - 6062 Aluminum Alloy

Requirement: MIL-T-7081C and QQ-A-200/8b, Table I
Aluminum alloy material 6061 shall have a chomium element content of 0.15 percent minimum and 0.35 percent maximum. Aluminum alloy material 6062 shall have a chromium element content of 0.04 percent maximum.

Deviation: Aluminum alloy with a chromium element content of 0.04 percent minimum to 0.35 percent maximum shall be acceptable as either 6061 or 6062 aluminum, providing all other requirements of Table I are satisfied.

Reason: The 6062 designation has been discontinued by the aluminum industry and 6061 now encompasses the entire range 0.04 to 0.35 percent.

Effectivity: Saturn S-II Stages.

Deviation 131 Seamless Aluminum Tubing

Requirement: MIL-T-7081C, dated 3 April 1959, Tube, Aluminum Alloy, Seamless; Round, 6061 and 6062, Aircraft Hydraulic Quality.

Deviation: Delete the requirement for compliance with MIL-T-7081C in its entirety as applicable to the servoactuator, main pump, and auxiliary motor-pump of the engine actuation system.

Reason: Aluminum alloy tubing is not utilized in the design, fabrication, or inspection of the particular components cited.

Effectivity: S-II-T, S-II-D, S-II-1 and subs; Battleship test vehicle, Electromechanical Mockup, and the three engine actuation systems to be delivered to MSFC.

Deviation 136 Seamless Aluminum Tubing

Requirement: MIL-T-7081C, dated 3 April 1959, Tube, Aluminum Alloy, Seamless, Round, 6061 and 6062, Aircraft Hydraulic Quality.

Deviation: Delete the requirement for compliance with MIL-T-7081C in its entirety as applicable to the quick disconnect couplings of the engine actuation system.

Reason: Aluminum tubing is not utilized in the design or fabrication of the particular component cited.

Effectivity: S-II-T, S-II-D, S-II-1 and subs; Battleship test vehicle, Electromechanical Mockup, and the three engine actuation systems to be delivered to MSFC.

Deviation 132 Corrosion-Resistant Steel Tubing

Requirement: MIL-T-8808A, dated 1 April 1958, Tubing, Steel, Corrosion-Resistant (18-8 Stabilized), Aircraft Hydraulic Quality.

Deviation: Delete the requirement for compliance with MIL-T-8808A in its entirety as applicable to the servoactuator on the engine actuation system.

Reason: Steel tubing (18-8 stabilized) is not utilized in the design, fabrication, or inspection of the particular component cited.

Effectivity: S-II-T, S-II-D, S-II-1 and subs; Battleship test vehicle, Electromechanical Mockup, and the three engine actuation systems to be delivered to MSFC.

Deviation 133 Pressure Relief Valves

Requirement: MIL-V-8813, dated 20 November 1957, Valves, Aircraft, Hydraulic Pressure Relief, Type II Systems.

Deviation: Delete the requirement for compliance to Specification MIL-V-8813 in its entirety as applicable to the servoactuator, main pump, auxiliary motor-pump, quick-disconnect couplings, and bleed valve.

Reason: No hydraulic pressure relief valves are utilized in the design, fabrication, or inspection of the particular components cited.

Effectivity: S-II-T, S-II-D, S-II-1 and subs; Battleship test vehicle, Electromechanical Mockup, and the three engine actuation systems to be delivered to MSFC.

Deviation 138 Environmental Protection

Requirement: MSFC-DWG-10M01071, dated 6 March 1961, Environmental Protection When Using Electrical Equipment Within the Area of Saturn Complexes, Where Hazardous Areas Exist.

Deviation: Delete the requirement for compliance to Drawing MSFC-DWG-10M01071 in its entirety, as applicable to the quick-disconnect couplings, and the bleed valve of the engine actuation system.

Reason: No electrical equipment is utilized in the design, fabrication or inspection of the particular components cited.

Effectivity: S-II-T, S-II-D, S-II-I and subs; Battleship test vehicle, Electromechanical Mockup, and the three engine actuation systems to be delivered to MSFC.

Deviation 178 Standard for Electrical and Electronic Symbols

Requirement: MSFC Drawing 10443376, Paragraph 3.1 (second sentence): "Where symbol appears for component in this standard . . . ."

Deviation: Change second sentence to read: "Where no exact symbol appears . . . ."

Requirement: MSFC Drawing 10443376, Paragraph 3.4 (second sentence): "The following reference designations not presently part of XDOD-STD-0001, shall be used within logic graphical symbols."

Deviation: Remove logic reference designation from paragraph 3.4.

Add to paragraph 3.2 these requirements which now appear in Paragraph 3.4:

AG	AND gate	IV	Inverter
CT	Counter	OS	One shot
BO	Blocking oscillator	OR	OR gate
CF	Cathode follower	PA	Pulse amplifier
CD	Current driver	RG	Resistor
DL	Delay line	ST	Schmitt trigger
EF	Emitter follower	SA	Shift advance driver
FF	Flip-flop	SR	Shift register
GD	Gap detector	TG	Time generator

Requirement: MSFC Drawing 10443376, Paragraph 4.5.2 Advanced Schematic. "An advanced schematic is a schematic diagram that contains . . . this type of schematic is most useful for maintenance and trouble location."

Deviation: Change Paragraph 4.5.2 to read: "Advanced Schematic: An advanced schematic is a drawing that shall define complete wiring, terminal and pin function designation. The advanced schematic diagram shows all information of a wiring diagram except for physical locations, wire routing, and wire gage."

Requirement: MSFC Drawing 10443376.

Deviation: Add the following as Paragraph 4.5.2.1: "Internal circuitry of "black boxes," which are the responsibility of the designing activity, shall be shown on advanced schematic diagrams to show operation sequencing, safety interlocking, monitoring, and power connections. Such internal circuits may be shown without detail reference to physical location of components or connections within the "black box," but will reflect necessary contact assignments for interface with system schematic."

Reason: To clarify existing requirements and to add capability of utilizing standard abbreviations and symbols not specified in MSFC Drawing 10443376.

Effectivity: This deviation shall apply to the Battleship Test Facility, Electromechanical Mockup, S-II-T, S-II-S/D, S-II-1, and subsequent

Deviation 128 Hose Assemblies

Requirement: MSFC-DWG-10509318, dated 9 July 1960.

Deviation: Delete the requirement for compliance to Specification MSFC-DWG-10509318 in its entirety, as applicable to the accumulator reservoir manifold assembly, servoactuator, main pump, auxiliary motor-pump, quick-disconnect couplings, and bleed valve.

Reason: Hose assemblies are not utilized in the design, fabrication, or inpsection of the particular components cited.

Effectivity: S-II-T, S-II-D, S-II-1, and subs; Battleship test vehicle, Electromechanical Mockup, and the three engine actuation systems to be delivered to MSFC.

Deviation 337 - Fluid Requirements

Requirement: MA-004-003-2H (MSFC-DWG-13M50097) prescribes the specifications applicable to the procurement and quality of helium, nitrogen, oxygen, and hyrdogen.

Deviation: In lieu of these requirements, a fluid which meets any applicable fluid specification listed in SID 61-367 may be procured and used. The maximum allowable imparities in fluids at the Stage/GSE interface during stage checkout, static firing, and launch countdown at MTF or KSC shall not exceed that specified in 13M50097. The maximum allowable imparities in fluids at the Stage/GSE interface during stage checkout at Seal Beach shall not exceed those specified in 13M50097, except for nitrogen, where the gaseous imparties shall not exceed those specified in MIL-P-27401. Reperformance of completed tests shall not be required because of this deviation. SCN 119R2

Effectivity: S-II-3 and subs.

Deviation 338 - Helium and Nitrogen Sampling and Testing

Requirement: MA-004-003-2H (MSFC-DWG-13M50097) delineates the requirements for sampling and testing helium and nitrogen for hydrocarbon, moisture, and particulate content at Seal Beach and MTF.

Deviation: In lieu of these requirements, the following procedure are authorized:

1. Seal Beach SCN 119R2

   a. Vendor analyses of helium and nitrogen for conformance to applicable specifications are acceptable. Samples at the Seal Beach central facility shall be analyzed as deemed necessary for moisture and hydrocarbon content.

   b. After repair or invalidation of the central gas system, samples shall be tested for particulate, moisture, and hydrocarbon content.

   c. At a central point in Station VII (VCO), moisture monitors shall be permanently installed to sample moisture in helium and nitrogen systems prior to tribution to station GSE or stage. Dewpoints shall be be determined and recorded every 24 hours.

   d. After modification of any gas distribution line the system shall be blown down and particulate samples taken.

   e. Prior to stage checkout, four pneumatic distribution lines shall be selected at random and particulate samples taken for certification prior to hookup.

2. MTF

   a. Prior to a stage being brought into a stand and subsequent to a stage leaving a stand, all pneumatic servicing lines at the Stage/GSE interface shall be processed per the requirements of NR Drawings F02-000209 and F02-000109 (Fluid Site Installation - Fluid Distribution Lines). All lines shall be certified prior to hookup of each stage. SCN 119R1

   b. The supply system servicing the GSE/facility shall be checked weekly. During the period a stage occupies a stand, samples shall be taken weekly at the facility single-point high pressure gas manifold sampling point, and tested for hydrocarbon, moisture, particulate, and purity.

   c. After modification of any gas distribution line, the system cleanliness shall be established and the sampling requirements of NR Drawings F02-000209 and F02-000109 shall apply.

Effectivity: S-II-3 and subs.

New page

Deviation 152 Component Cleanliness

Requirement: ABMA-DWG-10509305, dated 1 June 1960, Cleanliness of Components for Use in Liquid Oxygen, Fuel, and Pneumatic Systems, Specification for.

Deviation: Delete the requirement for compliance to Drawing ABMA-DWG-10509305 in its entirety as applicable to the accumulator reservoir manifold assembly (ARMA), servoactuator, main pump, auxiliary motor-pump, quick-disconnect couplings, and bleed valve for the engine actuation system.

Reason: This drawing is not applicable to the particular hydraulic system components cited.

Effectivity: S-II-T, S-II-D, S-II-1 and subs; Battleship test vehicle, Electromechanical Mockup, and the three engine actuation systems to be delivered to MSFC.

Deviation 139 Soldering

Requirement: MSFC-PROC-158A, dated 12 April 1962, Soldering of Electrical Connections (High Reliability), Procedure for.

Deviation: Delete the requirement for compliance with MSFC-PROC-158A in its entirety, as applicable to the bleed valve on the engine actuation system.

Reason: To carify existing requirements and to add capability of utilizing standard abbreviations and symbols not specified in MSFC Drawing 10443376.

Effectivity: This deviation shall appply to the Battleship Test Facility, Electromechanical Mockup, S-II-T, S-II-S/D, S-II-1, and subsequent

Deviation 353 Soldering Electrical Connections

Requirement: MSFC-PROC-158, prescribes the procedure for soldering of electrical connections.

Deviation: Soldering and electrical connection procedures used by Parker Aircraft Company in the production of equipment in accordance with NR Procurement Specification MC284-0358 shall be in accordance with NPC200-4.

Effectivity: Prototypes, qualification test specimens, and production items produced in accordance with MC284-0358.

Reason: This process and procedure are not utilized in the design, fabrication, or inspection of the particular component cited.

Effectivity: S-II-T, S-II-D, S-II-1 and subs; Battleship test vehicle, Electromechanical Mockup, and the three engine actuation systems to be delivered to MSFC.

Deviation 307

Requirement: MSFC-PROC-158A, 12 April 1962 "Soldering of Electrical Connections (High Reliability), Procedure for, Paragraph V. B. 1 reading "The Quality Assurance Division shall be responsible for enforcement of the requirement of this procedure during fabrication, assembly, modification, repair, storage and issue."

Deviation: Delete the requirement of MSFC-PROC-158A in its entirety, as applicable to internal connections of radio noise filters used in assembly of batteries per Specification MC461-0004.

Reason: Radio noise filters are procured by Electric Storage Battery Company, Raleigh, N. C., per their control drawing 259-1003 from Spraque Electric Co. as a standard off-the-shelf item. The internal wiring of the filter is completely potted before unit is sealed. External wiring to the filter will be soldered per MSFC-PROC-158A, and potted, If this deviation is not granted a production delay of 6 months will occur. This filter is used for suppression of radio noise from the thermo switch in the battery heater circuit. This heater circuit is utilized only for ground operation of the vehicle from GSE power.

Effectivity: Electromechanical Mockup, Battleship, S-II-T, S-II-1, and subs, plus qualification test articles.

Deviation 37 Flux

Requirement: MSFC-PROC-158A, 12 April 1962, paragraph VI. A. 1. b "Only non-corrosive and non-conductive rosin-type fluxes shall be used . . . ."

Deviation: Fluxes shall conform to specification MIL-P-14256.

Reasons: A standard is required to provide uniformity in the classification of fluxes. This specification has been used successfully by S&ID to define non-corrosive and non-conductive.

Deviation 271 Solder Flux

Requirements: MSFC-PROC-158A, 12 April 1962, Soldering of Electrical Connections (High Reliability), Procedure for, Paragraph VI. A. 1. b. "Only non-corrosive and non-conductive rosin-type fluxes shall be used."

Deviation: A hydrazine, non-corrosive, quick-wetting, alcohol flux, Fairmont H-200, may be used to solder solid silver wire and copper tin-plated wire with Sn-60 (QQ-S-571) inside batteries fabricated by Electric Storage Battery Co., Raleigh, North Carolina.

Reason: Electric Storage Battery Co. (ESB) cannot use a rosin-type flux for soldering inside the battery because the rosin flux chemically reacts with the battery plates and reduces the life and reliability of the battery. Due to the location of soldering above the plates, it is impossible to assure enough cleaning and inspection between plates after soldering to determine if any residue contamination is present. ESB has determined from past operations and laboratory tests that Fairmont H-200 will not impair life or reliability of batteries.

Effectivity: This deviation shall apply to the Battleship test vehicle, Electromechanical Mockup, S-II-F, S-II-T, S-II-1, and subsequent flight stages.

Deviation 36a Soldering of Electrical Connections

Requirement: MSFC-PROC-158A, 12 April 1962, paragraph VI.A.1.c. Insulation tubing.- "Insulation tubing shall be clear, flexible polyvinyl chloride sleeving conforming to type I of Specification MIL-I-7444 . . . . Tubing shall be slipped over all soldered terminals of relays, connectors, and similar items that are not protected by insulated grommets or by potting . . . . All routed conductors in harness or box assemblies shall be protected at abrasion points by appropriate clear insulation tubing."

Original Deviation: Insulation tubing.- Insulation tubing shall be clear, flexible polyvinyl chloride sleeving conforming to type I of Specification MIL-I-7444. Teflon tubing conforming to Specification MIL-I-22129 shall be used in application where extremely high temperature (220 degrees F or higher) conditions necessitate usage. Tubing shall be slipped over all soldered terminals of relays, connectors, and similar items that are not protected by insulated grommets or by potting. The tubing shall extend over the full length of the soldering end of the terminal and shall extend a distance equal to or greater than the tubing diameter above the stripped portion of the attached conductor.

All route conductors in harness or box assemblies shall be protected at abrasion points by appropriate clear insulation tubing. Heat-shrink insulation tubing shall be made of a material that does not emit gases or chemicals that are detrimental to the soldered joint, the wire, or the insulation of the wire. Heat-shrink tubing shall not be used on components where the application of heat will damage the component. The solder joint must be visible through the tubing to facilitate troubleshooting and inspection.

Revised Deviation: Insulation tubing. - Insulation tubing shall be clear, flexible polyvinyl chloride sleeving conforming to type I of Specification MIL-I-7444. Teflon tubing conforming to Specification MIL-I-22129 shall be used in application where extremely high temperature (220 degrees F or higher) conditions necessitate usage. Tubing shall be slipped over all soldered terminals of relays, connectors, and similar items that are not protected by insulated grommets or by potting. Leads attached by the side route to turret or bifurcated terminals need not be sleeved. The tubing shall extend over the full length of the soldering end of the terminal and shall extend a distance equal to or greater than the tubing diameter above the stripped portion of the attached conductor. All route conductors in harness or box assemblies shall be protected at abrasion points by appropriate clear insulation tubing. Heat-shrink insulation tubing shall be made of a material that does not emit gases or chemicals that are detrimental to the soldered joint, the wire, or the insulation of the wire. Heat-shrink tubing shall not be used on components where the application of heat will damage the component. The solder joint must be visible through the tubing to facilitate troubleshooting and inspection.

Reasons: It is impossible to install insulation sleeving over component leads which are soldered to turret or bifurcated terminals because:

a. sleeving bends are too sharp;

b. sleeving large enough to go over the terminal would be much too large to fit component leads; conversely, sleeving which would fit the leads could not possibly fit over the terminals.

Effectivity: This deviation is applicable to the Electromechanical Mockup, Battleship, MSFC Systems 1 and subs., S-II-T, S-II-D, S-II-1 and subs.

Deviation 39 Solvent

Requirement: MSFC-PROC-158A, 12 April 1962, paragraph VI.A.1.e "Solvent used for removal of grease, oil, dirt, or excess flux shall be ethyl alcohol, conforming to MIL-A-6091 or MIL-E-463."

Deviation: Solvents used for removal of grease, oil, dirt, or excess flux shall be (1) ethyl alcohol, conforming to MIL-A-6091 or MIL-E-463, or (2) isopropyl alcohol conforming to MIL-I-10428.

Reasons: The additionally-recommended solvent removes grease, oil, and dirt of excess flux more rapidly than ethyl alcohol. It is more economical and non-toxic and no permit is required for its use.

Deviation 40 Wire

Requirement: MSFC-PROC-158A, 12 April 1962, paragraph VI. A. 1g ". . . . Wire shall be cut to length before soldering and the wire ends shall not extend beyond the connection. Standed wire shall be twisted in its original form after insulation removal."

Deviation: After a wire has been cut to length, the insulation stripped, and the wire trimmed and attached to a terminal, the excess pigtail shall be trimmed prior to soldering. After insulation removal, if the lay has been disturbed on the stranded wire, the wire shall be twisted to its original lay.

Reason: Thermal strippers generally do not disturb the wire.

Deviation 191 Silver-Plated, Teflon-Insulated Wire

Requirement: MSFC-PROC-158A, paragraph VI. A. 1. g. "The wire size.... For applications where high temperature (220 degrees F or higher) necessitates usage, teflon-insulated nickel-plated copper stranded wire shall be used.... Silver-plated teflon-insulated wire is not acceptable."

Deviation: Silver-plated teflon-insulated wire may be used in the position indicators for the fill valve, prevalve, normally open recirculation shutoff valve, and normally closed recirculation shutoff valve.

Reason: The stage-mounted valves have been designed by Rocketdyne Division of NAA and use silver-plated, teflon-insulated wire on the indicator circuit. Preliminary results of Rocketdyne testing indicate a much higher failure rate for nickel-plated, teflon-insulated wire than for silver-plated, teflon-insulated wire under conditions of cryogenic temperature and vibration. The use of silver-plated, teflon-insulated wire has been approved by NASA for similar usage on the J-2 rocket engines.

Effectivity: This deviation shall apply to the Battleship test facility, the Electromechanical Mockup, S-II-S, S-II-T, S-II-1, and subsequent flight stages.

Deviation 272a Wire for Coaxial Cables

Requirement: MSFC-PROC-158A, paragraph VI. A. 1. g. "Wire. - The wire size, number of strands, insulation resistance, insulation material, and wire plating shall be as shown on the electrical drawings and as required by the applicable specifications. For application where high temperature (220 degrees F or higher) necessitates usage, teflon-insulated nickel-plated copper-stranded wire shall be used. Excess wire shall be cut off prior to soldering the connection. Wire shall be cut to length before soldering, and the wire ends shall not extend beyond the connection. Stranded wire shall be twisted in its original form after insulation removal.

CAUTION

Silver-plated teflon-insulated wire is not acceptable."

Deviation: RF coaxial cable Types RG115A/U and RG210/U (silver-plated, teflon insulated center conductor and silver plated shield) and RG9B/U and RG222/U (silver-plated center conductor and/or shield) may be used for antenna and transmission line systems.

Reason: This type of cable is required for elevated temperatures. Silver plated center conductor and shield has high conductivity (low attenuation at RF frequencies) and silver plated shield has good shielding effectiveness.

Deviation 317 Use of Silver-Plated Wire

Requirement: MSFC-PROC-158A, dated April 12, 1962, paragraph VI. A. 1. g. - (cf. Amendments 69a and 572) Wire. - "The wire size... CAUTION Silver-plated teflon-insulated wire is not acceptable."

Deviation. - Delete the CAUTION requirement in its entirety as applicable to transducers, absolute, pressure, potentiometer; and transducers, differential, pressure, potentiometer.

Reason: For this application, wire is coupled to a moving wiper assembly and the smallest diameter wire is mandatory to prevent excessive hysteresis.

The smallest wire available is silver-plated and 0.0135 inch in diameter. Nickel-plated copper wire cannot be obtained in this small diameter. The manufacturer of this silver-plated wire, "Tensolete", has developed and uses a monomolecular layer of a corrosion inhibitor which eliminates the problem of cuprous oxide formation.

Effectivity: This deviation shall be effective only for transducers, absolute, pressure, potentiometer, part numbers ME-499-0042-0001 and ME-449-0042-0002, and for transducers, differential, pressure, potentiometer, part numbers ME-449-0043-0001, ME-449-0043-0002, and ME-449-0043-0003, manufactured by Sparton Southwest, Colvin Division, Albuquerque, New Mexico, as used on S-II-T, S-II-1, and S-II-2 and subsequent.

Deviation 317a Use of Silver-Plated Wire

Requirement: MSFC-PROC-158A, Paragraph VI.A.1.g. "The wire size... for applications where high temperature (220 degrees F or higher) necessitates usage, teflon-insulated nickel-plated copper stranded wire shall be used .... Silver-plated teflon-insulated wire is not acceptable."

Deviation: Silver-plated teflon insulated wires may be used.

Reason: Because of the relatively small amounts of total heat required to solder silver-plated wire to hermetic seals in the gyro, temperature rise of the seal during the soldering process will be less, thereby minimizing the probability of cracking the seal. Silver-plated wire allows a minimal amount of solder on joints which makes it easier to eliminate solder blobs.

Effectivity: ME493-0009-0001. Gyroscope Package, Rate. 3 Axis. S-II-1 through S-II-3 inclusive.

Deviation 327a Use of Silver-Plated Wire

SCN 40

Requirement: MSFC-PROC-158A, Paragraph VI, A.1.g. "The wire size for applications where high temperature (220 degrees F or higher) necessitates usage, teflon-insulated nickel-plated copper stranded wire shall be used. . . .Silver-plated teflon-insulated wire is not acceptable."

SCN 60

Deviation: Silver-plated teflon insulated wires may be used to wire the Power Supplies for ME464-0019-0003, ME464-0019-0004, ME464-0019-0005.

Reason No. 1: ME464-0019-0003 - Silver-plated teflon insulated wire is used for component leads and for wire harnesses interconnecting printed circuit boards. This choice of design was based primarily on the ease of procurement of components such as variable resistors and filter components that were readily available with the subject wire as integral lead material, and due to existing supplier stock on hand of the subject wire for general wire harness purposes. These wires are contained within a moisture proof package and will therefore not be subjected to a highly corrosive atmosphere such as salt spray. All wires are securely fastened to prevent flexing and all exposed wire at solder connections will be conformally coated. ME464-0019-0003 power supplies are presently installed in vehicles S-II-1 thru S-II-4. Fabrication, relative to use of subject wire, has been completed for stage requirements through S-II-10.

Reason No. 2: ME464-0019-0004 - Silver-plated teflon insulated wire is used for component leads only. This choice of design was based primarily on the ease of procurement of components such as variable resistors and filter components that were readily available with the subject wire as integral lead material. These wires are contained within a moisture proof package and will therefore not be subjected to a highly corrosive atmosphere such as salt spray. All wires are securely fastened to prevent flexing and all exposed wire at solder connections will be conformally coated. Fabrication, relative to use of subject wire, has been completed for approximately 15 ME464-0019-0004 power supplies.

Reason No. 3: ME464-0019-0005 - Silver-plated teflon insulated wire is used for variable resistor leads only. This choice of design was based primarily on the ease of procurement of variable resistors with the subject lead material. These wires are contained within a moisture proof package and will therefore not be subjected to highly corrosive

atmosphere such as salt spray. All wires are securely fastened to prevent flexing and all exposed wire at solder connections will be conformally coated. Fabrication, relative to use of subject wire, has been completed on six ME464-0019-0005 power supplies. Use of silver-plated leads on variable resistors will be discontinued on subsequent manufactured units. SCN 60

Effectivity: All wiring in the ME464-0019-0003 (for use in all 5 vdc Power Supply applications on S-II-1 and S-II-2, and for those 5 vdc Instrumentation Excitation Power Supplies on S-II-3 through S-II-10) and component lead wires only in the ME464-0019-0004 configurations of the 5 vdc Power Supply, and variable resistor lead wires only in the first six ME464-0019-0005 units delivered. These six -0005 units will be selected from the following eight serial numbers, with the specific serial numbers affected by this SCN to be identified at time of shipment of the six units: EM30100, EM30102, EM32781, EM32782, EM32783, EM32784, EM32785, EM32786.

Deviation 66 Thermal Stripper

Requirement: MSFC-PROC-158A, 12 April 1962, paragraph VI. A. 2. a(1) "Thermal-type insulation strippers approved by MSFC . . . . . ."

Deviation: Thermal type insulation strippers shall be used on wire size No. 22 AWG (stranded wire gage) and smaller (see Figure 1). No. 20 AWG and larger wire may be stripped with thermal or precision type strippers provided the correct stripping hole for the corresponding gage of the wire shall be used. The setting of the cutter and the work produced shall be checked to assure that no nicks or cuts appear on the wire. Stripped wire with nicks or cuts shall not be used. Defective strippers shall not be used.

Reason: Meaning of "MSFC approved" not clear.

Deviation 65 Precision Strippers

Requirement: MSFC-PROC-158A, 12 April 1962, paragraph VI.A.2.a(2) Precision cutting type strippers. Non-adjustable, factory-set, cutting-type insulation strippers shall be approved by MSFC . . . . .

Deviation: Non-adjustable, factory-set, cutting-type insulation strippers may be used when thermal strippers cannot be used; however, to prevent stretching the wire, avoid use on wire size No. 22 American Wire Gage (AWG) and smaller. The correct stripping hole for the corresponding gage of the wire shall be used. The setting of the cutter and the work produced shall be checked to assure that no nicks or cuts appear on the wire. Stripped wire with nicks or cuts shall not be used. Defective strippers shall not be used.

Reason: Meaning of "MSFC approved" not clear.

Deviation 62 Files

Requirement: MSFC-PROC-158A, 12 April 1962, paragraph VI.A.2.c "Files for dressing copper tips shall be fine, single-cut, shear-tooth type."

Deviation: Files for dressing copper tips shall produce a smooth surface capable of being easily tinned.

Reason: The call out is not definite enough. Double-cut and other type files will achieve the same result as single-cut.

Deviation 46 Cleaning Tool

Requirement: MSFC-PROC-158A, 12 April 1962, paragraph VI.A.2.e "An efficient cleaning tool utilizing 1/2-inch copper shielding braid for cleaning of component leads can be constructed as shown in Figure 5."

Deviation: An efficient cleaning tool utilizing 1/2-inch copper shielding braid for cleaning of component leads can be constructed as shown in Figure 5. Abrasive ink erasures may also be used in the tool.

Reasons: The copper braid can be too harsh and remove the tinning on stainless steel lead wires. Ink erasures do a satisfactory cleaning job.

Deviation 45 Cleaning Printed Circuit Pads

Requirement: MSFC-PROC-158A, 12 April 1962, paragraph VI.A.2.g "For cleaning printed circuit pads, a white pencil-style typewriter eraser shall be used (see Figure 6)."

Deviation: For cleaning gold-plated printed circuit pads, a white pencil style typewriter eraser shall be used (see Figure 6). An electric typewriter eraser may be used if the connecting circuit is protected by an erasing shield.

Reason: Use of an electric eraser reduces cleaning time by at least 50 percent.

Deviation 64 Soldering Iron Tips

Requirement: MSFC-PROC-158A, 12 April 1962, paragraph VI.A.2.i "Copper or MSFC-approved plated tips shall be used."

Deviation: Copper or plated copper tips shall be used.

Reason: "MSFC approved" should be deleted until clarification is obtained. Specific types should be called out.

Deviation 63a CAUTION

Requirement: MSFC-PROC-158A, 12 April 1962, paragraph VI.A.3.a(2) "All soldering shall be performed in an area which is environmentally controlled to the satisfaction of MSFC."

Deviation: NAA's S-II Manufacturing Building No. 45, Compton Facility, electrical assembly areas, as presently constituted, shall be considered adequate to comply with the requirements of this paragraph. The work area and benches shall be maintained in a clean and orderly condition. All dirt, grease, oil, solder splatter, wire, and insulation cuttings and other foreign matter shall be removed from the work area. The air conditioner filters shall be properly serviced, and the air conditioner shall control the environment so that the integrity of workmanship will not degenerate due to perspiration deposit on work or other degradation of fabricated articles which could be caused by extreme weather conditions.

Reason: In accordance with agreement reached with NASA Resident Program Manager.

Deviation 279 Cleaning and Tinning Soldering Irons

Requirement: MSFC-PROC-158A, 12 April 1962, Soldering of Electrical Connections (High Reliability), Procedure for, Paragraph VI. A. 3. c. (1). "The copper tip shall be dressed by filing to a smooth surface of desired shape. To prevent excess oxidation, the iron shall be unplugged and allowed to cool before filing."

Deviation: In the manufacture of storage batteries where soldering irons with wattages of 200 watts or greater are utilized, it is permissible to utilize "TIN-EZY" (Johnson Manufacturing Co., Mt. Vernon, Iowa) to clean and tin the iron without permitting the iron to cool.

Reason: Large soldering irons (200-watts and larger) rapidly become oxidized during soldering operations. To clean per MSFC-PROC-158A results in one-half hour per cleaning operation, thus reducing production and increasing cost. Utilizing TIN-EZY precludes the necessity of cooling the iron for cleaning and tinning.

Effectivity: This deviation shall apply on the Electromechanical Mockup, S-II-F, S-II-T, S-II-1, and subsequent; and engineering test units.

Deviation 50 Insulation Clearance

Requirement: MSFC-PROC-158A, 12 April 1962, paragraph VI. A. 3. d(2) "Insulation clearance from terminal shall be a minimum of 1/32 inch and a maximum of the outside diameter of the wire insulation."

Deviation: Insulation clearance from terminal shall be:

(a) Wires having an insulation outside diameter of greater than 1/32 inch shall have a minimum clearance between the terminal and wire insulation of 1/32 inch and a maximum clearance equal to the insulation outside diameter plus 1/32 inch.

(b) Wires having an insulation outside diameter of less than 1/32 inch shall have a minimum clearance equal to the outside diameter of the insulation and a maximum clearance of 1/32 inch.

Reason: This tolerance is required because precision stripping would involve excessive costs.

Deviation 49 Tinning Conductors

Requirement: MSFC-PROC-158A, 12 April 1962, paragraph VI.A.3.d.(3) ". . . . . A thermal shunt shall be used to prevent the solder from wicking under the insulation . . . . . ."

Deviation: . . . . . A thermal shunt shall be used to prevent the solder from wicking under the insulation. Thermal shunts may be omitted during dip tinning, if no wicking occurs under the insulation.

Reasons: Use of thermal shunts during dip tinning would incur excessive costs. Dip tinning can be performed in a satisfactory manner without such shunts.

Deviation 276 Pretinning for Soldering in Batteries

Requirement: MSFC-PROC-158A, 12 April 1962, Soldering of Electrical Connections (High Reliability), Procedure for, Paragraph VI. A. 3. d. (3). "All portions of stranded wires coming in contact with the soldered area shall be tinned by the assembler as illustrated in Figure 7, or by other MSFC approved methods."

Deviation: In the manufacture of storage batteries, wherein wire (stranded copper, nickel-plated) sizes AWG No. 6 and larger are utilized, it is acceptable to solder without prior pretinning, provided said wires are properly cleaned with isopropyl alcohol.

Reason: The pretinning of the large mass of wires utilized in conjunction with their counterpart soldering cups results in severe wicking by virtue of the necessary high heat transfer. A much more reliable and satisfactory connection can be realized without pretinning of these larger wire sizes when used with an appropriate flux such as Fairmont H-200.

Effectivity: This deviation shall apply on the Electromechanical Mockup, S-II-F, S-II-T, S-II-1 and subs, and engineering test units.

Deviation 180 Solder Application

Requirement: MSFC-PROC-158A, dated 12 April 1962, Soldering of Electrical Connections (High Reliability), Procedure for, Paragraph VI.A.4.C. (last sentence). "Flow (or dip) soldering is prohibited."

Deviation: In the soldering of coil magnet wires to lead wires inside relay assemblies, dip soldering is permitted for Filtor, Inc., and Babcock Relays.

Reason: Dip soldering has been utilized in the manufacture of standard 2 PDT relays with great success and reliability. Relays on which the dip solder process is used are listed in the preferred products list for ABMA-PD-R-187 (the NASA contractual relay specification which governs our relay procurement). The dip solder pot uses silver solder (95% tin, 5% silver) and Filtor uses Kester No. 215 resin solder flux. The silver solder is used to ensure reliability during high temperature operation. The solder pot temperature is maintained between 580 F and 620 F. Flux on solder joints is removed by isopropyl alcohol. The relays are standard off-the-shelf proprietary items for which no development costs were incurred by this program. If this deviation is not granted, the supplier will be forced to deviate from a process which, based upon past experience, has proven to be reliable for this specific application.

Effectivity: This deviation shall apply to the Battleship test facility, the Electromechanical Mockup, S-II-S, S-II-T, S-II-1, and subsequent flight stages.

Deviation 48 Solder Application

Requirement: MSFC-PROC-158A, 12 April 1962, paragraph VI.A.4.c ". . . . . Flow (or dip) soldering is prohibited."

Deviation: Flow (or dip) soldering is prohibited. The pretinning of stranded wire by dipping into a pot of molten tin-lead solder is permissible.

Reason: Misinterpretation is possible without sentence permitting dip tinning.

Deviation 176 Solder Joints on Piezoelectric Acoustic Pickup

Requirement: MSFC-PROC-158A, dated 12 April 1962, Soldering and Electrical Connections (High Reliability), Procedures for, Paragraph VI.A.4.d. "A solder joint shall have a shiny bright appearance, no porosity, good fillet between conductors, good adherence to both parts, and no excess flux or solder. The contour of the wire shall be visible after soldering as shown in Figure 9."

Deviation: A solder joint shall have a shiny, bright appearance, no porosity, good fillet between conductors, good adherence to both parts, and no excess flux or solder. The contour of the wire shall not be required to be visible after soldering.

Reason: The design of this unit cannot provide for terminals as tie points. This results in a wire contour which is not visible.

Effectivity: This deviation, which applies to the piezoelectric acoustic pickup only, is effective on all S-II flight stages, and only on the Battleship test vehicle, Electromechanical Mockup, and engine actuation systems 1 and subs.

Deviation 54 Solder Joint

Requirement: MSFC-PROC-158A, 12 April 1962, paragraph VI.B.1.d ". . . . . No solder shall spill over and adhere to the sides of the cup."

Deviation: . . . . . No solder shall spill over and adhere to the outside of the cup. A slight tinning in the area of the soldering iron contact is permissible.

Reason: Extremely difficult and time-consuming to solder the cup with a properly tinned iron without having some solder adhere to the cup.

Deviation 302 Turret Terminals

Requirement: MSFC-PROC-158A, dated April 12, 1962, paragraph VI. B. 2.a.- "Size. - Terminals shall be of sufficient size to accommodate the conductors. Terminals or slots shall not be modified to accept oversize conductors. Conductor size shall not be reduced to accommodate undersize terminals." and paragraph VI. B. 2. f. -"Solder joint. - A minimum amount of solder shall . . . be covered with solder (see Figure 11)."

Deviation: Turret terminals used in Engineered Magnetics' design of the Power Static inverter shall be of a sufficient size when the basic diameter of the terminal is equal to or greater than the diameter of the largest wire attached to the terminal, provided the diameter of the largest wire does not exceed one-half the difference between the terminal diameter and the base diameter of the terminal. The solder fillet between the bottom wire and the terminal base shall be considered sufficient provided the wire diameter does not protrude beyond the edge of the terminal base, and the contour is visible. In restricted space locations the space between adjoining wires on the terminal can be a minimum of the combined thickness of the two adjoining wiring insulation. If the wires are bare of insulation, the separation distance may be zero. In either case the contour of the wires must be visible after soldering, and this shall be sufficient in meeting the requirement for a slight fillet. Wires soldered to center or top shoulders may protrude beyond the diameter of those shoulders, but not beyond the base diameter, and the solder fillet may be formed between the wires and the outside edge of those shoulders.

On hollow feed through turret terminals, when using 28 gauge or smaller wire, the wire may be brought over the shoulder and soldered to the terminal beneath the shoulder with a 180 to 270-degree wrap. Wires soldered in this manner may protrude beyond the base diameter, provided that a minimum spacing distance of 1/16 inch is maintained between the protruding wire and the adjacent terminals or wires.

It shall be permissible to solder wires to pin-type terminals (no grooves or shoulders) as supplied on transistors and diodes, with a 180 to 270-degree wrap. The wire diameter in this instance shall not exceed the diameter of the pin terminal.

Reason: This clarification deviation to MSFC-PROC-158A is required by Engineered Magnetics, Division of Gulton Industries, Hawthorne, California, for packaging the Power Static Inverter (For S-II Recirculation System motors). Their space, weight and mounting requirements, supplied by S&ID specification MC495-0006, is restricted, therefore requiring use of miniature terminals.

Effectivity: This deviation shall be effective only for Power Static Inverter, part number MC495-0006, for S-II Recirculation System motors on EMM, Battleship, S-II-T, S-II-1 and subsequent.

Deviation 53 Mounting

Requirement: MSFC-PROC-158A, 12 April 1962, paragraph VI. B. 2c ". . . . . will provide a snug fit . . . The terminal board shall be free of cracks, cuts, scratches, delaminations, or other damage."

Deviation: . . . . . will provide a tolerance of ±0.001 inch on the hole diameter . . . . . The terminal board shall be free of cracks, cuts, scratches, delaminations, or other damage that will degrade electrical resistance, except that 0.005 inch delamination for drilling and 1/16 inch delamination for swaging or soldering is permissible.

Reasons: (1) Snug fit is interpreted as ±0.0002 inch. Holding drilled holes to this tolerance would greatly increase cost. (2) Unless this amount of delamination is allowed, an extremely high rejection rate can be anticipated.

Deviation 44 Flux

Requirement: MSFC-PROC-158A, 12 April 1962, paragraph VI. B. 2. g "After soldering any excess flux shall be removed . . . . ."

Deviation: After soldering all flux shall be removed . . . . .

Reason: No flux rather than any excess flux should be specified.

Deviation 67a Turret Terminal

Requirement: MSFC-PROC-158A, 12 April 1962, paragraph VI. B. 3. a. "A half-wrap (180 degrees) shall be used to attach wires."

Existing Deviation: "A half-wrap (180-200 degrees) shall be used to attach wires."

Requested Deviation: The bend to attach a wire or lead to a turret terminal shall be no smaller than 180 degrees and no larger than 270 degrees.

Reason: It is extremely difficult to measure, cut, solder, and inspect within existing deviation parameters. The 180-270 degree tolerance would still ensure no mechanical connection.

Effectivity: All Saturn S-II stage applications.

Deviation 301 Wire Bend at Terminal

Requirement: MSFC-PROC-158A, dated April 12, 1962, paragraph VI. B. 3. a. - "A half-wrap (180 degrees) shall be used to attach wires."

Existing Deviation: "The bend to attach a wire or lead to a turret terminal shall be no smaller than 180 degrees and no larger than 270 degrees."

New Deviation: The bend to attach a wire or lead to a turret terminal shall be no smaller than 180 degrees and no larger than 270 degrees. However, a 360-degree wrap shall be acceptable wherein the wire size is 0.006 inch or smaller for the following parts: transducers, absolute, pressure, potentiometer; and transducer, differential, pressure, potentiometer.

Reason: The extremely small diameter of the wire, 0.006 inch, for these transducers, necessitates the use of a 360-degree wrap.

Effectivity: This deviation shall be effective only for transducers, absolute, pressure, potentiometer, part numbers ME449-0042-0001 and ME449-0042-0002; and for transducers, differential, pressure, potentiometer, part numbers ME449-0043-0001, ME449-0043-0002, and ME449-0043-0003, as used on S-II-T, S-II-1, S-II-2 and subsequent.

Deviation 42 Presoldering

Requirement: MSFC-PROC-158A, 12 April 1962, paragraph VI.B.5.b "An inspection of the printed circuit board shall be made before mounting the components to be soldered. The presence of . . . . . :"

Deviation: Presoldering and postsoldering requirements. An inspection of the printed circuit board shall be made before mounting components to be soldered and after soldering operation has been completed. The presence of . . . . . .

Reason: Item (7) implies some work has been done on the board.

Deviation 51 Cleaning

Requirement: MSFC-PROC-158A, 12 April 1962, paragraph VI.B.5.C(1) "Regardless of visual appearance, all component leads and terminals shall be cleaned just prior to soldering."

Deviation: Regardless of visual appearance, all component leads and terminals shall be cleaned within 24 hours of soldering.

Reasons: "Just prior" is indefinite. The 24-hour period would permit cleaning of parts on a prior shift. Parts would be stored in cellophane bags after cleaning.

Deviation 250a

Requirement: MSFC-PROC-158A, dated 12 April 1962, paragraph VI. B. 5. C(3). Lead Bending. - "Component leads shall be bent with a round smooth-finished tool (see Figure 3) to prevent damage. The radius of the bend shall be equal to or greater than twice the lead diameter. The minimum distance from component end seal to the start of bend shall be 1/16-inch (see Figure 15). On components that have a welded lead, such as tantalum capacitors, the start of the bend shall be 1/16-inch or more from the weld (see Figure 16).

Deviation: Lead Bending. - Component Leads shall be bent in such a manner to prevent damage to the lead. The radius of the bend shall be equal to or greater than twice the lead diameter. The minimum distance from the component end seal to the start of the bend shall be 0.015 inch. On components that have a welded lead, such is tantalum capacitors, the start of the bend shall be 0.015 inch or more from the weld. The lead will be supported by a special tool, between the end seal, or weld, as applicable, and the start of the bend in those cases where that distance is 0.015 inch minimum such that no stress will be placed on the end seal or the weld.

Reason: In order to build a longitudinal accelerometer which conforms to the restraints of the package outline, defined by NAA/Control Drawing ME901-0225, extremely high component density is required. Complete compliance to VI. B. 5. C. (3) is thus not possible within the space envelope provided.

Effectivity: This shall apply for all accelerometers per P. O. M4J3X5-751018 to S-II-1 and subsequent Flight Stages.

Deviation 253 Crystal Can Relays

Requirement: MSFC-PROC-158A, April 12, 1962, Paragraph VI. B. 5. c. (3). ".... The minimum distance from component end seal to the start of bend shall be 1/16 inch...."

Deviation: Crystal can relays may have bends and clearances less than 1/16-inch whenever space does not permit the required distances.

Reason: Babcock and Filtor crystal can relays are limited in space. The addition of a diode and resistor to these relays to meet contractual transient

protection would require increasing the size, and therefore would impose development costs and schedule delays. This deviation is not intended to relieve the subject vendors from quality or reliability requirements originally specified.

Effectivity: This deviation shall apply to the Battleship test facility, the Electromechanical Mockup, S-II-S, S-II-T, S-II-1, and subsequent flight stages.

Deviation 55 Component Mounting

Requirement: MSFC-PROC-158A, 12 April 1962, paragraph VI.B.5.d ". . . . . suitable retaining clamp (see Figure 17 (a), (b), and (c) . . . ."

Deviation: . . . . . suitable retaining clamp [see Figure 17 (a), (b), and (c)]. Vertically mounted components between two stacked boards or stacked components in a "cordwood" arrangement are acceptable when properly supported in encapsulation.

Reason: Mounting of components between two vertically stacked boards is common practice in module miniaturization.

Deviation 43 Solder Coverage

Requirement: MSFC-PROC-158A, 12 April 1962, paragraph VI.B.5.f ". . . . . and no excess flux or solder . . . . ."

Deviation: . . . . . and no flux or excess solder.

Reason: No flux rather than no excess flux should be specified.

Deviation 57a Terminal Shank Tolerance

Requirement: MSFC-PROC-158A, paragraph VI.B.5.i.(1) (Amendment 86). "A tolerance of ±0.001 inch on the hole diameter shall be permissible."

Deviation: The clearance shall not exceed 0.007 inch between the diameter of the terminal shank and the diameter of the hole.

Reasons: Manufacturers state that printed circuit boards with plated-through holes cannot be made with the tolerance required because (1) close tolerances are attainable on holes drilled in metal, but the fibrous materials of which the printed circuit boards and terminal boards are made frays when drilled, making close tolerance difficult to attain; (2) plating thickness of holes is not uniform, and meeting the minimal requirements of plating thickness will vary the tolerance of each hole; (3) solder reflow thickness varies with the temperature of solder, period of immersion, and temperature of board at time of reflow. For these reasons, close tolerances are not possible. With existing tolerances, an accumulation of variations will result in excessive rejections of printed circuit boards.

Deviation 31 Swaging Tool

Requirement: MSFC-PROC-158A, 12 April 1962, paragraph VI.B.5.i.5 and Figure 21. "An alternate . . . . . ; place 60-degree . . . . . ."

NOTE

Swaging tool . . . . . 60-degree . . . shown in Figure 21.

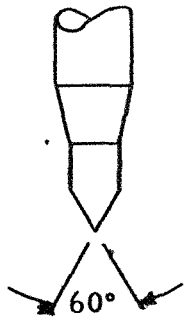


Figure 21. Swaging Tool

Deviation: An alternate . . . . . ; place 48 degrees ± 12 degrees . . . .

NOTE

Swaging tool . . . . . 48 degrees ± 12 degrees . . shown in Figure 21.

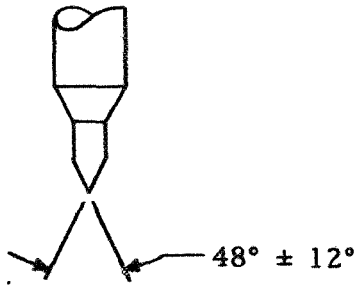


Figure 21. Swaging Tool

Reasons:

1. Cracks are developing in the terminals when 60-degree swages are used. The 60-degree swaging operating increases the periphery of the terminal cove 100% more than the 48-degree ± 12-degree swage.

2. The 48-degree ± 12-degree swaging operation creates the same diameter at the point of contact with the terminal board as the 60-degree swage, which provides the same contact pressure.

Deviation 61a Coating

Requirement: MSFC-PROC-158A, 12 April 1962, paragraph VI.B.5.j "....The protective coating shall be Hysol 12-007 (Manufactured by Hysol Corp., Olean, N.Y.), or equivalent." SCN 39

Deviation: The protective coating shall be flexible polyurethane resin. Hysol 12-007 (Manufactured by Hysol Corp., Olean, N.Y.), or equivalent shall be used for coating manufacturer's identification of component parts and for bonding of component parts. If a component has a glass envelope the only approved protective coating shall be flexible polyurethane resin. Also, refer to MSFC-PROC-293, "Coating, Conformal (Polyurethane), Printed Circuit Assemblies".

However, this deviation shall not apply to ME464-0019-0003, Instrument Excitation Power Supply. Conformal coating material, Dennis No. 1162, may be used in ME464-0019-0003, Instrument Excitation Power Supply.

Reason: Dennis No. 1162 is used to protect printed circuit boards and components from moisture, dust, and other contaminants. Dennis No. 1162 is not considered to be an equivalent to Hysol 12-007 and therefore does not exhibit the detrimental characteristics of Hysol when it is in contact with glass components. Printed circuit boards have been fabricated, with Dennis No. 1162 conformal coating, in sufficient quantity to supply program requirements for ME464-0019-0003 power supplies for all vehicles S-II-1 through S-II-10. ME464-0019-0003 power supplies are presently installed in vehicles S-II-1 through S-II-4. Also, examinations were made of a test item both pre and post vibration. The minute cracks that were evident are considered inconsequential and will in no way affect the operation of the unit.

Effectivity: All ME464-0019-0003 configuration of 5 vdc Power Supply on S-II-1 and S-II-2, and those ME464-0019-0003 configurations of 5 vdc Instrumentation Excitation Power Supplies on S-II-3 through S-II-10.

Deviation 266a

Requirement: MSFC-PROC-158A, dated April 12, 1962, Paragraph VI, B.5.j.
Coating. - "The protective coating shall be flexible polyurethane resin. Hysol 12-007 (manufactured by Hysol Corp., Olean, N.Y.) or

equivalent, shall be used for coating manufacturer's identification of component parts and for bonding of component parts. If a component has a glass envelope the only approved protective coating shall be flexible polyurethane resin. Also, refer to MSFC-PROC-293, Coating, Conformal (Polyurethane), Printed Circuit Assemblies.

Deviation: The protective coating shall be RTV Dow Corning 882 or equivalent. RTV is characteristically non-transparent.

Reason: The Dow Corning RTV has been used successfully for similar units over the past several years. In this situation, the RTV provides a portion of the structural support for the printed circuit boards and contained components. The resiliency of the RTV provides a superior shock mounting for the printed circuit boards and contained components. The result is an instrument capable of sustaining greater vibration and shock than would be possible with the use of other protective coatings for the printed circuit boards.

Effectivity: This deviation shall apply to SD Purchase Order M4J3XS-751018 for the procurement of Longitudinal Accelerometers P/N 4106 effective on S-II-1 and subsequent flight stages.

Deviation 355 Coating

SCN 172

Requirement: MSFC-PROC-158A, dated April 12, 1962, paragraph VI.B.5.j Coating. - The protective coating shall be flexible polyurethane resin. Hysol 12-007 (manufactured by Hysol Corp., Olean, New York) or equivalent, shall be used for coating manufacturer's identification of component parts and for bonding of component parts. If a component has a glass envelope, the only approved protective coating shall be flexible polyurethane resin. Also, refer to MSFC-PROC-293, Coating, Conformal (Polyurethane), Printed Circuit Assemblies.

Deviation: The circuit board assembly shall be encapsulated with Eccofoam FP in lieu of conformal coating.

Effectivity: All ME456-0004 Timers on S-II-1 and subs.

Deviation 101a Soldering

Requirement: MSFC-PROC-158A, 12 April 1962, page 28, Appendix, Qualification and Certification

Deviation:

1. Scope

This procedure specifies the methods, equipment, and materials which shall be used for soldering electrical connections for space vehicles, ACE/GSE, and supporting equipment. Any method, equipment, or material not described herein may be utilized if NASA approval is obtained prior to use.

2. Qualification and Certification

a. Qualification

(1) Qualification of Personnel - All personnel engaged in fabrication, assembly, and inspection of electrical-electronic equipment manufactured under contracts containing this procedure shall be certified by a Category I or II instructor/examiner prior to performing work on engineering models, prototype models, or production items.

(2) Demonstration of Proficiency - To achieve certified status, the solder operator shall demonstrate his skill or proficiency according to the requirements set forth herein.

(a) All test specimens shall be fabricated in the presence of a Category I or II instructor/examiner.

(b) After the trainee has demonstrated his ability to the satisfaction of a Category I or II instructor/examiner, a certification will be issued.

(3) Certification Categories - The certificate issued to trainees will show the trainee to be certified in one or more of the following categories:

(a) Category I - Instructor/Examiner - These are certified Government instructors who have been designated and authorized by NASA to certify

Categories II, III, IV and V. Candidates for this category must satisfactorily complete the 80-hour instructor's course at a NASA school. Category I personnel satisfactorily demonstrating hand soldering proficiencies to a designated representative of a NASA School of Reliability and Quality Assurance for Hand Soldering shall be recertified by the designated NASA representative.

(b) Category II - Instructor/Examiner - Those certified instructors and examiners employed by either supplier or Government are authorized to certify Categories III and V. Certification and recertification requirements are the same as for Category I.

(c) Category III - Operator/Inspector - This category consists of supplier personnel who have satisfactorily completed the provisions of the 40-hour course at a NASA-approved supplier school. They shall be required to interpret contractual specifications and shall have demonstrated the manual skills required by the specifications. Recertification of operator/inspectors requires demonstration to the satisfaction of the certifier that the candidate is still qualified for certification based on continuous performance audit or completion of a recertification course at a NASA-approved school.

(d) Category IV - Inspector (Government) - This category is restricted to Government inspection personnel. Certification and recertification requirements are the same as Category II. A designated Category I instructor/examiner may recertify the Government inspector in accordance with NASA recertification requirements.

(e) Category V - Limited Operator - Individuals certified to this category are restricted to specified operations, i.e., soldering electrical connectors. It is intended for, but not limited to, supplier personnel who normally perform only one type of operation. To attain certification or recertification, a candidate must demonstrate to the satisfaction of the certifier that he is qualified to perform the specified operation.

b. Certification - When a supplier is operating a NASA-approved school, a company certificate may be issued by the supplier to its fabrication and inspection personnel and to the personnel of subcontractors and vendors. The designated Category I NASA personnel will be notified by the contractor prior to the training of subcontractor or vendor personnel. The signed certificate (either NASA or company) will be considered evidence that the applicant had satisfactorily fulfilled all requirements set forth herein. The certificate shall be valid only in the plant of the supplier in whose name the certificate was issued, and the holder shall be recertified within 12 months from the date of the last entry thereon or at any time the holder's work is found to be unsatisfactory.

c. Maintenance of Certified Status - A Category I or IV Government representative may require reexamination testing of any operator whenever he has reason to question the proficiency of the operator or the quality of workmanship. To aid the Category I or IV Government-authorized NASA representative in determining the proficiency of operators, the supplier shall maintain and make available complete inspection records.

d. Training and Certification of Supplier Personnel

(1) Demonstration of Ability - The supplier shall establish a school that follows guidelines established by NASA. The supplier shall then demonstrate to the satisfaction of the NASA-designated Government representative that:

(a) An efficient training program is being conducted.
(b) A close and continuing control over the school will be maintained.
(c) Only qualified students will be certified.

The duration of this evaluation shall be determined by the NASA-designated Government representative.

(2) Supplier Certification of Personnel - When the supplier has compiled with the conditions of Paragraph d. (1), he will be authorized by a NASA-designated Government representative to issue certification (see Paragraph b.). This authorization may be revoked when:

(a) The supplier fails to meet NASA standards of training.
(b) The contract is completed or terminated.

e. Training Records

(1) The supplier is responsible for the training records on each trainee to include:

(a) Test specimens fabricated by the trainee
(b) Results of written tests
(c) A minimum of two copies of NASA Form 885, or a facsimile thereof, completed and signed by the Category II instructor/examiner and the designated Category I instructor/examiner

Note: The Category I NASA representative shall determine how many copies of Form 885 are necessary for each trainee.

(2) Compliance with the requirements of paragraph e.(1) shall constitute complete certification records.

Deviation 30a

Requirement: MSFC-PROC-252, Paragraph V. A. 1. e. "Flight evaluation reports."

Deviation: Delete this requirement in its entirety.

Requirement: MSFC-PROC-252, Paragraph VI. A. 3. a. "Mass characteristics and Mass distribution reports."

a. Reports shall be supplied.....
(1).....

Deviation: "Mass characteristics and Mass distribution reports."

a. Reports shall be submitted at the following times:

First report (based on estimated weights) 30 days after "design freeze;" second report (based on calculated weights) 18 months after "design freeze;" third and subsequent reports (consisting of updated information for each mission) as requested by MSFC. These reports shall include the following:

(1) .....

Requirement: MSFC-PROC-252, Paragraph VI. A. 4. "c. The contractor shall determine, ..."

c. The contractor shall analytically determine, to an accuracy of ±0.5%, and shall attempt to analytically determine, to an accuracy of ±0.25%, loaded propellant mass; and shall submit a report supporting this determination.

Requirement: MSFC-PROC-252, Paragraph VI.A. "5. Flight evaluation reports...."

Deviation: Delete this requirement in its entirety.

Reason: These deviations resulted from contract negotiations for implementation of MSFC-PROC-252 between NAA/SID and MSFC held on 28 and 29 January 1964. The foregoing deviations were agreed upon during the negotiations.

Effectivity: S-II-IFD, S-II-F, S-II-D, S-II-T, S-II-3 and subs.

Deviation 305

Requirement: MSFC-PROC-252, dated September 19, 1962, paragraph VI.A.4.b, "The contractor shall determine by physical measurements the weight and longitudinal center of gravity position of each stage or vehicle...".

Deviation: Delete the requirement for physical measurement of longitudinal center of gravity, as applicable to S-IC/S-II Interstage.

Reason: Calculated center of gravity values will be satisfactory for the Interstage.

Effectivity: S-II-1 and subsequent.

Deviation 328 Bond of Components

Requirement: MSFC-PROC-293, Paragraph VII, C.1.d. "For large fillets, bonding of large parts, and other general uses, Armstrong Products Company Resin X-81 with applicable activator shall be used prior to coating. Critical components such as glass diodes and glass-sealed resistors shall not be covered with X-81. SCN 38

Deviation: For large fillets, bonding of large parts and other general uses, Armstrong Products Company Resin X-81, Cycle-Weld C14, type A, Grade 1, or Ecco-Bond 26 parts A and B, may be used prior to coating. Critical components such as glass diodes and glass-sealed resistors shall not be covered with these materials.

Reason: From the inception of manufacturing processes on the Saturn S-II Program, North American Aviation's suppliers have used Cycle-Weld C14 and Ecco-Bond 26 materials with complete success and finds these to be equivalent to Armstrong Products Company Resin X-81.

Effectivity: ME464-0019-0003, ME464-0019-0004 and ME464-0019-0005, 5 vdc power supply, instrument excitation; vehicles S-II-1 through S-II-10.

Deviation 278a

Requirement: MSFC-SPEC-164(1), dated 15 June 1964, Paragraph 3.2.11 "Aluminum foil. - Aluminum foil used to protect cleaned surfaces shall be dry annealed aluminum foil conforming to Specification MIL-A-148."

Deviation: A liquid oxygen-compatible fluorohalocarbon film (Aclar 33c or Aclar 191), as cleaned to the same level as the part, shall be used for the packaging of items cleaned for use in liquid oxygen systems.

Reason: Foils meeting the subject specification have contaminated known precision cleaned items. The aluminum when used against a part made from a dissimilar metal creates a condition under which galvanic corrosion becomes a problem. Creases developed in the aluminum foil during wrapping of a part mar fine finishes and cut or otherwise damage plastic sealing surfaces.

Effectivity: This deviation shall apply to all S-II Stage Items.

Deviation 354 Bond of Components

Requirement: MSFC-PROC-293, Paragraph VII, C, 1. For large fillets, bonding of large parts, and other general uses, Armstrong Products Company Resin X-81 with applicable activator shall be used prior to coating. Critical components such as glass diodes and glass sealed resistors shall not be covered with X-81.

Deviation: MSFC-PROC-293, Paragraph VII, C, 1. For large fillets, bonding of large parts, and other general uses, Armstrong Products Company Resin X-81 with applicable activator shall be used prior to coating. Critical components such as glass diodes and glass sealed resistors shall not be covered with X-81. On Instrument Excitation Power Supply, ME464-0019-0005, use of Cabot Corporation, silica filler material, trade name CAB-O-SIL, is approved with the following conditions:

(a) Filler not to exceed three percent by weight of total mixed X-81 compound.

(b) Filled material to be used on capacitor C101 body only, and capacitor C105 body and leads only, on Panel Assembly Converter, 595258. SCN 218

Reason: Supplier is unable to produce adhesive with sufficient viscosity to fulfill mandatory requirement of bridging from capacitor leads to printed circuit board unless use of filler material is approved.

Effectivity: Deviation shall apply to Instrument Excitation Power Supplies ME464-0019-0005.

becomes a problem. Creases developed in the aluminum foil during wrapping of a part mar fine finishes and cut or otherwise damage plastic sealing surfaces.

Effectivity: This deviation shall apply to all S-II Stage items.

Deviation 297

Requirement: MSFC-SPEC-164(1), dated 15 June 1964, paragraph 3.7.1.5 - "Protection. - All significant surfaces or openings to surfaces that will contact the applicable service medium of miscellaneous metallic and Teflon components shall be protected from recontamination by covering the surfaces or openings with a minimum of two layers of aluminum foil (see 3.2.11) secured and reinforced with tape (see 3.2.12). The protected components shall be placed in clean polyethylene bags, purged with dry oil-free gas and heat-sealed (both ends) to assure an inert package during storage and overpacked as necessary to prevent damage during storage and handling.

Deviation: All significant surfaces or openings . . .two layers of aluminum foil (see 3.2.11) secured and reinforced with tape (see 3.2.12), except that the fuel mass sensor shall be protected with precision clean polyethylene bags, 6-mil minimum thickness, per LB-378, Type I, Grade A, Finish 1, and the oxidizer mass sensor shall be protected by LOX-compatible "ACLAR" bags (meets the requirements of MSFC-SPEC-106), Type 33C, 2 mil minimum thickness for the innermost cover. Both mass sensor bags shall be sealed' after a gaseous nitrogen purge per MIL-P-27401, Type I. The oxidizer mass sensor shall then be overwrapped in clean polyethylene bags and sealed. All protected components shall be placed in clean polyethylene bags, bags purged with dry oil-free gas and heat-sealed (both ends) to assure an inert package during storage and overpacked as necessary to prevent damage during storage and handling.

Reason: Past experience at Douglas Aircraft Company on the S-IV and S-IVB has shown that when fuel and oxidizer mass sensors are wrapped in aluminum foil, fragments from the aluminum foil can cause the sensors to short out. Nonconductive clean bags will protect the sensors from contamination and shorting out. Douglas has received a similar deviation from NASA for the S-IVB program and has requested the same deviation from S&ID for the S-II program. This deviation will also permit use of the present S-IV and S-IVB packaging techniques, equipment and facilities on the S-II Propellant Utilization System.

Effectivity: S-II-S, S-II-T, S-II-1, and Subs. Flight Stages.

Deviation 297

Requirement: MSFC-SPEC-164(1), dated 15 June 1964, paragraph 3.7.1.5- "Protection. - All significant surfaces or openings to surfaces that will contact the applicable service medium of miscellaneous metallic and Teflon components shall be protected from recontamination by covering the surfaces or openings with a minimum of two layers of aluminum foil (see 3.2.11) secured and reinforced with tape (see 3.2.12). The protected components shall be placed in clean polyethylene bags, purged with dry oil-free gas and heat-sealed (both ends) to assure an inert package during storage and overpacked as necessary to prevent damage during storage and handling."

Deviation: All significant surfaces or openings . . .two layers of aluminum foil (see 3.2.11) secured and reinforced with tape (see 3.2.12), except that the fuel mass sensor shall be protected with precision clean polyethylene bags, 6-mil minimum thickness, per LB-378, Type I, Grade A, Finish 1, and the oxidizer mass sensor shall be protected by LOX-compatible "ACLAR" bags (meets the requirements of MSFC-SPEC-106), Type 33C, 2 mil minimum thickness for the innermost cover. Both mass sensor bags shall be sealed after a gaseous nitrogen purge per MIL-P-27401, Type I. The oxidizer mass sensor shall then be overwrapped in clean polyethylene bags and sealed. All protected components shall be placed in clean polyethylene bags, bags purged with dry oil-free gas and heat-sealed (both ends) to assure an inert package during storage and overpacked as necessary to prevent damage during storage and handling.

Reason: Past experience at Douglas Aircraft Componay on the S-IV and S-IVB has shown that when fuel and oxidizer mass sensors are wrapped in aluminum foil, fragments from the aluminum foil can cause the sensors to short out. Nonconductive clean bags will protect the sensors from contamination and shorting out. Douglas has received a similar deviation from NASA for the S-IVB program and has requested the same deviation from S&ID for the S-II program. This deviation will also permit use of the present S-IV and S-IVB packaging techniques, equipment and facilities on the S-II Propellant Utilization System.

Effectivity: S-II-S, S-II-T, S-II-1, and Subs. Flight Stages.

Deviation 121

Requirement: MSFC-STD-100, dated 16 May 1961, Castings, Aluminum and Magnesium Alloy, Radiographic Inspection 4, Acceptance Standard For.

Deviation: Delete the requirement for compliance with MSFC-STD-100 in its entirety as applicable to the accumulator reservoir manifold assembly (ARMA), quick disconnect couplings, and bleed valve of the engine actuation system.

Reason: This process and procedure are not utilized in the design, fabrication, or inspection of the particular components cited.

Effectivity: S-II-T, S-II-D, S-II-1 and subs; Battleship test vehicle, Electromechanical Mockup, and the three engine actuation systems to be delivered to MSFC.

Deviation 280 Cannisters for Storage Batteries

Requirement: MSFC-STD-100, dated 16 May 1961, Castings, Aluminum and Magnesium Alloy, Radiographic Inspection of, Acceptance Standard for.

Deviation: Delete the requirement for compliance with MSFC-STD-100 in its entirety as applicable to the manufacture of cannisters for storage batteries, wherein Magnesium AZ91C, T6, Sand permanent mold castings are utilized. Replace with MIL-C-6021D, dated 17 October 1958, re: Grade B, Class II.

Reason: Electric Storage Battery (ESB) with their casting supplier have utilized MIL-C-6021D for their drawing callouts. MIL-C-6021D provides for radiographic inspection, but also utilizes other inspection and quality controls not specified in MSFC-STD-100, as penetrant and magnetic particle inspection and certification of inspection laboratories. The radiographic inspection as called out on ESB drawings, Grade B, Class II calls for a radiographic inspection requirement between the levels of III-F and IV-F when compared to MSFC-STD-100.

The battery cannister casting when assembled will not be subjected to more than 10 lbs. pressure differential because of incorporation of a 10 lb. relief valve in the battery design. All casting wall thicknesses are specified 0.188/0.250, and the mounting feet are 0.36 ± 03. The cells inside the cannister are encapsulated with potting compound. In addition to the drawing callout, ESB casting specification requires the following:

a. Heat treatment per MIL-M-6857, T-6 condition.
b. Heat-treat marking, and a serial number.

c. Radiographic inspection in accordance with MIL-I-6865 and ASTM-E-98-53T as specified on the applicable drawing (Grade B, Class II).
d. Each casting shall be tested for flows, imperfections, and any other physical defects by both radiographic and penetrant methods. The X-ray photographs of each casting shall be sent to ESB Co. with each casting shipment.
e. The penetrant inspection shall be in accordance with MIL-I-6866.

Effectivity: The deviation shall apply on EMM.

Deviation 314

Requirements: MSFC-STD-105A 12 December 1962 — Synthetic Rubber, Age Control of, Standard for

Deviation: Delete the requirements of this standard in its entirety as applicable to silicone elastomer parts used on electrical connectors both as static seals and as dielectric.

Reason: All stage connectors utilize a silicone elastomer. Age control of silicone parts is not necessary because this material is not affected by the atmospheric conditions that are anticipated for the stage prior to launch.

Effectivity: S-II-F, S-II-T/D, S-II-1 and subsequent.

Deviation 187 Unit Numbers

Requirement: MSFC-STD-349, dated 15 November 1963, Paragraph 3.1.4. "A space or compartment containing any combination of parts, subassemblies, and assemblies that, for convenience or practicality, are grouped together (see Figure 1). A unit may or may not be functional in itself. (Examples: instrument canister, generator room.)"

Deviation: Within a given compartment, unit numbers may be assigned to major equipment containers at the discretion of the assigning group.

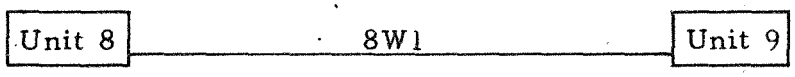
Reason: This clarification reflects a mutual agreement between NASA and NAA representatives and is written in response to a NASA letter from E.W. Neubert to W.F. Parker dated 7 July 1964. Acceptance of MSFC-STD-349 by NAA as a contractual specification is contingent upon approval of this amendment.

Effectivity: This deviation shall apply to the Electromechanical Mockup, Battleship test facility, S-II-F, S-II-T, S-II-1, and subsequent flight stages.

Deviation 188 Cable Identification

Requirement: MSFC-STD-349, dated 15 November 1963, Paragraph 5.2.6.1. "Cables shall be identified by a unit number that identifies a specific unit, by the letter "W" that identifies the cable, and by a number that identifies the specific cable. Cables interconnecting two units shall be assigned the lower number of the two unit numbers. Cables used for connecting assemblies in a unit shall be assigned the number of the unit in which they appear.

Example:



8W1 No. 1 cable interconnecting unit 8 and higher No. unit 9".

Deviation: Brackets, cutouts, panels, etc., upon which a receptacle of cable assemblies are mounted may be assigned an assembly number for location purposes. Cables so attached will reflect the assembly designation as an integral part of the cable reference designation.

Reason: This clarification reflects a mutual agreement between NASA and NAA representatives, and is written in response to a NASA letter from E.W. Neubert to W.F. Parker dated 7 July 1964. Acceptance of MSFC-STD-349 by NAA as a contractual specification is contingent upon approval of this amendment.

Effectivity: This deviation shall apply to the Electromechanical Mockup, Battleship test facility, S-II-S, S-II-T, S-II-1, and subsequent flight stages.

Deviation 189 Socket Identification

Requirement: MSFC-STD-349, dated 15 November 1963, Paragraph 5.4.4. "A socket or fuseholder that is always associated with a single particular part, subassembly, or unit (such as an electron tube, relay, fuse, or printed-circuit board), with or without integral designation. The designation shall include the class letter "X" and the letter, or letters, and number that identifies the associated part. For example, the socket for a relay 10K3 would be identified 10XK3. If multiple parts that plug into sockets are operated in parallel, as described in 5.3, the sockets shall also be suffixed with dash numbers in accordance with 5.3.3. In the case of a dual type fuseholder for fuses F1 and F2, this type should be identified XF1."

Deviation: Where various subassemblies may be placed into one socket, the socket will be marked with each reference designation, i.e., one socket could be marked XA1, XA2, XA3 (cell selection modules, timing and bypass modules, delay and no-time delay modules). Each part which may be inserted shall be so identified on the applicable schematic diagram.

Reason: This clarification reflects a mutual agreement between NASA and NAA representatives, and is written in response to a NASA letter from E.W. Neubert to W.F. Parker dated 7 July 1964. Acceptance of MSFC-STD-349 by NAA as a contractual specification is contingent upon approval of this amendment.

Effectivity: This deviation shall apply to the Electromechanical Mockup, Battleship test facility, S-II-F, S-II-T, S-II-1, and subsequent flight stages.

Deviation 190 Stage Designations

Requirements: None

Deviation: Add the following paragraph to MSFC-STD-349, dated 15 November 1963:

5.7.4 Designation Assignment. - Unit numbers 200-229 have been assigned for use on the Saturn S-II Stage.

Reason: This amendment is written at NASA request that specific S-II stage designations be included in this basic specification on reference designations.

Effectivity: This deviation shall apply to the Battleship test facility, the Electromechanical Mockup, S-II-F, S-II-T, S-II-1, and subsequent flight stages.

Deviation 122 Scope

Requirement: MS200.2, dated 6 January 1961, Internal Protection of Stainless Steel Pipe and Tubing During Fusion Welding.

Deviation: Delete the requirement for compliance with MS200.2 in its entirety as applicable to the main pump and auxiliary motor-pump of the engine actuation system.

Reason: This process and procedure are not utilized in the design, fabrication, or inspection of the particular components cited.

Effectivity: S-II-T, S-II-D, S-II-1 and subs; Battleship test vehicle, Electromechanical Mockup, and the three engine actuation systems to be delivered to MSFC.

Deviation 77 Helical Thread Insert

Requirement: MS-260.0, 6 March 1961, paragraph 3.2. "Type I and Type II helical coil thread inserts shall be completely identified by a part number. . . . given below."

Deviation: Only MS or NAA standard part numbers shall be used.

Reason: Product control cannot be maintained with commercial numbers.

Deviation 147 Blind Locking Fasteners

Requirement: MS260.2, dated October 1960, Installation of Jo-Bolt Blind Locking Fasteners.

Deviation: Delete the requirement for compliance with MS260.2 in its entirety as applicable to the accumulator reservoir manifold assembly (ARMA), servoactuator, main pump, auxiliary motor-pump, quick-disconnect couplings, and bleed valve on the engine actuation system.

Reason: No Jo-Bolt blind locking fasteners are utilized in the design or fabrication of the particular components cited.

Effectivity: S-II-T, S-II-D, S-II-1 and subs; Battleship test vehicle, Electromechanical Mockup, and the three engine actuation systems to be delivered to MSFC.

Deviation 78 Jo-Bolt Fasteners

Requirement: MS-260.2, October 1960, paragraph 3.2. "Jo-Bolt blind locking fastener assemblies shall be fabricated. . . from materials which meet all the requirements of Specifications MIL-S-6758, MIL-S-8695, QQ-A-282(1), or AMS-5641A."

Deviation: Jo-Bolt blind locking fasteners assemblies shall be fabricated from materials which meet all the requirements of specifications MIL-S-6758, MIL-S-8695, QQ-A-282(1), AMS-5641A, MIL-S-5000, MIL-S-6049, AMS-5636, AMS-5639, or AMS-6407.

Reason: The use of additional specifications for material purposes will permit multiple-source procurement.

Deviation 79 Jo-Bolt Protective Finishes

Requirement: MS-260.2, October 1960, paragraph 3.3. "All Jo-Bolt blind locking fastener assembly components fabricated from a ferrous base alloy shall. . . meet all the requirements of Specification QQ-P-416A, Type II, Class 3. . . Specification MIL-A-8625A, Type II."

Deviation: Protective finishes shall be in accordance with Specification QQ-P-416A, Type I, Class 3.

Reason: Protective finish in accordance with Specification QQ-P-416A, Type II, Class 3, is not applicable to S-II stage.

Deviation 80 Jo-Bolt Material

Requirement: MS-260.2, October 1960, paragraph 4.1.1. "Bolt material shall be MIL-S-6758 (AISI 4130) or MIL-S-8695 (AISI 4037) heat treated. . ."

Deviation: Bolt material shall be MIL-S-6758 (AISI 4130) or MIL-S-8695 (AISI 4037), MIL-S-5000 (4340), MIL-S-6049 (8740), or AMS-6407 heat treated to 180,000-200,000 psi U. T. S. level.

Reason: Use of additional materials will permit multiple-source procurement.

Deviation 81 Jo-Bolt Sleeve Material

Requirement: MS-260.2, October 1960, paragraph 4.1.3. "Sleeve material shall be AMS 5641 (AISI 303) in the fully-annealed condition."

Deviation: Sleeve material shall be AMS 5641 (AISI 303), AMS 5636 (302), or AMS 5639 (304) in the fully-annealed condition.

Reason: Use of additional materials will permit multiple-source procurement.

Deviation 82 Jo-Bolt Material

Requirement: MS-260.2, October 1960, paragraph 4.2.1. "Bolt material shall be MIL-S-6785 (AISI 4130) or. . . level."

Deviation: Bolt material shall be MIL-S-6758 (AISI 4130), MIL-S-6049(8740), or AMS 6407 heat treated to 180,000-200,000 psi U. T. S.

Reason: Use of additional materials will permit multiple-source procurement.

Deviation 83 Jo-Bolt Sleeve Material

Requirement: MS-260.2, October 1960, 4.2.3. "Sleeve material shall be AMS 5641 (AISI 303) in the fully-annealed condition."

Deviation: Sleeve material shall be AMS 5641 (AISI 303), AMS 5636 (302), or AMS 5639 (304) in the fully-annealed condition.

Reason: Use of additional materials will permit multiple-source procurement.

Deviation 84 Jo-Bolt Material

Requirement: MS-260.2, October 1960, paragraph 4.3.1. "Bolt material shall be MIL-S-6758 (AISI 4130) or MIL-S-8695 (AISI 4037) heat treated. . ."

Deviation: Bolt material shall be MIL-S-6758 (AISI 4130) or MIL-S-8695 (AISI 4037) heat treated to 180,000-200,000 psi U. T. S.

Reason: Use of additional material will permit multiple-source procurement.

Deviation 85 Jo-Bolt Sleeve Material

Requirement: MS-260.2, October 1960, paragraph 4.3.3. "Sleeve material shall be AMS 5641 (AISI 303) in the fully-annealed condition."

Deviation: Sleeve material shall be AMS 5641 (AISI 303), AMS 5636 (302), or AMS 5639 (304) in the fully-annealed condition.

Reason: Use of additional materials will permit multiple-source procurement.

Deviation 86 Jo-Bolt Material

Requirement: MS-260.2, October 1960, paragraph 4.4.1. "Bolt material shall be MIL-S-6758 (AISI 4130) or MIL-S-8695 (AISI 4037) heat treated. . ."

Deviation: Bolt material shall be MIL-S-6758 (AISI 4130), MIL-S-8695 (AISI 4037), MIL-S-5000 (4340), MIL-S-6049 (8740), or AMS 6407 heat treated to 180,000-200,000 psi U.T.S.

Reason: Use of additional materials will permit multiple-source procurement.

Deviation 87 Jo-Bolt Material

Requirement: MS-260.2, October 1960, paragraph 4.5.1. "Bolt material shall be MIL-S-6758 (AISI 4130) or MIL-S-8695 (AISI 4037) heat treated. . ."

Deviation: Bolt material shall be MIL-S-6758 (AISI 4130), MIL-S-8695 (AISI 4037), MIL-S-5000 (4340), MIL-S-6049 (8740), or AMS 6407 heat treated to 180,000-200,000 psi U.T.S.

Reason: Use of additional materials will permit multiple-source procurement.

Deviation 88 Jo-Bolt Sleeve Material

Requirement: MS-260.2, October 1960, paragraph 4.5.2. "Sleeve material shall be AMS 5641 (AISI 303) in the fully-annealed condition."

Deviation: Sleeve material shall be AMS-5641 (AISI 303), AMS-5636 (AISI 302), or AMS-5639 (304) in the fully-annealed condition.

Reason: Use of additional materials will permit multiple-source procurement.

Deviation 89 Jo-Bolt Material

Requirement: MS-260.2, October 1960, paragraph 4.7.1. "Bolt material shall be MIL-S-6758 (AISI 4130) or MIL-S-8695 (AISI 4037) heat treated to the 180,000-200,000 psi U. T. S. level."

Deviation: Bolt material shall be MIL-S-6758 (AISI 4130), MIL-S-8695 (AISI 4037), MIL-S-5000 (4340), MIL-S-6049 (8740), or AMS 6407 heat treated to 180,000-200,000 psi U. T. S.

Reason: Use of additional materials will permit multiple-source procurement.

Deviation 90 Jo-Bolt Sleeve Material

Requirement: MS-260. 2, October 1960, paragraph 4. 7. 3. "Sleeve material shall be AISI 303 (AMS 5641) in the fully-annealed condition."

Deviation: Sleeve material shall be AMS 5641 (AISI 303), AMS 5636 (302), or AMS 5639 (304) in the fully-annealed condition.

Reason: Use of additional materials will permit multiple-source procurement.

Deviation 134 Aluminum Welding Wire

Requirement: MS700.0, dated 12 January 1961, Acceptance of Spooled Aluminum Alloy Welding Wire for Launch Vehicle Application.

Deviation: Delete the requirement for compliance with MS700.0 in its entirety as applicable to the servoactuator in the engine actuation system.

Reason: This process and procedure are not utilized in the design, fabrication or inspection of the particular component cited.

Effectivity: S-II-T, S-II-D, S-II-1 and subs; Battleship test vehicle, Electromechanical Mockup, and the three engine actuation systems to be delivered to MSFC.

Deviation 127 Asbestos Gaskets

Requirement: MS750.0A, dated 22 April 1961, Non-Metallic (Asbestos) Gaskets.

Deviation: Delete the requirement for compliance with MA750.0A in its entirety as applicable to the accumulator reservoir manifold assembly (ARMA), servoactuator, quick-disconnect couplings, and bleed valve of the engine actuation system.

Reason: This material is not utilized in the design, fabrication, or inspection of the particular components cited.

Effectivity: S-II-T, S-II-D, S-II-1, and subs; Battleship test vehicle, Electromechanical Mockup, and the three engine actuation systems to be delivered to MSFC.

Deviation 316

Requirement: NASA Standard SE-008-001-1, dated June 1965, Project Apollo Coordinate System Standard, Figure A-8b.

Deviation: a. Applicable documentation published prior to 25 February 1966 will not be republished just to implement the standards.

SCN 3 to 367B

b. Saturn S-II drawings and documentation will not be changed if the presently used structural axes system is translatable with the structural body axes shown in Figure A-8b of the standard.

SCN 3 to 367B

Reason: Revision and republication of SID documentation and changing of existing drawings would create a severe cost and schedule impact.

Deviation 312a Traceability

Requirement: NPC 200-2 dated 20 April 1962, Quality Assurance Provision for Space System Contractors.

Deviation: NAA shall, from the point of receipt by NAA, maintain traceability on the propellant utilization computer to the lowest replaceable part level. The subcontractor shall not be required, during manufacturing, refurbishment or repair, to maintain traceability at the replaceable part level, for the propellant utilization computer, part numbers ME901-0206-0008 and ME901-0206-0016.

Reason: Parts were purchased prior to completion of contract negotiations in order to meet required hardware delivery dates. As such, they were not subject to requirements for Traceability and Identification per NPC 200-2.

Effectivity: S/N 001, S-II-F; S/N 002, Battleship; S/N 003, S-II-T; S/N 004, S-II-1; S/N 005, 006, 007, Qualification Tests; S/N 008, S-II-2; S/N 009 and 012, Spares; S/N 010, S-II-3; S/N 011, S-II-4; S/N 013, S-II-5; S/N 014, S-II-6; S/N 015, S-II-7; S/N 016, S-II-8 S/N 017, S-II-9; S/N 018, S-II-10

Deviation 96 Qualification Status List

Requirement: NPC 200-2, 20 April 1962, paragraph 4.3.5. "The contractor shall prepare and maintain a qualification status list showing the planned and completed qualification status of each part, component, subassembly, and higher level of assembly. The basis for any omission of qualification tests shall be shown. Where qualification is based on tests conducted under the applicable contract, reference shall be made to the pertinent test reports or data. The qualification status list and changes thereto shall be submitted for approval in accordance with paragraph 2.2 and Appendix B at intervals mutually agreed upon with the NASA installation."

Deviation: The contractor shall prepare a Saturn S-II Qualification Status List in accordance with the format of SID 62-1224, reissued 1 April 1963, "Saturn S-II Qualification Status List." The qualification status list shall show the planned and completed qualification status of each part, component, subassembly, and higher level of assembly. The basis of any omission of qualification tests shall be shown. Where qualification is based on tests conducted under the applicable contract, reference shall be to the pertinent test plan number or document. The acceptability of prior test history shall be coordinated with NASA, when required, in all cases where qualification is judged to be unnecessary due to previous testing. Applicable pages of section II, Component/End-Item Qualification Status of SID 62-1224, will be updated monthly to indicate results of tests conducted and submitted to the NASA Resident Manager for review. The qualification status list shall be updated and submitted on a semi-annual basis to MSFC for review.

Reasons: Subjecting the Qualification Status List to the requirements of an approval (Type I document) rather than to the requirements of a review (Type II document) would result in:

(1) A specific form requirement for approval to obsolete effort already expended on the document.

(2) Additional coordination for negotiating changes and revisions.

(3) Schedule and milestone problems, if approval or disapproval ran beyond the specified two-week period.

(4) Additional effort and schedule slippage, if revision were required.

(5) Formal release procedures which would result in a QSL at least three months out-of-date at the time of release.

Deviation 91 Suppliers of Materials

Requirement: NPC 200-2, 20 April 1962, paragraph 5.3.1.d(2). "Suppliers of materials, parts, and components (including off-the-shelf items) shall be required as a minimum to follow NASA Quality Publication NPC 200-3."

Deviation: Paragraph 5.3.1.d(2). Suppliers of materials, parts, and components (including off-the-shelf items) shall be required as a minimum to follow NASA Quality Publication NPC 200-3, except where the NASA Resident Quality Assurance Representative determines the requirements need not be invoked. The Quality Assurance and Reliability requirements imposed on suppliers by NAA in purchase orders or subcontracts shall be used as a basis in making this decision.

Reasons: (1) The requirements of NPC 200-3 are presently applied to all equipment covered by a procurement specification; (2) All materials controlled by a "specification control drawing" are reviewed, and the application of NPC 200-3 is based on cost, complexity, and ability to inspect in-house; (3) NPC 200-3 cannot be applied to all commercial procurements. In many instances, commercial parts and raw materials can only be procured through distributors. The distributor cannot set up a system to control quality as required by NPC 200-3, nor can the contractor enforce the requirements on the manufacturer because of lack of contract.

Deviation 92 Articles of Supplier Design

Requirements: NPC 200-2, 20 April 1962, paragraph 5.3.1.k. "The supplier shall notify the contractor of any proposed changes in design, fabrication method, or process and obtain approval of the change from the contractor before making the change. Appropriate identification of those articles on which the change is incorporated shall be required."

Deviation: Paragraph 5.3.1.k. Articles of Supplier Design. The contractor shall require that all suppliers obtain approval of all changes in fabrication methods or processes which are a part of design definition, i.e., callouts on basic drawings. All other supplier fabrication methods and processes must be initially approved by the contractor, and thereafter continuously monitored to assure acceptability. Appropriate identification of those articles on which the change is incorporated shall be required.

Reasons: Notification of all changes in fabrication methods and processes would:

1. Tie-down all development and detailed action review.
2. Minimize the responsibility of the supplier.
3. Incur significant costs through delays and extensive administrative processes.
4. Develop serious schedule problems through approval time cycles.

Deviation 93 Evaluation

Requirement: NPC 200-2, 20 April 1962, paragraph 9.4. "Results of all evaluations shall be submitted to the cognizant NASA installation and its designated representative for review in accordance with paragraph 2.2 and Appendix B."

Deviation: Test and measuring equipment in use as of 21 May 1962 will not require re-evaluation, but those initial evaluations of in-use equipment shall be made available to the NASA S-II Resident Project Office on request. S&ID shall inform the NASA S-II Residency in writing when any other evaluation of inspection, measuring, and test equipment has been completed. The contractor's records of these evaluations are required to be available for the NASA S-II Residency's review at the contractor's or subcontractor's facilities upon request.

Reason: Elimination of unnecessary effort by previous mutual agreement of the parties.

Deviation 95 Quality Program Provisions

Requirement: NPC 200-2, 20 April 1962, paragraph 14.2.4. "The report shall identify the model and serial number of the end item . . ."

Deviation: The requirements of this report shall be met by supplying appropriate historical data (including, but not limited to total operating hours of time-significant items associated with each system and subsystem) from

the inspection records, together with other pertinent data obtained during manufacture and final acceptance tests of the S-II stage, ground support equipment, propulsion engines, etc. These data shall be assembled in a package which will accompany the end-items as loose equipment. The packages shall be updated during interim handling and operational testing of the end items, and will provide a means for postflight total-stage evaluation by MSFC. The data listed herein shall be recorded in a table of contents in such a manner as to provide ready reference, by end item, to the appropriate section of the data package. Data packages shall include the following elements of data, as appropriate:

a. Operational Data - Information to be provided shall include stage checkout and other final acceptance tests results (i.e., variable data, actuator setting, and prestatic and poststatic firing checkout documentation).

b. Operational Time Data - Operating time records will be provided for major hardware such as control system, telemeter packages, etc., and for those subsystems and components with varied or critical useful time/cycle life characteristics.

c. Configuration and Serialization Data - Such information will consist of indenture number, identity by part number, part name, and serial number, and a listing of drawing change letters or Engineering Orders that have been incorporated in each part.

d. Replacement Data - Information concerning replacements made during installation, testing, or final checkout shall be provided. Documentation shall include positive identity of the part that was removed, and the replacement part that is installed.

e. Failure and Malfunction Records - This shall consist of documentation of failures or malfunctions occurring during final test or checkout of the end-items.

f. Corrective Action - Information shall be provided relative to corrective action that was taken, or that which is pending, concerning troubles, malfunctions, deficiencies and failures experienced during installation, testing, and final checkout.

g. Weight and Balance Record - Information concerning the total weight and horizontal, vertical, and lateral C. G. shall be provided.

h. Waiver and Deviation - Documentation to reflect approved waivers and deviations which authorize delivery of an end item in which a variation exists shall be provided.

i. Preservation Data - This shall include information relative to the preservation measure accomplished, the time span durability expectancy, or additional preservation measures that are required to preclude damage or deterioration during subsequent handling, shipping, or interim storage.

j. Unaccomplished Test Record - Should shipment of an end item be effected without completion of all prescribed tests, at the direction of the Contracting Officer, documents shall be provided defining the test or tests that were not performed and the reasons therefor.

k. Record of Material Review Actions - A summary compilation report of all MRB dispositions concerning the respective end item will be provided.

l. Engine Log Book - Significant historical data concerning the engines will be provided (i.e., installation or removal, record of associate equipment, rework and modification, records or transfer, special inspections, and alignment data).

m. Alignment Data Report - Information relative to the alignment of all critical components with respect to the basic stage reference center-line and fin planes shall be provided.

n. Propellant Tank Loading Data - This information will provide verification of the sensing equipment installation, the performance of tank calibration, and the functional accuracy of the sensing instrumentation.

o. Shipping Data - This shall consist of packing lists, certifications and certificates of conformance where required, special handling instructions, and shortage records.

p. Drawings - Copies of the latest revised drawings that are necessary for operation and maintenance of the respective end item will be provided.

Reason: To definitize the content of the "Narrative End-Item Report."

Deviation 94 Quality Program Documentation

Requirement: NPC 200-2, 20 April 1962, page B-i, Appendix B.

1. "The contractor shall submit the following for approval by the cognizant NASA Installation:

a. Qualification Status List . . . 4.3.5

b. End-Item Test Plan 7.4.2.1
c. End-Item and Inspection Procedures 7.4.2.2

2. The contractor shall submit the following for review:

a. Quality Program Plan 3.1
b. Test and Inspection Procedures 7.3.1
c. Process Control Procedures 7.5.4
d. Results of Special Measuring and Test Equipment Evaluations 9.4
e. Storage Procedures for End Items 11.5
f. Special Sampling Plans; Application of Sampling . . 12.3

3. The contractor shall submit the following for information:

a. Monthly Quality Status Report 14.2.1
b. Quarterly Summaries of Quality Program Performance Audits . . . . . 15.2"

Deviation:

1. The contractor shall submit the following for approval by the cognizant NASA Installation:

a. End-Item Test Plan (Submitted as part of General Test Plan) 7.4.2.1
b. End-Item Test and Inspection Procedures (The initial submittal only will require approval. Revisions and modifications will be submitted for review.) . . . 7.4.2.2

2. The contractor shall submit the following for review:

a. Quality Program Plan
b. Qualification Status List
c. Test and Inspection Procedures
d. Process Control Procedures
e. Storage Procedures for End Items
f. Special Sampling Plans; Application of Sampling

3. The contractor shall submit the following for information:

a. Monthly Quality Status Report 14.2.1
b. Quarterly Summaries of Quality Program Performance Audits 15.2

Reasons: (1) The "Qualification Status List" has been changed from Type I documentation to Type II documentation by Amendment 105 to SID 61-367. (2) The requirements for official submittal of "Results of Special Measuring and Test Equipment Evaluations" have been deleted by Amendment 108 to SID 61-367.

II. S-II GROUND SUPPORT EQUIPMENT DOCUMENTS

S-II GROUND SUPPORT EQUIPMENT DOCUMENTS

The following are all applicable design, method and material documents for Saturn S-II Ground Support Equipment. S-II Ground Support Equipment documents are also listed with their related NAA specifications in Appendix C of this report.

All subsidiary specifications referenced in the primary specifications specified herein are applicable only to the extent referenced in the primary specification and shall be limited to the subject matter of the particular paragraph or phrase in the subsidiary specification to which the primary specifications refer.

SPECIFICATIONS

Federal

BB-N-411b(1) January 19, 1966	Nitrogen, Technical	SCN 119R2
OO-P-416A December 11, 1956	Plating, Cadmium (Electrodeposited)	
WW-T-700-4C August 21, 1965	Tube, Aluminum Alloy, Round, Square, Rectangular, and other Shapes, Drawn, Seamless, 5052	SCN 119R2
WW-T-700/6c August 21, 1964	Tube, Aluminum Alloy, Drawn, Seamless, 6061 and	
Bureau of Mines Publication No. 1 August 1963	Helium, Grade A	SCN 119R2

Military

MIL-B-5087A(1) January 29, 1958	Bonding, Electrical (For Aircraft)
MIL-C-5541(1) March 28, 1950	Chemical Films for Aluminum and Aluminum Alloys
MIL-E-5556A July 23, 1954	Enamel, Camouflage, Quick-Drying
MIL-H-5606A(1) May 17, 1961	Hydraulic Fluid, Petroleum Base, Aircraft and Ordnance

MIL-I-6181D 25 November 1959	Interference Control Requirements, Aircraft Equipment
MIL-W-6858B 2 November 1960	Welding, Resistance: Aluminum, Magnesium, Non-Hardening Steels or Alloys, Nickel Alloys, Heat-Resisting Alloys, and Titanium Alloys; Spot and Seam
MIL-W-6873A 19 January 1959	Welding; Flash, Carbon and Alloy Steel
MIL-T-7081C 3 April 1959	Tube, Aluminum Alloy, Seamless, Round, 6061 and 6062, Aircraft Hydraulic Quality
MIL-E-7729A(1) 28 February 1956	Enamel, Gloss, Aircraft Application
MIL-B-7883(1) 28 January 1954	Brazing of Steels, Copper, Copper Alloys, and Nickel Alloys
MIL-M-008090D 21 February 1961	Mobility Requirements, Ground Support Equipment, General Specification for
MIL-P-8585A 17 October 1957	Primer Coating, Zinc- Chromate, Low-Moisture-Sensitivity
MIL-A-8625A 14 December 1954	Anodic Coatings, for Aluminum and Aluminum Alloys
MIL-T-8808A 1 April 1958	Tubing, Steel, Corrosion - Resistant (18-8 Stabilized) Aircraft Hydraulic Quality
MIL-V-8813 20 November 1957	Valves: Aircraft, Hydraulic Pressure Relief, Type II Systems
MIL-F-8815 18 March 1960	Filter and Filter Elements, Fluid Pressure, Hydraulic, Line, 15-Micron Absolute, Type II Systems
MIL-R-11468 27 September 1951	Radiographic Inspection; Soundness Requirements for Arc and Gas Welds in Steel
MIL-R-11469 24 September 1951	Radiographic Inspection; Soundness Requirements for Steel Castings

MIL-R-11471(2) February 26, 1960	Radiographic Inspection of Metals	
MIL-P-25508D March 16, 1962	Propellant, Oxygen	SCN 119R2
MIL-P-25732A January 6, 1969	Packing, Preformed, Petroleum Hydraulic Fluid Resistant, 275 F.	
MIL-P-27201A September 1, 1964	Propellant, Hydrogen	SCN 119R2
MIL-P-27401B September 19, 1962	Propellant Pressurizing Agent, Nitrogen	SCN 119R2
MIL-P-27407(1) January 8, 1965	Propellant Pressurizing Agent, Helium	
MIL-D-70327(1) July 1, 1969	Drawings, Engineering and Associated Lists	

Army Ballistic Missile Agency

ABMA-PD-C-4 June 25, 1958	Cleaning and Conditioning of Metallic and Nonmetallic Surfaces
ABMA-PD-R-27A August 14, 1959	Radiographic Inspection; Soundness Requirements for Fusion Welds in Aluminum and Magnesium Missile Components
ABMA-PD-W-45A September 22, 1959	Welding, Fusion, Shielded Arc, Missile Components, Aluminum and Magnesium, Manual or Automatic
ABMA-PD-E-53 February 11, 1960	Electrical Wiring Procedures
ABMA-PD-W-153 May 26, 1958	Certification of Welding Operators for Fusion Welding Guided Missile Airframes
ABMA-PD-R-187 November 7, 1958	Relays, Hermetically Sealed, Missile Equipment

Marshall Space Flight Center

MSFC-PROC-158A April 12, 1962	Soldering of Electrical Connections (HIgh Reliability), Procedures for
MSFC-SPEC-106 April 20, 1962	Testing Compatibility of Materials for Liquid Oxygen Systems

MSFC-SPEC-164(1) June 15, 1963	Cleanliness of Components for Use in Liquid Oxygen, Fuel and Pneumatic Systems, Specification for
MSFC-SPEC-234A July 27, 1967	Nitrogen, Space Vehicle
MSFC-SPEC-356A April 15, 1967	Hydroden, Liquid
MSFC-SPEC-364B April 15, 1967	Helium
MSFC-SPEC-399 April 24, 1964	Oxygen, Type II, Grade C
MS005.0 May 17, 1961	Fabrication of Type 17-7 PH Stainless Steel
MS005.1A April 15, 1961	Fabrication of Type 410 Stainless Steel Sheet, Plate and Strip
MS200.2 January 6, 1961	Internal Protection of Stainless Steel Pipe and Tubing During Fusion Welding
MS260.0 March 6, 1961	Insert, Helical Coil Thread, Installation of
MS260.2 October 1960	Installation of Jo-Bolt Blind Locking Fasteners
MS700.0 January 12, 1961	Acceptance of Spooled Aluminum Alloy Welding Wire for Launch Vehicle Application
MS750.0A April 22, 1961	Nonmetallic (Asbestos) Gaskets

SCN 119R2

STANDARDS

Federal

FED-STD-151A May 6, 1959	Metals, Test Methods
FED-STD-595 March 1, 1956	Colors

Military

MIL-STD-129C July 11, 1960	Marking for Shipment and Storage

MIL-STD-171A October 11, 1960	Finishing of Metal and Wood Surfaces
MIL-STD-453(1) October 29, 1962	Inspection, Radiographic

New Page

MIL-STD-1247 12 March 1963	Identification of Pipe, Hose, and Tube Lines for Aircraft, Missiles, Space Vehicles, and Associated Support Equipment and Facilities
MS33586A 16 December 1958	Metal, Definition of Dissimilar

Army Ballistic Missile Agency

ABMA-STD-3(1) 27 June 1958	Etching of Aluminum Before Spot Welding
ABMA-STD-428B 8 April 1960	Printed Circuit Design and Construction Standard

Marshall Space Flight Center

MSFC-STD-100 16 May 1961	Castings, Aluminum and Magnesium Alloy, Radiographic Inspection of, Acceptance Standard for
MSFC-STD-105A(1) 16 April 1965	Synthetic Rubber, Age Control of, Standard for
MSFC-STD-110A 16 March 1962	Electrical Hardware, Equipment, Material, and Methods Used in Saturn Ground Support Equipment
MSFC-STD-162 26 July 1961	Mechanical Symbols

SCN 254 to 367B

DRAWINGS

Army Ballistic Missile Agency

10415462 17 March 1960	Procedure for Determining the Degree of Contamination on the Downstream Side of Wire Mesh, Hydraulic Filter Elements, and Contamination Testing of MIL-H-5606B Hydraulic Oil and Hydraulic Systems
10421421 1 February 1960.	Saturn Grounding and Shielding Layout

10509301 25 July 1960	Riveting Fabrication and Inspection, Standard for
10509302 16 May 1960	Packaging and Packing of Parts, Repair Parts, and Components for Space Vehicles, General Specification for
10509318 9 July 1960	Hose Assemblies, Flexible, High-Pressure, Specification for

Marshall Space Flight Center

10M01071 6 March 1961	Environmental Protection When Using Electrical Equipment Within the Areas of Saturn Complexes Where Hazardous Areas Exist, Procedure for

PUBLICATIONS

Military

MIL-HDBK-5 5 March 1959	Strength of Metal, Aircraft Elements

National Aeronautics and Space Administration and Marshall Space Flight Center

NPC 200-2 20 April 1962	Quality Assurance Provisions for Space System Contractors

GENERAL DOCUMENTS

Non-Government Documents

Society of Automotive Engineers

ARP 598 1 March 1960	Procedure for the Determination of Particulate Contamination of Hydraulic Fluids by the Particle Count Method
ARP 599 19 August 1960	A Dynamic Test Method for Determining the Degree of Cleanliness of the Downstream Side of Filter Elements

ARP 604A 31 May 1961	Hose Assemblies, Aircraft and Missiles, High-Temperature, High-Pressure (250,000 Cycles)

Space and Information Systems Division, North American Aviation, Inc.

MA0303-1032C 11 May 1965	Electrical and Electronic Reference Designations, Standard for
SID 61-408 2 November 1962	Design Criteria for S-II System Facility (AMR)

DEVIATIONS TO S-II GROUND SUPPORT EQUIPMENT DOCUMENTS

Deviations from S-II ground support equipment documents follow in alpha-numerical order by document. See Appendix B for cross reference indexes.

Deviation 363 Wiring Procedures

Requirement: ABMA-PD-E-53, dated 11 February 1960, Electrical Wiring Procedures.

Deviation: Delete the requirement for compliance with ABMA-PD-E-53 in its entirety and substitute the requirement of MSFC-PROC-256, Electrical Fabrication, Procedure for, dated 1 March 1964, as applicable to the following items:

NAA SCD Control No. ME181-0111, Relay Distribution Panel Assembly
NAA SCD Control No. ME455-0100, Plug-in Module Relay Assembly

Reason: Parts ME181-0111 and ME455-0100 are to be manufactured by Brown Engineering Co. Inc., of Huntsville, Alabama. Brown Engineering shop personnel are certified by NASA to perform electrical fabrication operations in accordance with MSFC-PROC-256.

Effectivity: As called out in the deviation, applicable only to Brown Engineering Co.

Deviation 224 Scope

Requirement: ABMA-PD-E-53, 11 February 1960, paragraph 1.1 "This specification covers the fabrication of . . . . Alternate procedures proposed by the contractors require the prior written approval of the procuring agency."

Deviation: The Contractor requests approval for the use of the resistance welding method for the fabrication of electronic modules and electrical connections.

Reason: Welded electronic modules and electrical connections provide greater reliability coupled with weight and space saving.

Effectivity: Battleship Test Vehicle, Electromechanical Mockup, S-II-S and subs., and associated ground support equipment.

Deviation 174a Lacing Cord

Requirements: ABMA-PD-E-53, 11 February 1960, paragraph 3.1.4. "Lacing cord shall be in accordance with Specification MIL-Y-1140."

Deviation: Lacing and spot-typing material shall be twine or tape in accordance with Specification MIL-T-713, Type P (nylon), Class 2 or 3. Where resistance to high temperature is required, a braided glass fiber tape shall be used.

Reason: Temperature encountered in many applications does not require use of glass materials, such as Specification MIL-Y-1140. When temperature and/or other environments require use of glass material, fray resistance is highly desirable; fray resistance is not covered by Specification MIL-Y-1140.

Effectivity:

Deviation 72 Connectors

Requirements: ABMA-PD-E-53, dated 11 February 1960, paragraph 3.1.6. "Connectors shall be in accordance with MIL-C-5015, Type E or MIL-C-26482."

Deviation: Connectors shall be in accordance with MIL-C-5015, Type R, or MIL-C-0026482.

Reasons: MIL-C-5015, Type E, and MIL-C-26482 are inactive for new design. MIL-C-0026482 with removable crimp-type contacts for better mechanical strength and electrical continuity is preferred. MIL-C-5015, Type R, replaces Type E and is superior to Type E relative to meeting environmental requirements.

Deviation 195 Insulation Sleeving

Requirement: ABMA-PD-E-53, 11 February 1960, paragraph 3.1.9. "Insulation sleeving shall be in accordance with Specification MIL-I-7444."

Deviation: Insulation sleeving shall be in accordance with Specification MIL-I-7444. Where a heat-shrinkable tubing is desired, a thermally stabilized, irradiated polyolefin sleeving or a modified polytetraflouroethylene sleeving (both to Specification MB0150-007) shall be used. For high temperature use up to an operating temperature of 650 C where a low dielectric strength and low voltage application is required, an uncoated braided, glass yarn sleeving (to Specification NA2-41101) may be used.

Reason: The heat shrinkable tubing can be installed more quickly and affords equivalent protection. Application of Specification MIL-I-7444 sleeving requires the use of a dilator fluid which is both toxic and flammable. For this reason, the use of this type of sleeving requires an adequate ventilation system to be installed.

The glass yarn sleeving is capable of withstanding greater temperatures than the teflon sleeving.

Deviation 223 Cable and Harness Assemblies

Requirement: ABMA-PD-E-53, paragraph 3.1.11.
"All cable and harness assemblies shall be in accordance with applicable drawings and shall meet the requirements of ABMA-PD-C-711A."

ABMA-PD-C-711A, paragraph 4.7.3.3.
"1,000-volt, 60-c.p.s. power shall be applied at a rate of 500 volts per second and shall be maintained for not more than 1 minute between pairs of adjacent pins and between the connector shell (ground) and each pin of the connector. The current-measuring device shall be as specified in 4.7.1.1."

Deviations: Paragraph 4.7.3.3 of Specification ABMA-PD-C-711A shall not apply to cable and harness assemblies. Cable and harness assemblies shall comply with the requirements of paragraph 4.4.2.1 of Specification ABMA-PD-E-53.

Reason: DC potentials tests are less damaging than AC potentials tests. Consequently, reduced voltage tests should be used for inplant acceptance

testing since over-potential, less-than-breakdown voltage may damage the insulation and reduce its safety factor and reliability. Method 301 of Standard MIL-STD-202B covers the above precautions in high-voltage testing.

Effectivity: This deviation is effective on all S-II GSE Automatic Checkout Equipment.

Deviation 267 Cable and Harness Assemblies

Requirement: ABMA-PD-E-53, 11 February 1960, paragraph 3.1.11. "All cable and harness assemblies shall be in accordance with applicable drawings and shall meet the requirements of ABMA-PD-C-711A."

ABMA-PD-C-711A, paragraph 4.7.3.3.
"1,000-volt, 60-c.p.s power shall be applied at a rate of 500 volts per second and shall be maintained for not more than 1 minute between pairs of adjacent pins and between the connector shell (ground) and each pin of the connector. The current-measuring device shall be as specified in 4.7.1.1."

Deviation: Paragraph 4.7.3.3 of Specification ABMA-PD-C-711A shall not apply to cables and harness assemblies. Cable and harness assemblies shall comply with the requirements of paragraph 4.4.2.1 of Specification ABMA-PD-E-53.

Reason: DC potentials tests are less damaging than AC potentials tests. Consequently, reduced voltage tests shall be used for inplant acceptance testing since over-potential, less-than-breakdown voltage may damage the insulation and reduce its safety factor and reliability. Method 301 of Standard MIL-STD-202B covers the above precautions in high-voltage testing.

Deviation 290 Electrical Wiring

Requirements: ABMA-PD-E-53, dated 11 February 1960, Paragraph 3.2.2. "Connectors shall be potted in accordance with Drawing A8931070."

Deviation: Connectors shall be potted in accordance with Specification MSFC-PROC-186A (Appendix A shall not apply) and MSFC-PROC-196.

Reason: In reply to NAA leter 64MA7812, dated 26 June 1964, NASA resident contract personnel requested submittal of a contract specification, approval of which would show mutual agreement as to the status of MSFC-PROC-186A and 196.

Effectivity: MSFC-PROC-196 and MSFC-PROC-186A, excluding Appendix A, are effective on all Saturn S-II ground support equipment.

Deviation 73 Shield Termination

Requirement: ABMA-PD-E-53, 11 February 1960, paragraph 3.2.3 and Figure 1. "Figure 1 shows shields interconnected with jumper wires in series, leading to common ground wire."

Deviation: Groups of ground jumpers shall be connected individually to the common ground wire, or by common shield ground jumpers interconnected in closed-end connectors (bomb tails). Figure 1 should show jumper wires to their respective ferrules.

Reason: Individual grounding provides for more economical and efficient maintenance and repair.

Deviation 74 Shield Separation

Requirement: ABMA-PD-E-53, 11 February 1960, paragraph 3.2.3.1. "The strands of the shield wire shall be separated... as shown in Figure 2."

Deviation: The shield should be separated from the conductor by use of a two-piece ferrule installation.

Reason: The method per ABMA-PD-E-53 results in a bulky and expensive installation.

Deviation 75 Lacing and Sleeving

Requirement: ABMA-PD-E-53, 11 February 1960, paragraph 3.2.3.2. "The loose end of the shield. . . and a second wrapping of lacing. . . shall be wrapped around the entire assembly. The wrapping shall consist of a spot tie of at least four turns."

Deviation: Two-piece ferrule installation shall be used instead of lacing and sleeving.

Reasons: Lacing and sleeving are slow-production processes with resultant greater costs than costs acquired with use of ferrules. In addition, more time is required by Inspection and Quality Control personnel to qualify the lacing and sleeving methods.

Deviation 76 Grounding to Structure

Requirement: ABMA-PD-E-53, 11 February 1960, paragraph 3.2.3.3. "When the cable, harness, or wire bundle . . . are to be grounded . . . individual shields will be terminated. The complete assembly shall be as shown in Figure 8."

Deviation: Two-piece ferrules shall be used for grounding to structure.

Reason: The method per AMBA-PD-E-53 is too costly. If repairs have to be made, it would be necessary to re-encapsulate the installation.

Deviation 77 Two-piece Ferrules

Requirement: ABMA-PD-E-53, 11 February 1960, paragraph 3.2.3.5.1. "A single-piece ferrule. . . may be used. If the ferrule assembly is not insulated, place a piece of sleeving over the assembly."

Deviation: Two-piece ferrules, such as Burndy grounding sheath connectors, shall be used.

Reasons: Single-piece ferrules require slow and costly assembly methods. In addition, inspection practices require more time than when two-piece ferrule construction is used.

Deviation 299 Grounding Lugs

Requirements: ABMA-PD-E-53, dated 11 February 1960, Paragraph 3.2.6. "Lug terminal connector grounding. - When terminal grounding lugs are used and assembled to the screw of the connector cable clamps or other approved grounding screws, the lug shall be assembled with a split washer between the screw head and the terminal lug. The terminal lug shall make direct contact with the grounding surface."

Deviation: ABMA-PD-E-53, dated 11 February 1960, Paragraph 3.2.6. Lug terminal connector grounding. - When terminal grounding lugs are used and assembled to the screw of the connector cable clamps, the lug shall be assembled with a split lockwasher between the screw head and the terminal lug. The terminal lug shall make direct contact with the connector cable clamp. Drawer and panel grounding shall be as indicated in Enclosure (1). The ground stud will be mounted through a clearance hole in the chassis with a flat washer, lockwasher, and mounting nut. The panel ground lug shall be assembled on the mounted stud with a flat washer, lockwasher, and nut.

Reason: Mounting the terminal lug next to the aluminum chassis will cause the self-insulated terminal to bend as a result of the terminal insulating collar extending below the plane of the terminal tongue. As a consequence, there exists a possible interference between the top of the insulated terminal collar and the ground study assembly hardware. Premounting the ground stud hardware per Enclosure (1) affords sufficient clearance from the chassis to prevent interference with the terminal insulating collar.

Aluminum is the required construction material for GSE panels and drawers per MSFC-STD-110A, Paragraph 5.2. Due to aluminum being an active metal, unprotected aluminum when exposed to air will form a thin layer of oxidized metal which acts as an insulator. Independent mounting of the ground stud to the drawer provides assurance of a low resistance ground bond exclusive of the addition or removal of shield grounds from the drawer ground stud.

Effectivity: This deviation shall apply to all S-II ground support equipment.

Deviation 160 Securing Wire Bundles

Requirement: ABMA-PD-E-53, 11 February 1960, paragraph 3.2.7. "All wire bundles, harnesses, and cables should be continuously laced when the length is sufficient to accommodate two complete stitches. Spot ties may be substituted for a continuous lace within subassemblies when the lacing length is less than four complete stitches..."

Deviation: Spot typing of all wire bundles, harnesses and cables on deliverable GSE equipment for use on the electromechanical mockup shall be acceptable through the development phase of the equipment. The bundles, harnesses, and cables shall be continuously-laced or spot-tied in compliance with the requirements of the specification after the development phase is completed.

Reasons: Spot typing will (1) simplify tying of harnesses, especially while on jig boards, and (2) simplify rework when incorporating engineering changes in completed equipment.

Deviation 172a Wire Bundle Lacing

Requirement: ABMA-PD-E-53, Paragraph 3.2.7: "All wire bundles, harnesses, and cables should be continuously laced when the length is sufficient to accommodate two complete stitches. Spot ties may be substituted for a continuous lace when the lacing length is less than four complete stitches...."

Deviation: All wire bundles, harnesses and cables shall be secured by spot tying.

Reason: Continuous lacing can cause rigidity and damage to wire bundles and harnesses. Due to close proximity of connectors and pin runs, continuous lacing is virtually impossible. The excessive amount of serves-required makes routing and termination of wires at connectors extremely difficult. Lacing and serving of runs to connectors is impractical and cannot be done before installation of wires.

Effectivity: This deviation is applicable to all ground support equipment. Any work already accomplished which combines spot tying and continuous lacing shall be acceptable.

Deviation 256 Securing Wire Bundles

Requirement: ABMA-PD-E-53, 11 February 1960, paragraph 3.2.7. "All wire bundles, harnesses, and cables should be continuously laced when the length is sufficient to accommodate two complete stitches. Spot ties may be substituted for a continuous lace within subassemblies when the lacing length is less than four complete stitches. . . ."

Deviation: Spot tying of all wire bundles, harnesses and cables on the C7-41 and C7-603 for use on the Battleship Test Facility shall be acceptable.

Reason: Spot tying (1) simplify tying of harnesses and (2) simplify rework from incorporating engineering changes into complete equipment.

Effectivity: This deviation is effective on GSE Models C7-41 and C7-603 which are to be used on the Battleship Test Facility.

Deviation 285 Torque Requirements

Requirement: ABMA-PD-E-53, Paragraph 3.2.11.
"When the backshells, adapters, and connector cable clamps are assembled to the connector, and when plugs are mated with receptacles on MS-E and MS-R connectors, the component parts shall be used to provide the torque necessary to all sections of the assembly to seal the connector. The following minimum torque values shall be used:

Connector Size	Torque Ft. Lbs.
14	4
20	7
24	9
28	11
32	13
40	17"

Deviation: Moisture-proof connectors having resilient inserts shall be tightened after mating with a strap wrench so as to compress the insert material, effecting a proper seal. Unless otherwise specified on engineering drawings, all other types of connectors shall be hand-tightened.

Reason: To preclude marring the exterior surface of the connector and to provide maximum connector engagement, a strap wrench will be used in lieu of a torque wrench. Hand tightening provides sufficient torque for proper engagement of connectors other than those having resilient inserts.

Effectivity: This deviation shall apply to all S-II ground support equipment.

Deviation 187 Cable and Harness Assemblies

Requirement: ABMA-PD-E-53, 11 February 1960, paragraph 4.4.2.1. "The insulation resistance shall be measured with an instrument that has a test potential of 500 volts direct current. The instrument shall have a full-scale reading of 2,000 megohms or greater, with a minimum accuracy of 5 percent at 100 megohms."

Deviation: The insulation resistance shall be measured with an instrument that has a test potential of 500 volts direct current. The instrument shall have a full-scale reading of 500 megohms or greater, with a minimum accuracy of +10 percent -0 percent at 100 megohms.

Reasons: The Contractor's automatic insulation resistance testers have a full scale reading of 500 megohms, which is more than adequate to verify that cable and harness assemblies meet the requirements of applicable MSFC specifications. Changing the insulation resistance test instrument accuracy from a minimum of 5 percent at 100 megohms to +10 percent -0 percent, will provide greater assurance that no wire assemblies will be approved with insulation resistance less than the reject limit. The overall test equipment accuracy has not been reduced as +5 percent above the reject limit and -5 percent below the reject limit yields a total tolerance of 10 percent.

Effectivity: This change is applicable to GSE and items identified in SID 61-362.

Deviation 188 Electrical Assemblies

Requirement: ABMA-PD-E-53, 11 February 1960, paragraph 4.4.2.2. "The insulation resistance shall be measured with an instrument that has a test potential of 100 volts direct current. The instrument shall have a full-scale reading of 2,000 megohms or greater, with a minimum accuracy of 5 percent at 100 megohms."

Deviation: The insulation resistance shall be measured with an instrument that has a test potential of 100 volts direct current. The instrument shall have a full-scale reading of 500 megohms or greater, with a minimum accuracy of +10 percent -0 percent at 100 megohms.

Reason: The Contractor's automatic insulation resistance testers have a full scale reading of 500 megohms, which is more than adequate to verify that cable and harness assemblies meet the requirements of applicable MSFC specifications. Changing the insulation resistance test instrument accuracy from a minimum of 5 percent at 100 megohms to +10 percent -0 percent, will provide greater assurance that no wire assemblies will be approved with insulation resistance less than the reject limit. The overall test equipment accuracy has not been reduced as +5 percent above the reject limit and -5 percent below the reject limit yields a total tolerance of 10 percent.

Effectivity: This change is applicable to GSE end items identified in SID 61-362.

Deviation 20 Ceramic Insulation

Requirement: Specification ABMA-PD-R-187, 7 November 1958, paragraph 3.4.2. "Ceramic insulating material shall conform to grade L3B of Specification JAN-I-30. All external ceramic surfaces shall be glazed in accordance with Specification JAN-I-10."

Deviation: Ceramic insulating material shall conform to grade L311, or better, of Specification MIL-I-10A. All external ceramic surfaces shall be glazed in accordance with Specification MIL-I-10A.

Reason: JAN-I-30 does not exist, and JAN-I-10 has been superseded by Specification MIL-I-10A.

Deviation 297 Relay Color Coding

Requirement: ABMA-PD-R-187, Paragraph 3.10.2. "Terminal marking. - Relay header beads shall be permanently color coded, using bright colors, in accordance with the following:

(a) Normally closed contact - brown
(b) Normally open contact - green
(c) Movable contact - yellow
(d) Pin 19 - blue (see individual specification sheet)

(e) Pin 20 - white (see individual specification sheet)
(f) Pin 21 - white, if applicable (see individual specification sheet)."

Deviation: Relay headers for GSE relays used in potted assemblies may be marked with only one colored bead and one colored dot in lieu of the required eight colored beads. Relay header beads must be potted so that the color code does not show.

Reason: The requested deviation demonstrates the system which is in standard use at S&ID. The original requirement is more complicated and does not adequately identify the terminals. To identify the terminals readily, a blue bead marking terminal X2 and a red dot between pins 1 and 6 are used to orient the relay with the diagram on the case. In the identification of terminals, this system lessens the chance of error due to poor color perception. S-II airborne and GSE relays which use the deviated color coding are potted in modules; therefore the relay header color-coding system is invisible and unimportant in all areas subsequent to module assembly at S&ID. The specification controlling S-II relays has been changed to reflect the use of deviated color-coding in potted assemblies only.

Effectivity: This deviation shall apply to all S-II ground support equipment.

Deviation 384

Requirement: ABMA-PD-W-45A, dated 22 September 1959, paragraph 2.1, reference the following specifications:

QQ-A-255	QQ-A-283	QQ-A-357
QQ-A-261	QQ-A-287	QQ-A-359
QQ-A-266	QQ-A-315	QQ-A-362
QQ-A-267	QQ-A-318	QQ-A-411
QQ-A-268	QQ-A-325	QQ-A-561
QQ-A-270	QQ-A-327	MIL-A-19070
QQ-A-277	QQ-A-355	MIL-A-19842
QQ-A-232	QQ-A-356	

Deviation: The above specifications have been replaced, respectively, by the following:

QQ-A-250/3c	QQ-A-250/12c	QQ-A-200/1a
QQ-A-200/2b	QQ-A-250/13c	QQ-A-250/2b
QQ-A-225/4b	QQ-A-225/7a	QQ-A-250/5c
QQ-A-200/3b	QQ-A-250/8c	QQ-A-225/1b
QQ-A-225/6b	QQ-A-225/8b	QQ-A-250/1c

QQ-A-200/8b	QQ-A-250/11c	QQ-A-250/7c
QQ-A-200/11b	QQ-A-250/4c	QQ-A-250/9d
QQ-A-225/9b	QQ-A-225/2b	

Reason: The old aluminum specifications for wrought products were cancelled on 16 December 1963. New "slash Number" specifications were released to supersede the cancelled ones. The new "slash Number" specifications cover the same alloys as the old specifications. Therefore, the weldability is the same. Since ABMA-PD-W-45A is concerned with welding only, the change to the new specifications is entirely inconsequential to the intent of the documents.

Effectivity: These deviations shall be effective on all stage and ground support equipment.

Deviation 71 Cleaning and/or Conditioning

Requirement: ABMA-PD-C-4, 25 June 1958, paragraph 3.2. Cleaning and/or conditioning processes. "Cleaning and/or conditioning may be accomplished in accordance with any of the following processes . . ."

Deviation: Cleaning and/or conditioning shall be performed in accordance with NAA process specifications for materials and processes that are not injurious to parts.

Reason: NAA has existing facilities and procedures that provide assurance equivalent to specification ABMA-C-4 and alternate methods if required.

Deviation 37a Plating

Requirement: ABMA-STD-428B, 8 April 1960, paragraph 3.8.4 "The surface finish on all boards shall be gold plating Sel-Rex bright or hard gold or equivalent 0.000100 inch minimum to approximately 0.000150 inch maximum. . . . ."

Present Deviation: Circuitry and all plated-through holes shall be electrodeposited tin-lead (Sn 63 ± 5 percent) with a thickness of 0.0003 to 0.0007-inch reflow using a hot-wax process. Etched edges of circuits need not be plated.

Deviation: Circuitry and all plated-through holes shall be electrodeposited tin-lead (Sn 60 ± 10 percent) with a minimum thickness of 0.0003 inch. Etched edges of circuits need not be plated.

Reason: (a) Autonetics QRS Lab. Lab Memo PC-12-314 Dated 12-17-63, "Delamination of the Printed Circuit Board Base Material During the Solder Reflowing Operation"

(b) Autonetics QRS Lab. Lab Memo PC 9-3-6, Dated 9-10-63 "Fused Vs. Unfused Solder Plated Printed Circuits"

(c) Autonetics QRS Lab. Lab Memo PC-11-3-12, Dated 11-7-63, "Fused Vs. Unfused Solder Plated Circuit Boards; Supplementary Report"

(d) Autonetics M&P Lab TR-63-332, Dated 16 May 1963, "Metallographic Investigation of Solder-Copper Reactions on Solder Coated Copper Circuitry"

(e) Tin Research Institute, Greenford, Middlesex, England, "The Solderability of Some Tin, Tin Alloy and Other Metallic Coatings," by C. J. Thwaites, April 1960

Tests by NAA and vendors indicate that solder plating of this type is superior to gold plating in solderability, conductivity, and reliability. The hot wax reflow process has a detrimental effect on the epoxy coating, and the advantages of a longer shelf life (if any) are therefore outweighed by this detrimental effect. The hot-wax process actually decreases the reliability of the board. Solderability is not affected by deletion of the process.

This requirement to improve the solder quality and reduce the number of soldered hole imperfections in a component assembled printed circuit board is justified in view of the test data accumulated by numerous electronic firms employed in aerospace projects. However, due to the reflow requirements, the rejection rate for circuit boards shipped into this facility is so high that very few boards have passed inspection. The discoloration spots found around terminal areas and circuitry accounts for the majority of the rejections and is considered by NASA to be a defect that impairs the reliability and usefulness of the circuit board. These spots are a direct result of the board being exposed to high temperatures during the reflow operation. Tests conducted by NAA on the discoloration spots show that although the appearance of the board has been affected, the electrical properties, when compared with boards without spots, have not changed. The elimination of the reflow operation will resolve the problem of the discoloration spots; however, there are some doubts that unfused and fused solder plating are equal in solderability.

A literature survey has been conducted to determine if unfused solder plate can be used in production facilities without impairing the solderability of terminal areas during component assembly. In Reference (a), the conclusions were, "The delamination is a function of the hot oil bath, the base material and the circuit design." Test procedures in this report indicated that reflow operations were varied in temperature, time and quenching medium without eliminating the susceptibility of some boards to delaminate. The investigation did not reveal any method of fusing circuit boards without some minor delamination being produced. The solderability of fused and unfused boards were evaluated in Reference (b) and Reference (c). The results of the tests performed disclosed no differences between the fused and unfused solder plate when tested for solderability, and recommendation was that the fusing operation should be eliminated. By eliminating this operation, side benefits such as less holes out of tolerance, no exposures of boards to trichloroethylene solvent, and less warpage, could be realized. In a report, Reference (d), on copper reaction with solder plating to determine the interfaced solid state diffusion during aging, the following observations were noted. "The interface phases in the reflowed samples were approximately twice as thick as those in the unfused samples." When the interface phases penetrate the solder plating, the solderability of that surface is materially reduced. The Tin Research Institute, Reference (e), released a report on Solderability of Tin Alloys, noting that, "As-deposited solder coatings of 0.0003 inch thick minimum provided adequate soldering properties when stored either in a storeroom or hot steam atmosphere."

Effectivity: This deviation is applicable to all S-II GSE Automatic Checkout Equipment.

Deviation 398

Requirement: ARP 604A, dated 31 May 1961, paragraph 4.3.1.3, Oil Aging: "In all the tests using oil-aged samples, the hose assemblies should be filled, with no pressure, with a high temperature test fluid and soaked in an air oven at a temperature of 400°F for seven days."

Deviation: In all of the tests using oil-aged samples, the hose assemblies shall be filled, with no pressure, with hydraulic fluid and soaked in an air oven at a temperature of 275°F for eight hours.

Reason: The 400°F and seven day requirements greatly exceed the environmental conditions encountered in the engine actuation system.

Effectivity: All GSE.

Deviation 399

Requirement: ARP 604A, dated 31 May 1961, paragraph 4.3.1.4, Air Aging: "Air-aged samples shall be kept in air at a temperature of 400°F for 7 days."

Deviation: Air-aged samples shall be kept in air at a temperature of 275°F for 8 hours.

Reason: The 400°F and seven day requirements greatly exceed the environmental conditions encountered in the engine actuation system.

Effectivity: All GSE.

Deviation 412

Requirement: MA0303-1032B, Paragraph 5.2.6.1 Cables. - "Cables shall be identified by a . . . . . in which they appear."

Deviation: Add the following sentence: Field installed cable assemblies shall be identified in accordance with this paragraph at the time of installation as specified on the field site installation drawing, by the field installation contractor.

Reason: Cable assemblies for the effected end items are not identified by NAA prior to shipment.

Effectivity: GSE End Items C7-35, C7-38, C7-40, and C7-93.

Deviation 417

Requirement: NAA Process Specification No. MA0303-1032C, Paragraph 5.2.3, "Designation of units, assemblies, subassemblies, and parts.- The complete reference designation shall consist of the following: The unit number that identifies the specific unit, the letter "A" that designates an assembly, a number that identifies the specific assembly, a letter or letters that identifies the class of items to which the part belongs (see 5.7) and a number that identifies the specific part . . . ." (Example follows and concludes paragraph 5.2.3.)

Paragraph 5.3.2, "Letters - The letter or letters used to identify the class to which a part belongs shall be as specified in 5.7.

Deviation: Paragraph 5.2.3. Electrical distributors shall be identified as follows:

Units and Assemblies. - Units and assemblies shall be identified as in 5.2.2.

Distributors. - The distributor bays corresponding to a subassembly shall be identified by a single letter per bay, beginning with the letter "A" for the first bay and continuing consecutively through the alphabet, omitting the letters "I", "J", "O", "Q", and "X".

Terminal board columns. - Each terminal board column shall be identified with the item class letters "TB" and with a double letter designation. The first letter shall identify the bay in which the column is located. The second letter shall identify the specific column in the bay, omitting the letters "I", "J", "O", "Q", and "X".

Example:

TB	B	C
Item Class	Bay Identification	Column Identification

TBBC The third terminal board column in the second bay.

TBAD The fourth terminal board column in the first bay.

This method of terminal board column identification shall be applicable to single bay distributors as well as multi-bay distributors.

Receptacles. - Each receptacle shall be identified by the item designation letter ("J") for receptacles (see 5.7), followed by the single identification letter for the distributor bay, followed by the specific receptacle number.

Example:

J	P	12
Item Designation Letter	Distributor Bay Identification Letter	Receptacle Number

JP12 Receptacle 12 located in bay "P", which is the thirteenth bay.

Deviation: Paragraph 5.3.2. The item designation letter "W" and the identifying number shall be omitted.

Reason: The proposed method is a simplified, yet complete means of identifying electrical distributor items. Adoption of the proposed simplified identification method would result in time savings and a great reduction in the probability of error in handling identification numbers.

The existing requirement of MA0303-1032C dictate the use of 13 to 17 characters to identify a single electrical termination. Under existing requirements, a sample wire termination is, "from 275A140W1J155-AA to 275A140A12TB54-18." Sixteen and seventeen spaces are required, respectively, to identify the terminations.

Using the proposed method of identification, the same termination is, "from 275A140JM15-AA to 275A140ME-118," which requires only 14 and 13 spaces respectively. Below is a comparison between the two designation methods for this example:

Required Designation	No. Spaces	Proposed Designation	No. Spaces
W1J155-AA	9	JM15-AA	7
A12TB54-8	9	TBME-118	8

At present there is no way of knowing which bay contains W1J155 without intimate knowledge of the distributor design. All that is known is that it is receptacle Number 155 in the distributor which is approximately 22 feet long. By contrast, the proposed method locates JM15 in bay "M", so that finding the receptacle is no problem. Similarly, locating terminal column "TBME" is simpler than locating terminal board A12TB54 because the proposed method has only eight column identifications per bay as opposed to 96 terminal board identifications per bay under existing conditions.

In the above example, the double suffix letters (-AA) is the identification for the specific contact lug on receptacle JM15. No possibility for confusion between a reference to contact lug AA and a reference to column A in bay A, also identified by the letters AA, exists. Any double letter combination suffix is understood to be a contact lug; a double letter prefixing a number is always a terminal board column identification. The situation of having more than 22 terminal board columns per which would result in insufficient letters to identify the columns (AA through AZ) can not even be envisioned under any present or proposed designs and need not be considered for this application. Individual terminals arranged in columns are customarily numbered from top to bottom. Those arranged in rows are customarily numbered from left to right. Terminal numbers 8 and 118 are random numbers selected to illustrate the greatest number of spaces in the proposed deviation vs the least number of spaces in the existing identification requirements.

Documenting and locating the wiring terminations can be quite time consuming when long identification numbers must be coped with. Besides saving time, use of terminal column identification "TBME" vs. terminal board identification "A12TB54", results in a much lower probability of error, because of the reduced number of characters involved.

The proposed method of terminal column and receptacle identification has been very successfully used in SSFL Battleship Test Stand and Control Center electrical distributors, EMM (Downey) electrical distributors, and in Seal Beach Station 8 distributors.

Effectivity: C7-93.

Deviation 438 Anodic Coatings

Requirement: MIL-A-8625A, dated December 14, 1954, Paragraph 1.2 Classification - "Anodic coatings shall be of one grade only and of the following two types as specified:

Type I - Chromic-acid coatings
Type II - Sulphuric-acid coatings"

Deviation: Anodic coating per Aerospace Material Specification, AMS 2468A, may also be used.

Reason: Specification AMS2468A allows (1) hard anodic coating without sealing to provide the maximum degree of abrasion resistance, (2) drawing callout of coating thickness to improve producibility.

Effectivity: All ME273-0055 Type I, II and III disconnect couplings.

Deviation 23 Bonding Jumpers

Requirement: MIL-B-5087A, 29 January 1958, paragraph 3.1.1. "Bonding jumpers shall conform to Standard MS25083."

Deviation: Round bonding jumpers shall conform to standard MS25083.

Reasons: The requirement above is restrictive and, therefore, eliminates the use of flat braided copper strap for bonding jumpers. A flat strap generally has lower RF impedance than a round conductor of the same cross-sectional area.

Deviation 176 Induction Brazing

Requirement: MIL-B-7883(1), 28 January 1954, paragraph 4.2.3. "The mating surfaces shall be coated with flux. . . ."

Deviation: The mating surfaces shall be coated with flux (unless brazing is to be performed in a vacuum or an inert atmosphere). . . .

Reason: Cleanliness requirements for tubing and plumbing systems preclude the use of flux. Flux in plumbing systems could not be removed with solvent after brazing.

Deviation 177 Stainless Steel

Requirement: MIL-B-7883(1), 28 January 1954, paragraph 6.5. ". . . the joint should be cleaned and degreased immediately prior to brazing . . ."

Deviation: The components of a joint shall be protected after cleaning. Small components shall be enclosed in a Polyamide bag. Tubing 24 inches or less shall be enclosed in a heat sealed Polyethylene sleeve, and tubing in excess of 24 inches shall be enclosed in a Polyethylene bag and taped in place until joint assembly.

Reason: With fluxless brazing, parts which have been fabricated (in some cases with braze-alloy-preforms in place), cleaned, and packaged by the vendor, cleanliness requirements are so severe that additional handling would actually contaminate the parts.

Deviation 178 Stainless Steel

Requirement: MIL-B-7883(1), 28 January 1954, paragraph 6.5. ". . . braze alloy conforming to Class 5 of QQ-S-561 should be used."

Deviation: . . . braze alloy conforming to Specification AMS 4778 shall be used.

Reason: Specification QQ-S-561 does not permit vacuum or controlled atmosphere brazing for plumbing systems; it requires flux, which is difficult to remove and is reactive to S-II propellants. Specification AMS 4778 has been tested and found suitable for cryogenic applications.

Deviation 281 Electrical Quick Disconnects

Requirement: MIL-C-26482(ASG) Notice 2, dated 9 February 1961.

Deviation: Delete the requirements of MIL-C-26482(ASG), Notice 2, dated 9 February 1961. Electrical quick disconnects shall be fabricated in accordance with MIL-C-26482C, Amendment 1, dated 20 February 1963.

Reason: The superseding issue (MIL-C-26482C, Amendment 1) is not materially different from the contractual document (MIL-C-26482(ASG), Notice 2) and is therefore acceptable to S&ID.

Effectivity: This deviation shall apply to all S-II ground support equipment.

Deviation 437 Schematic Drawing Numbering

Requirement: MIL-D-70327(1), dated 16 March 1959, Paragraph 3.1.3 - "Drawing sizes shall be in accordance with MIL-STD-2." MIL-STD-2b, dated 25 August 1960, Paragraph 5.3.1.8.4 - "Multisheet, block L. Block L is reserved for sheet numbers of bookform and multisheet drawings. Each sheet shall be identified by the number entered in block H and the sheet number. The total number of sheets shall be shown only on sheet 1 (example: sheet of of 4). Remaining sheets shall be numbered in consecutive order (sheet 2, 3, etc.) (see Figure 6)."

Deviation: Block L is reserved for sheet numbers of multisheet and bookform drawings. The total number of sheets shall be shown only on sheet 1 (example: Sheet 1 of 4). Remaining sheets shall be numbered in consecutive order (Sheet 2, 3, etc.). An acceptable alternate method of number is to point-number the sheets (example: 1, 1.1, 1.2, 2.2).

Reason: Saturn Stage harnesses and site system schematics are prepared as bookform drawings and where additions or deletions are required, the point-number procedure will eliminate the need for renumbering every sheet of the bookform drawing. Each of the bookform drawings will be furnished with an index of pages which will provide the necessary page control. (Note: this deviation is already approved for S-II Stage schematics, see page 34 of SID 61-367B.)

Effectivity: Saturn S-II GSE.

Deviation 218 Abbreviations

Requirements: MIL-D-70327(1), 1 July 1959, Paragraph 3.1.11. "Abbreviations shall be in accordance with MIL-STD-12B."

Deviation: (a) Abbreviations for hydrogen, nitrogen, and oxygen shall be as follows:

Liquid hydrogen	-	LH_2
Gaseous hydrogen	-	GH_2
Liquid nitrogen	-	LN_2
Gaseous nitrogen	-	GN_2
Liquid oxygen	-	LOX

(b) When vertical dimension limitations will not permit the use of the subscript numeral, the numeral shall appear on the base plane line with the upper case letters but the numeral shall be smaller in size unless the vertical space limitations compels the use of a letter height which is the minimum height allowable for legibility considerations. When the minimum height lettering is required, the numeral shall be the same height as that of the upper case letters.

Reason: (a) The abbreviations are part of preferred usage indicated in MSFC Memo No. M-ASTR-EA-372-63, dated April 17, 1963, which was attached to and part of Technical Directive No. M-SAT-S-II, No. 78-63, dated May 2, 1963. This deviation will afford uniformity of usage and is in accordance with Contractors "Design Requirements Manual."

(b) The dimensions and arrangement change as listed in (b) above is required for visual readout and is the result of space limitations of certain items such as small parts, placards, and instrument and readout panels.

Deviation 439 Selection of Specifications and Standards

Requirement: Specification MIL-D-70327, dated 16 November 1959, Amendment 1, dated 1 July 1959, Paragraph 3.4. Order of precedence of specifications and standards. Where identical items of equal quality are identified by more than one document, the item shall be referenced on drawings in the following order:

SCN 206 to 367B

Deviation: The order of precedence for the selection of specifications and standards shall be in accordance with Standard MIL-STD-143.

Reason: To eliminate conflict between MIL-D-70327 and Contract End Item Specifications and to be consistent with revision adopted by Amendment 2 to Specification MIL-D-70327 dated 27 March 1962.

Effectivity: Saturn S-II Ground Support Equipment.

Deviation 163 Differential Pressure Indicator

Requirement: MIL-F-8815, 18 March 1960, paragraph 3.3.5
"Filter assemblies shall incorporate an integral nonelectrical device which will visually warn by raising a red indicator when the differential across the element exceeds 70 ± 10 psi. The red indicator, once actuated, shall remain up until manually reset. The indicator shall not be operable below 30° ± 20° F."

Deviation: Delete entire paragraph.

Reason: Filters used in S-II GSE hydraulic systems are monitored, for pressure drop, by differential pressure switches interlocked to warning lights that are conspicuously displayed on monitor panels. Therefore, non-electric devices have not been incorporated into the design of filters used in S-II GSE hydraulic systems.

Deviation 164 Element Collapse

Requirements: MIL-F-8815, 18 March 1960, paragraph 3.3.6
"Elements shall be designed to withstand a differential pressure of 4,500 psi."

Deviation: Wire mesh elements, used in high pressure hydraulic systems, shall be designed to withstand a minimum differential pressure of 3000 psig.

Reason: The high pressure wire mesh filter, used in S-II GSE hydraulic systems, was selected from an evaluation test program. The particular element selected will withstand a minimum differential pressure of 3000 psig. This element is continuously monitored by two (2) differential pressure switches; one of which actuates at 100 psid and the other at 150 psid. When actuated at 100 psid, a filter restricted warning light illuminates and at 150 psid a filter plugged warning light illuminates. The 150 psid actuation also de-energizes electrical power to the pump motor. Based on the above, it is S-II GSE opinion that the 4500 psid parameter is an unrealistic requirement to the S-II GSE hydraulic systems.

Deviation 59

Requirement: MIL-I-6181D, 25 November 1959

Deviation: Delete the requirement for compliance to specification MIL-I-6181D in its entirety as applicable only to the C7-28 Electric Cable Test Set.

Reason: Compliance with Specification MIL-I-6181D is not considered necessary. The C7-28 Electric Cable Test Set is used only during periods of inactivity in Stage checkout. A placard will be installed on the panel to restrict use only during periods of inactivity and a "CAUTION" notice will be included in the Saturn S-II Handling and Auxiliary Equipment Maintenance Manual Number SM-S-II-18. The deviation would permit the use of standard equipment that would preclude costly development of special equipment which would not be used during periods of activity.

Deviation 190a Tape Recorder

Requirement: MIL-I-6181D, dated 25 November 1959. This specification, and the documents referenced therein, establish the design requirements, interference test procedures and limits for electronic aeronautical equipment to be installed in or closely associated with vehicles operating above the surface of the earth (see Notice 2 dated 1 June 1962).

Deviation: Specification MIL-I-6181D shall not apply to the wide band tape recorder (GSE Model C7-516) to be purchased by NAA/S&ID to NAA/S&ID Specification Control Drawing ME435-0019.

Reason: NASA Technical Directive M-SAT-S-II 41-63 (Revision 1), dated 8 July 1963, Paragraph 7, suggests that NAA procure the above tape recorder as an off-the-shelf item and that NAA "not require the vendor to modify the equipment to meet MIL-I-6181D." North American will purchase this item to Specification Control Drawing ME435-0019 (Model VR-3600, manufactured by Consolidated Electrodynamics Corporation, equivalent to Item 5, page 6, of the above referenced technical directive).

Effectivity: This deviation shall apply only to the GSE Model C7-516 Wide Band Tape Recorder.

Deviation 395

Requirement: MIL-I-6181D, dated 25 November 1959.

Deviation: The RFI requirements of MIL-I-6181D shall not be applicable to NAA cable at the location where the cables enter NASA-furnished distributors.

Reason: The cables will enter the NASA-furnished distributors in the same manner as NASA-provided cable, which do not conform to MIL-I-6181D.

Effectivity: C7-35, C7-38, and C7-40.

Deviation 407

Requirement: MIL-I-6181D, dated November 25, 1959.

Deviation: Delete the requirement for compliance with Specification MIL-I-6181D in its entirety as applicable to Digital Data Acquisition Subsystem.

Reason: MSFC has directed that the Contractor procure this equipment to MSFC Drawing 50M01828 and MSFC-SPEC-295, Receiving Station, Pulse Code Modulated Digital Data Acquisition Subsystem, Model DRS-1, Specification for. Neither of these documents contains requirements to meet MIL-I-6181D. Because the Contractor, as directed, no longer has control over the design, the Contractor cannot guarantee compliance with Specification MIL-I-6181D for the subject equipment.

Effectivity: This deviation shall be effective only for Digital Data Acquisition Subsystem, C7-403, unit 1 and Subs.

Deviation 64a Operation

Requirement: MIL-I-6181D, 25 November 1959, paragraph 3.2.1 "Electrical and electronic equipment shall operate satisfactorily, not only independently but also in conjunction with other equipment which may be installed nearby. This requires that the operation of such equipment shall not be adversely affected by interference voltages and fields reaching it from external sources, and also requires that such equipment shall not, in itself, be a source of interference which might adversely affect the operation of other equipments. . . ."

Deviation: The Contractor shall not be held to guarantee compliance with interference control requirements for the Control Data Corporation 924-A, Computer Group consisting of the following:

(1) C7-101, Automatic Checkout Computer
(2) C7-103, Program Input Rack
(3) C7-104, Data Printout Rack
(4) C7-105, Auxiliary Memory Rack

Reason: MSFC has directed the Contractor to purchase the Control Data Corporation 924-A Computer Group as commercial off-the-shelf equipment. MSFC has proposed incorporation of an RFI "fix" into the Computer Group by Control Data Corporation. The Contractor has no guarantee that proposed RFI "fix" will be adequately effective in the reduction of RFI for the Computer Group. Because the Contractor no longer has control of the RFI reduction design, the Contractor cannot guarantee compliance with Specification MIL-I-6181D.

Effectivity: This deviation is applicable to GSE Models C7-101, C7-103, C7-104 and C7-105.

Deviation 250a Noncompliance with RFI Requirements

Requirement: MIL-I-6181D, 25 November 1959, Paragraph 3.2.1. "Electrical and electronic equipment shall operate satisfactorily, not only independently but also in conjunction with other equipment which may be installed nearby. This requires that the operation of such equipment shall not be adversely affected by interference voltages and fields reaching it from external sources, and also requires that such equipment shall not, in itself, be a source of interference which might adversely affect the operation of other equipments. The limits specified herein are established to insure that the air vehicles will meet the requirements of Specification MIL-I-6051 or other applicable system specification.".

Deviation: The contractor shall not be held to guarantee compliance with the above interference control requirements for the following equipment:

Model No.	Title	Part No.
C7-512	Oscillograph Rack	G7-871200
C7-513	Decommutation Rack	G7-871300
C7-514	Discriminator Rack	G7-871400
C7-515	Receiver Rack	G7-871500
C7-518	Single Side Band Rack	G7-871800

Reason: Late redirection by MSFC in TD M-SAT-S-II-41-63 (dated 28 March 1963) caused schedule problems. To meet the pressing schedule requirements, the equipment listed in this deviation request was procured on a mandatory source basis for EMM only and was not modified to meet radio frequency interference specifications. This equipment is used in the end items listed above (first column, Model No.); therefore, these items cannot be guaranteed to comply with the interference control requirements.

Effectivity: This deviation is effective on GSE Models C7-512, Oscillograph Rack; C7-513, Decommutation Rack; C7-514, Discriminator Rack; C7-515, Recover Rack; Serial No. 1 only, C7-515, C7-518 reallocated to Seal Beach.

Deviation 19 Short Duration Interference

Requirements: MIL-I-6181D, 25 November 1959, paragraph 3.2.2. "Interference resulting from manual operation of switches, but not including any electrical or electromechanical operations resulting from the manual switching, may deviate from the limits as indicated below, other short-duration interference may deviate from limits as indicated below. Approval shall be obtained from the procuring activity before using these deviations."

Maximum Duration	Maximum Recurrence	Deviation Permitted
3 Seconds	Twice per normal operational period	No limitation

Deviation: Formal approval is required to use the no-limitation deviation permitted for:

	Function	Maximum Duration	Maximum Recurrence	Deviation Permitted
1.	AC Power on	1 second	Once per normal operational period	No limitation
2.	AC Power off	1 second	Once per normal operational period	No limitation
3.	DC Power on	1 second	Once per normal operational period	No limitation
4.	DC Power off	1 second	Once per normal operational period	No limitation

	Function	Maximum Duration	Maximum Recurrence	Deviation Permitted
5.	Main Pump on	1 second	Once per normal operational period	No limitation
6.	Main Pump off	1 second	Once per normal operational period	No limitation
7.	Service Pump on	1 second	Once per normal operational period	No limitation
8.	Service Pump off	1 second	Once per normal operational period	No limitation
9.	Oil Temperature Switch Actuation	1 second	There is no operation during normal operation. Operation occurs only in case of console malfunction.	No limitation
10.	Low voltage and fast reversal release actuation	1 second	There is no operation during normal operation. Operation occurs only in case of console malfunction.	No limitation
11.	Differential pressure switch actuation (a) Restricted Filter #1 (b) Restricted Filter #2 (c) Restricted Filter #3 (d) Plugged Filter #1 (e) Plugged Filter #2 (f) Plugged Filter #3	1 second	There is no operation during normal operation. Operation occurs only in case of console malfunction.	No limitation
12.	High System Pressure Switch Actuation	1 second	There is no operation during normal operation. Operation occurs only in case of console malfunction.	No limitation

	Function	Maximum Duration	Maximum Recurrence	Deviation Permitted
13.	High Return Pressure Switch Actuation	1 second	There is no operation during normal operation. Operation occurs only in case of console malfunction.	No limitation
14.	Reservoir level switch actuation	1 second	There is no operation during normal operation. Operation occurs only in case of console malfunction.	No limitation
15.	Pump inlet pressure switch open	1 second	Once per normal operational period	No limitation
16.	Pump inlet pressure switch closed	1 second	Once per normal operational period	No limitation
17.	Limit switches in Supply Motor Valves open (total of 4 motor valves)	1 second	Once per normal operational period	No limitation
18.	Limit switches in Supply Motor Valves closed (total of 4 motor valves)	1 second	Once per normal operational period	No limitation
19.	Actuation switches for opening Supply Motor Valves (total of 4 motor valves)	1 second	Once per normal operational period	No limitation
20.	Actuation switches for closing Supply Motor Valves (total of 4 motor valves)	1 second	Once per normal operational period	No limitation

Reason: The above functions fall well within the no-limitation deviation permitted by paragraph 3.2.2 of Specification MIL-I-6181; however, NASA approval is required before these deviations can be utilized in the operation of the Hydraulic Power Console, Model Number C7-601.

NOTE

For additional information refer to NAA/S&ID drawing G7-985811, Schematic Diagram, Electrical System, C7-601 Hydraulic Power Console.

Deviation 416 Conducted Interference

Requirement: MIL-I-6181D, Paragraph 4.3.1 "Conducted Interference. Radio interference voltages in the frequency range of 0.15 to 25 mc, generated by the equipment or system in excess of the values indicated in Figures 7, 8, 9, and 10 shall not appear on any conductor, external to the system, which could conduct interference to other equipment . . . ."

Deviation: The contractor shall not be held to guarantee compliance with MIL-I-6181D conducted interference limits on power input conductor segments external to the racks of those ACE/GSE end items which have power input line filters installed external to the racks. This deviation applys only to the conductor segments of the power input cables between the "in-line" power line filter output, and the rack power input at the interface plate connector pins.

Reason: To meet the understood purpose and the power line conducted interference limits of MIL-I-6181D by the most practical method at this time, the contractor is installing power line filters in the interconnecting cabling adjacent but external to the racks. The contractor interprets MIL-I-6181D to imply that any necessary power line filters should be installed as an integral part (inside) of the end item. The present contractor method complies with MIL-I-6181D, except for the conductor segments between the filter and the rack. These conductor segments will be completely shielded to minimize interference.

Effectivity: C7-48, C7-102, C7-106, C7-107, C7-108, C7-109, C7-201, C7-202, C7-204, C7-205, C7-208, C7-209, C7-210, C7-211, C7-307, C7-401, C7-402, C7-403, C7-406, C7-510, C7-511, C7-513, C7-514, C7-519, C7-801, C7-802, and C7-805.

Deviation 415 Conducted Interference

Requirement: MIL-I-6181D, Paragraph 4.3.1 "Conducted Interference. Radio interference voltages, in the frequency range of 0.15 to 25 mc, generated by the equipment or system in excess of the values indicated in Figures 7, 8, 9, and 10 shall not appear on any conductor, external to the system, which could conduct interference to other equipment . . . ."

Deviation: The contractor shall not be held to guarantee compliance with the conducted interference limits of MIL-I-6181D on output signal lines. The conducted interference on output signal lines due to the sum of all extraneous electro-magnetic energy shall be a minimum of 6 db below the threshold of susceptibility of terminating devices that are driven by the output signal lines.

Reason: A compatible delivered S-II stage and GSE system would be assured by the required contractor compliance with MIL-E-6051C without mandatory contractor compliance to MIL-E-6181D, Paragraph 4.3.1. Any possible incompatibility resulting from conducted interference on output signal lines will be detected during testing to MIL-E-6051C and will be corrected. The contractor compatibility interference control plans (SID 62-543, S-II Systems Interference Control Plan) are approved by the procuring agency.

To meet the output signal lines conducted interference limits of MIL-I-6181D would mean extensive redesign of intra-rack wiring.

Effectivity: All ACE/GSE end items (Reference SID 61-362, Volume I for identification).

Deviation 431 Radiated Interference

Requirement: MIL-I-6181D, Paragraph 4.3.2 "Radiated Interference. - Radiated interference fields in excess of the values given in Figures 14, 15, 16, and 17, shall not radiate from any unit, cable (including control, pulse, IF, video, antenna transmission, and power cables), or interconnecting wiring over the frequency range of 0.15 to 10,000 MC for CW and pulsed CW interference, and 0.15 to 400 MC for broadband impulse interference. This requirement includes the transmitter fundamental frequency radiating from cases or cabling, oscillator radiation, other spurious emanations, and broadband interference. This does not include radiation emanating from antennas. Test setups are illustrated in Figures 3, 4, 5, and 6."

Deviation: Same as Requirement except for Broadband Radiated Interference at the frequencies listed in the following table:

Frequency	Specified Limit (6181D)	Requested Limit
5.45 MC	67.5 DB	69.0 DB
5.6 MC	67.5 DB	74.0 DB
5.8 MC	67.5 DB	72.0 DB
13.2 MC	66.5 DB	67.0 DB
27.0 MC	45.0 DB	46.2 DB

Reason: The interference techniques used by Control Data Corporation on the 8090 Computer System (NAS7-200 C7-77 Digital Events Rack) are adequate for the intended use of the system. To fully meet the requirements of MIL-I-6181D, extensive rework to the system would be mandatory; this would necessitate replacing the glass door on the 614A-2 (NAS7-200 Discrete Input Scanner, Ref. Designator 260A2) with a full metal door, sacrificing visual access to the display panel indicators and the strip printer discrete stimuli and measurement data.

Deviation 436 Radiated Interference

Requirement: Specification MIL-I-6181D, dated November 25, 1959, Paragraph 4.3.2, RADIATED INTERFERENCE: "Radiated interference fields in excess of values given in Figures 14, 15, 16, and 17 shall not radiate from any unit, cable (including control, pulse, IF, video, antenna transmission, and power cables), or interconnecting wiring over the frequency range of 0.15 to 10,000 mc for CW and pulsed CW interference, and 0.15 to 400 mc for broadband impulse interference".

Deviation: NAA/S&ID shall be permitted to deviate from the radiated interference requirements of MIL-I-6181D as they relate to the ground support equipment. A 12 decibel deviation shall be permitted in the frequency range of 0.5 to 2.0 Megahertz (Megacycles) for broadband interference, in GSE equipment utilizing non-EMI-shielded circuit breakers.

Reason: Results of EMI testing of the C7-107 has shown that when all other radiation problems are corrected, radiated interference emanating from the circuit breakers exceeds the MIL-I-6181D Broadband radiated limits by 12 decibels or less in the frequency range of 0.5 to 2.0 Megahertz. At all other frequencies with which MIL-I-6181D is concerned, the interference levels are considerably lower than the specification limits. Correcting this radiated interference problem to meet the specification requirements would require replacing all presently installed circuit breakers with EMI-shielded types. The schedule impact of documentation changes and hardware replacement would be prohibitive when compared to the value gained in

reducing the radiated interference levels a maximum of 12 decibels in this narrow frequency range. Exceeding the limits of MIL-I-6181D by 12 decibels in this frequency range will not effect the operation of the vehicle because the Saturn V Critical Frequency Spectrum is outside this frequency range.

Effectivity: This deviation is effective on the following S-II ground support equipment: C7-44, C7-48, C7-100 series; C7-200 series; C7-307, C7-400 series; C7-500 series; and C7-800 series equipments utilizing non-EMI-shielded circuit breakers.

Deviation 33 Service Brake Performance

Requirement: MIL-M-8090C (ASG), 17 March 1959, Paragraph 3.2.5.2.3 "Service brakes shall hold the vehicle motionless and control is on an incline of 60 percent, and shall stop the vehicle on dry, hard, approximately level, smooth road, free from loose material within the distance and from the speed specified in the detail specification (see 6.5.19)."

Deviation: Service brakes shall hold the vehicle motionless and control it on an incline of 16 percent.

Reason: The S-II stage transporter will be traveling a predetermined course of known grades. The above deviation will provide adequate margin for service braking.

Deviation 34 Slope Performance, Requirements

Requirement: MIL-M-8090C (ASG), 17 March 1959, Paragraph 3.2.14 "The equipment for Type III mobility, fully equipped and loaded to result in the gross weight, shall operate satisfactorily on side slopes, right and left, up to 20 percent, and on longitudinal slopes up and down to 60 percent."

Deviation: The equipment for type III mobility, fully equipped and loaded to result in the gross weight, whall operate satisfactorily on side slopes, right and left, up to 20 percent, and on longitudinal slopes up and down to 16 percent.

Reason: The S-II stage transporter shall be traveling in a predetermined course of known grades.

Deviation 35 Parking Brake Performance

Requirement: MIL-M-8090C (ASG), 17 March 1959, Paragraph 4.3.2.1 ".... The vehicle shall be held motionless on a dry level incline at 60 percent with rated cross-country payload when the brakes are applied. The brakes shall hold the vehicle motionless on a 60-percent incline."

Deviation 30 Parking Brakes, Requirements

Requirement: MIL-M-8090D, 21 February 1961, paragraph 3.2.5.1. ".....The parking brake shall also hold the vehicle motionless on a dry, concrete incline of 60 percent, with rated cross-country payload. ....."

Deviation: The parking brake shall hold the vehicle motionless on a dry, concrete incline of 16 percent, with rated cross-country payload.

Reason: The S-II Stage transporter shall be traveling a predetermined course of known grades. The above deviation shall provide adequate margin for service braking.

Deviation 382

Requirement: MIL-M-008090D, Paragraph 3.3.4.1, Parking Brakes. - "The brakes shall be easily and quickly applied by means of a single manual control that will simultaneously operate all brakes. When service brakes..."

Deviation: The brakes shall be easily and quickly applied by means of two manually-operated brake levers; one at each end of the Aft Interstage Dolly. Each brake lever shall actuate the parking brakes for a single axle. When service brakes...

Reason: Utilization of two manually operated braking levers that will permit independent brake application on individual axles will (1) provide two-point actuation of parking brakes, (2) reduce force required to actuate the brakes, and (3) simplify the parking brake system, thereby reducing maintenance time required for proper adjustment of the system. Product reliability is also enhanced in that failure of an individual parking brake would not be detrimental; whereas failure of a single parking brake system could be very detrimental.

Effectivity: This deviation shall be effective on the Aft Interstage Dolly, H7-8.

Deviation 372a Corrosion Resisting Steel

Requirement: MIL-STD-171A, dated 11 October 1960, Paragraph 5.1.3.2 "Steel, corrosion-resisting. - Surface of corrosion-resisting steel shall be thoroughly cleaned and treated by one or more of the finishes listed in Table V-A. The procuring activity shall select the finish and shall reference it on drawings, in contracts, or in item specifications by the number shown in the tables."

Deviation: Surfaces of corrosion-resisting steel shall be thoroughly cleaned and treated by one or more of the finishes listed in Table V-A with the

exception that springs used to mount printed circuit connects in a floating mounting bushing shall be thoroughly cleaned and not finished. The procuring activity shall select the finish and shall reference it on drawings, in contracts, or in item specifications by the number shown in the tables.

Reason: A properly cleaned stainless steel surface soon becomes passive in clean air. Application of this material in an environment of controlled temperature and humidity does not require immediate reinforcement of a passive film.

Effectivity: This deviation shall apply on S-II ground support equipment used on the electromechanical mockup and battleship test vehicle, and those EMM ACE end items reallocated to Seal Beach.

Deviation 432 Identification Tapes

Requirement: MIL-STD-1247, Paragraph 4.1 "Identification. - Each line shall be identified as to function, content, applicable hazard, and direction of flow if applicable, except that . . . ."

Deviation: Delete the requirement for identification for lines less than 4 inches in diameter having insufficient length or unsuitable surface geometry.

Reason: In order to properly identify a line assembly in accordance with the requirements of MIL-STD-1247, as many as five tapes are required for a complete identification. Since application of tape on a line bend or radius or where the tape would cover a part number is prohibited, it is physically impossible to identify short lines in accordance with this specification.

Effectivity: All Saturn S-II GSE.

Deviation 390

Requirement: MIL-STD-1247, dated 12 March 1963, Figure 6, Note 2. - "Tag material to be annealed aluminum alloy, 0.025±0.003-in. thick, per QQ-A-561."

Deviation: Tag material to be annealed aluminum alloy, 0.025±0.003-in. thick, per QQ-A-250/1.

Reason: Specification QQ-A-561 was cancelled by the Government on 16 December 1963. Specification QQ-A-250/1 was released to supersede it. Since both specifications reference the same alloy, the change is inconsequential to the identification tags of MIL-STD-1247.

Effectivity: All GSE.

Deviation 386

Requirement: MIL-STD-1247, dated 12 March 1963, paragraph 5.7.1. - "Tapes shall be placed at both ends of a line. Spacing between tapes within a group shall be a minimun of one inch."

Deviation: Tapes shall be placed at both ends of a line.

Reason: In order to identify properly a line assembly, as many as five decals are required for one complete identification. The requirement also prohibits the application of tapes on a radius or bend. Due to the spacing callout, it is impossible to identify line assemblies with decals that could otherwise be identified.

Effectivity: This deviation shall be effective on all GSE.

Deviation 437 6061 - 6062 Aluminum Alloy

Requirement: MIL-T-7081C, QQ-A-200/8b, QQ-A-225/8b, QQ-A-250/11c and WW-T-700/6c, Table I Aluminum alloy material 6061 shall have a chromium element content of 0.15 percent minimum and 0.35 percent maximum. Aluminum alloy material 6062 shall have a chromium element content of 0.04 percent minimum and 0.14 percent maximum.

Deviation: Aluminum alloy with a chromium element content of 0.04 percent minimum to 0.35 percent maximum shall be acceptable as either 6061 or 6062 aluminum, providing all other requirements of Table I are satisfied.

Reason: The 6062 designation has been discontinued by the aluminum industry and 6061 now encompasses the entire range 0.04 to 0.35 percent.

Effectivity: Saturn S-II GSE.

Deviation 367 Wire and Cable Identification

Requirement: MIL-W-5088B, dated 27 October 1960, "3.9.3. Wire and cable identification. To facilitate maintenance, each wire and cable installed in accordance with this Specification shall be identified. Identification of each wire and cable shall be accomplished by a combination of letters and numbers...."

Deviation: Wire and cable identification. - To facilitate maintenance, each wire and cable, except for hard-wire networks as used on the following large carrier-type printed circuit (PC) boards or similar boards installed in accordance with this specification, shall be identified. Identification of each wire and cable shall be accomplished by a combination of letters and numbers. . . .

Carrier-Type PC Boards

Drawing Number	Part Name
G7-853807	Subaddress decoder
G7-852216	Test point selector
G7-852234	Memory control logic
G7-852616	Measurement display
G7-852696	Data transistor logic
G7-852736	Station buffer
G7-852686	Single shot control
G7-853126	Counter timer
G7-853136	Digital multimeter
G7-853176	Time code generator
G7-853326	Clock driver
G7-853336	Output register No. 1
G7-853339	Output register No. 2
G7-853376	Echo check
G7-853386	Control instruction decoder
G7-853616	Echo check display
G7-853833	Input register
G7-854456	Decoder driver

Reason: In order to facilitate fabrication of the above referenced PC boards, each wire of the various hard-wire networks is clearly shown on the PC board assembly drawing. With this type of documentation it is not required that each termination point be identified because each connection point is clearly shown on the PC board assembly drawing. Major space problems would result if all termination points for these wires were to be marked on the PC board surface. Also, the individual wires of the hard-wire network need not be identified by wire number since they are each shown in detail on the PC assembly drawing.

Effectivity: GSE automatic checkout equipment series C7-100, C7-200, C7-300, C7-400, C7-500, and C7-800.

Deviation 274 Designation Numbers

Requirement: MIL-W-5088B, Paragraph 3.9.3.1(3)(2). "Numbers 1,000 to 1,999, inclusive, shall be reserved for use by the procuring activity to identify wires installed by service modifications, except for those wires with circuit function letters of 'R', 'S', 'T', and 'Y'."

Deviation: Paragraph 3.9.3.1(e)(2) shall not apply to S-II Ground Support Equipment.

Reason: Reservation of blocks of numbers, such as required by Paragraph 3.9.3.1(e)(2) for field modification typical of combat aircraft operations, is of little value when applied to the type of equipment developed for GSE and ACE. For practical reasons the number of Wiring Harnesses in a unit of equipment is held to a minimum resulting in many wire lists requiring more than 1000 numbers. To maintain the capability of processing these wire lists through the IBM Automated Wire Listing system it is desirable to number the wires in uninterrupted sequence.

Effectivity: This deviation is applicable to all S-II Ground Support Equipment.

Deviation 78 Helical Thread Insert

Requirement: MS-260.0, 6 March 1961, paragraph 3.2. "Type I and Type II helical coil thread inserts shall be completely identified by a part number... given below."

Deviation: Only MS or NAA standard part numbers shall be used.

Reason: Product control cannot be maintained with commercial numbers.

Deviation 79 Jo-Bolt Materials

Requirement: MS-260.2, October 1960, paragraph 3.2. "Jo-Bolt blind locking fastener assemblies shall be fabricated... from materials which meet all the requirements of specifications MIL-S-6758, MIL-S-8695, QQ-A-282(1), or AMS-5641A."

Deviation: Jo-Bolt blind locking fastener assemblies shall be fabricated from materials which meet all the requirements of specifications MIL-S-6758, MIL-S-8695, QQ-A-282(1), AMS-5641A, MIL-S-5000, MIL-S-6049, AMS-5636, AMS-5639, or AMS-6407.

Reason: The use of additional specifications for material purposes will permit multiple-source procurement.

Deviation 80 Jo-Bolt Protective Finishes

Requirement: MS-260.2, October 1960, paragraph 3.3. "All Jo-Bolt blind locking fastener assembly components fabricated from a ferrous base alloy shall... meet all the requirements of specification QQ-P-416A, Type II, Class 3... specification MIL-A-8625, Type II."

Deviation: Protective finishes shall be in accordance with specification QQ-P-416A, Type I, Class 3.

Reason: Protective finish in accordance with specification QQ-P-416A, Type II, Class 3, is not applicable to the S-II stage.

Deviation 81 Jo-Bolt Material

Requirement: MS-260.2, October 1960, paragraph 4.1.1. "Bolt material shall be MIL-S-6758 (AISI 4130) or MIL-S-8695 (AISI 4037) heat treated..."

Deviation: Bolt material shall be MIL-S-6758 (AISI 4130) or MIL-S-8695 (AISI 4037), MIL-S-5000 (4340), MIL-S-6049 (8740), or AMS 6407 heat treated to 180,000-200,000 psi U.T.S. level.

Reason: Use of additional materials will permit multiple-source procurement.

Deviation 82 Jo-Bolt Sleeve Material

Requirement: MS-260.2, October 1960, paragraph 4.1.3. "Sleeve material shall be AMS 5641 (AISI 303) in the fully-annealed condition."

Deviation: Sleeve material shall be AMS 5641 (AISI 303), AMS 5636 (302), AMS 5639 (304), in the fully-annealed condition.

Reason: Use of additional materials will permit multiple-source procurement.

Deviation 83 Jo-Bolt Material

Requirement: MS-260.2, October 1960, paragraph 4.2.1. "Bolt material shall be MIL-S-6785 (AISI 4130) or... level."

Deviation: Bolt material shall be MIL-S-6758 (AISI 4130), or MIL-S-6049 (8740, or AMS 6407 heat treated to 180,000-200,000 psi U. T. S.

Reason: Use of additional materials will permit multiple-source procurement.

Deviation 84 Jo-Bolt Sleeve Material

Requirement: MS-260.2, October 1960, paragraph 4.2.3. "Sleeve material shall be AMS 5641 (AISI 303) in the fully-annealed condition."

Deviation: Sleeve material shall be AMS 5641 (AISI 303), AMS 5636 (302), or AMS 5639 (304) in the fully-annealed condition.

Reason: Use of additional materials will permit multiple-source procurement.

Deviation 85 Jo-Bolt Material

Requirement: MS-260.2, October 1960, paragraph 4.3.1. "Bolt material shall be MIL-S-6758 (AISI 4130) or MIL-S-8695 (AISI 4037) heat treated..."

Deviation: Bolt material shall be MIL-S-6758 (AISI 4130) or MIL-S-8695 (AISI 4037) heat treated to the 180,000-200,000 psi U. T. S.

Reason: Use of additional material will permit multiple-source procurement.

Deviation 86 Jo-Bolt Sleeve Material

Requirement: MS-260.2, October 1960, paragraph 4.3.3. "Sleeve material shall be AMS 5641 (AISI 303) in the fully-annealed condition."

Deviation: Sleeve material shall be AMS 5641 (AISI 303), AMS 5636 (302), or AMS 5639 (304) in the fully-annealed condition.

Reason: Use of additional materials will permit multiple-source procurement.

Deviation 87 Jo-Bolt Material

Requirement: MS-260.2, October 1960, paragraph 4.4.1. "Bolt material shall be MIL-S-6758 (AISI 4130) or MIL-S-8695 (AISI 4037) heat treated. . ."

Deviation: Bolt material shall be MIL-S-6758 (AISI 4130), MIL-S-8695 (AISI 4037), MIL-S-5000 (4340), MIL-S-6049 (8740), or AMS 6407 heat treated to 180,000-200,000 psi U. T. S.

Reason: Use of additional materials will permit multiple-source procurement.

Deviation 88 Jo-Bolt Material

Requirement: MS-260.2, October 1960, paragraph 4.5.1. "Bolt material shall be MIL-S-6758 (AISI 4130) or MIL-S-8695 (AISI 4037) heat treated. . ."

Deviation: Bolt material shall be MIL-S-6758 (AISI 4130), MIL-S-8695 (AISI 4037), MIL-S-5000 (4340), MIL-S-6049 (8740), or AMS 6407 heat treated to 180,000-200,000 psi U. T. S.

Reason: Use of additional materials will permit multiple-source procurement.

Deviation 89 Jo-Bolt Sleeve Material

Requirement: MS-260.2, October 1960, paragraph 4.5.2. "Sleeve material shall be AMS 5641 (AISI 303) in the fully-annealed condition."

Deviation: Sleeve material shall be AMS-5641 (AISI 303), AMS-5636 (AISI 302) or AMS-5639 (304) in the fully annealed condition.

Reason: Use of additional materials will permit multiple-source procurement.

Deviation 90 Jo-Bolt Material

Requirement: MS-260.2, October 1960, paragraph 4.7.1. "Bolt material shall be MIL-S-6758 (AISI 4130) or MIL-S-8695 (AISI 4037) heat treated to the 180,000-200,000 psi U. T. S.

Deviation: Bolt material shall be MIL-S-6758 (AISI 4130) or MIL-S-8695 (AISI 4037), MIL-S-5000 (4340), MIL-S-6049 (8740), or AMS 6407 heat treated to 180,000-200,000 psi U. T. S.

Reason: Use of additional materials will permit multiple-source procurement.

Deviation 91 Jo-Bolt Sleeve Material

Requirement: MS-260.2, October 1960, paragraph 4.7.3. "Sleeve material shall be AISI 303 (AMS 5641) in the fully-annealed condition."

Deviation: Sleeve material shall be AMS 5641 (AISI 303) AMS 5636 (302), or AMS 5639 (304) in the fully-annealed condition.

Reason: Use of additional materials will permit multiple-source procurement.

Deviation 445 - Fluid Rquirements

Requirement: MA-004-003-2H (MSFC-DWG-13M50097) prescribes the specifications applicable to the procurement and quality of helium, nitrogen, oxygen, and hydrogen.

Deviation: In lieu of these requirements, a fluid which meets any applicable fluid specification listed in SID 61-367 may be procured and used. The maximum allowable impurities in fluids at the Stage/GSE interface during stage checkout, static firing, and launch countdown at MTF or KSC shall not exceed that specified in 13M50097. The maximum allowable impurities in fluids at the Stage/GSE interface during stage checkout at Seal Beach shall not exceed those specified in 13M50097, except for nitrogen, where the gaseous impurities shall not exceed those specified in MIL-P-27401. Reperformance of completed tests shall not be required because of this deviation.

Effectivity: S-II-3 and subs.

Deviation 446 - Helium and Nitrogen Sampling and Testing

Requirement: MA-004-003-2H (MSFC-DWG-13M50097) delineates the requirements for sampling and testing helium and nitrogen for hydrocarbon, moisture, and particulate content at Seal Beach and MTF. SCN 119R1

Deviation: In lieu of these requirements, the following procedures are authorized:

1. Seal Beach

   a. Vendor analyses of helium and nitrogen for conformance to applicable specifications are acceptable. Samples at the Seal Beach central facility shall be analyzed as deemed necessary for moisture and hydrocarbon content.

   b. After repair or invalidation of the central gas system, samples shall be tested for particulate, moisture, and hydrocarbon content.

c. At a central point in Station VIII (VCO), moisture monitors shall be permanently installed to sample moisture in helium and nitrogen systems prior to distiribution to station GSE or stage. Dewpoints shall be determined and recorded every 24 hours. SCN 119R1

b. After modification of any gas distribution line the system shall be blown down and particulate samples taken.

e. Prior to stage checkout, four pneumatic distribution lines shall be selected at random and particulate samples taken for certification prior to hookup.

2. MTF SCN 119R2

a. Prior to a stage being brought into a stand and subsequent to a stage leaving a stand, all pneumatic servicing lines at the Stage/GSE interface shall be processed per the requirements of NR Drawings F02-000209 and F02-000109 (Fluid Site Installation - Fluid Distribution Lines). All lines shall be certified prior to hookup of each stage.

b. The supply system servicing the GSE/facility shall be checked weekly. During the period a stage occupies a stand, samples shall be taken weekly at the facility single-point high pressure gas manifold sampling point, and tested for hydrocarbon, moisture, particulate, and purity.

c. After modification of any gas distribution line, the system cleanliness shall be established and the sampling requirements of NR Drawings F02-000209 and F02-000109 shall apply.

Effectivity: S-II-3 and subs.

Deviation 171a Qualification and Certification

Requirement: MSFC-PROC-158A, Appendix (pages 28 through 31), Qualification and Certification.

Deviation:

1. Scope

This procedure specifies the methods, equipment and materials which shall be used for soldering electrical connections for space vehicles, ACE/GSE, and supporting equipment. Any method, equipment, or material not described herein may be utilized if NASA approval is obtained prior to use.

New Page

2. Qualification and Certification

a. Qualification

(1) Qualification of Personnel - All personnel engaged in fabrication, assembly, and inspection of electrical-electronic equipment manufactured under contracts containing this procedure shall be certified by a Category I or II instructor/examiner prior to performing work on engineering models, prototype models, or production items.

(2) Demonstration of Proficiency - To achieve certified status, the solder operator shall demonstrate his skill or proficiency according to the requirements set forth herein.

(a) All test specimens shall be fabricated in the presence of a Category I or II instructor/examiner.

(b) After the trainee has demonstrated his ability to the satisfaction of a Category I or II instructor/examiner, a certification will be issued.

(3) Certification Categories - The certificate issued to trainees will show the trainee to be certified in one or more of the following categories:

(a) Category I - Instructor/Examiner - These are certified Government instructors who have been designated and authorized by NASA to certify Categories II, III, IV and V. Candidates for this category must satisfactorily complete the 80-hour instructor's course at a NASA school. Category I personnel satisfactorily demonstrating hand soldering proficiencies to a designated representative of a NASA School of Reliability and Quality Assurance for Hand Soldering shall be recertified by the designated NASA representative.

(b) Category II - Instructor/Examiner - These certified instructors and examiners employed by either supplier or Government are authorized to certify Categories III and V. Certification and recertification requirements are the same as for Category I.

(c) Category III - Operator/Inspector - This category consists of supplier personnel who have satisfactorily completed the provisions of the 40-hour course at a NASA-approved supplier school. They shall be required to interpret contractual specifications and shall have demonstrated the manual skills required by the specifications. Recertification of operator/inspector requires demonstration to the satisfaction of the certifier that the candidate is still qualified for certification based on continuous performance audit or completion of a recertification course at a NASA-approved school.

(d) Category IV - Inspector (Government) - This category is restricted to Government inspection personnel. Certification and recertification requirements are the same as Category II. A designated Category I

instructor/examiner may recertify the Government inspector in accordance with NASA recertification requirements.

(e) Category V - Limited Operator - Individuals certified to this category are restricted to specified operations, i.e., soldering electrical connectors. It is intended for, but not limited to, supplier personnel who normally perform only one type of operation. To attain certification or recertification, a candidate must demonstrate to the satisfaction of the certifier that he is qualified to perform the specified operation.

b. Certification - When a supplier is operating a NASA-approved school, a company certificate may be issued by the supplier to its fabrication and inspection personnel and to the personnel of subcontractors and vendors. The designated Category I NASA personnel will be notified by the contractor prior to the training of subcontractor or vendor personnel. The signed certificate, either NASA or company, will be considered evidence that the applicant had satisfactorily fulfilled all requirements set forth herein. The certificate shall be valid only in the plant of the supplier in whose name the certificate was issued, and the holder shall be recertified within 12 months from the date of the last entry thereon or at any time the holder's work is found to be unsatisfactory.

c. Maintenance of Certified Status - A Category I or IV Government representative may require reexamination testing of any operator whenever he has reason to question the proficiency of the operator or the quality of workmanship. To aid the Category I or IV Government-authorized NASA representative in determining the proficiency of operators, the supplier shall maintain and make available complete inspection records.

d. Training and Certification of Supplier Personnel

(1) Demonstration of Ability - The supplier shall establish a school that follows guidelines established by NASA. The supplier shall then demonstrate to the satisfaction of the NASA-designated Government representative that:

(a) An efficient training program is being conducted.
(b) A close and continuing control over the school will be maintained.
(c) Only qualified students will be certified.

The duration of this evaluation shall be determined by the NASA-designated Government representative.

(2) Supplier Certification of Personnel - When the supplier has complied with the conditions of paragraph d. (1), he will be authorized by a NASA-designated Government representative to issue certification (see Paragraph b.). This authorization may be revoked when:

(a) The supplier fails to meet NASA standards of training.
(b) The contract is completed or terminated.

e. Training Records

(1) The supplier is responsible for the training records on each trainee to include:

(a) Test specimens fabricated by the trainee
(b) Results of written tests
(c) A minimum of two copies of NASA Form 885, or a facsimile thereof, completed and signed by the Category II instructor/examiner and the designated Category I instructor/examiner.

NOTE: The Category I NASA representative shall determine how many copies of Form 885 are necessary for each trainee.

(2) Compliance with the requirements of paragraph e. (1) above shall constitute complete certification records.

Deviation 366 Soldering

Requirement: MSFC-PROC-158A, dated 12 April 1962, Soldering of Electrical Connections (High Reliability), Procedure for.

Deviation: Delete the requirement for compliance with MSFC-PROC-158A in its entirety and substitute the requirements of MSFC-PROC-256, Electrical Fabrication, Procedure for, dated 1 March 1964, as applicable to the following items:

NAA/S&ID Control No. ME181-0111, Relay Distribution Panel Assembly
NAA/S&ID Control No. ME455-0100, Plug-in Module Relay Assembly

Effectivity: As called out in the deviation.

Deviation 121 Flux

Requirement: MSFC-PROC-158A, 12 April 1962, paragraph VI.A.1.b "Only non-corrosive and non-conductive rosin-type fluxes shall be used . . ."

Deviation: Fluxes shall conform to Specification MIL-F-14256.

Reasons: A standard is required to provide uniformity in the classification of fluxes. This specification has been used successfully by S&ID to define non-corrosive and non-conductive.

Deviation 120a Soldering of Electrical Connections

Requirement: MSFC-PROC-158A, 12 April 1962, paragraph VI.A.1.c. Insulation tubing. - "Insulation tubing shall be clear, flexible polyvinyl chloride sleeving conforming to type I of Specification MIL-I-7444 . . . . Tubing shall be slipped over all soldered terminals of relays, connectors, and similar items that are not protected by insulated grommets or by potting . . . . All routed conductors in harness or box assemblies shall be protected at abrasion points by appropriate clear insulation tubing."

Original Deviation: Insulation tubing. - Insulating tubing shall be clear, flexible polyvinyl chloride sleeving conforming to type I of Specification MIL-I-7444. Teflon tubing conforming to Specification MIL-I-22129 shall be used in application where extremely high temperature (220 degrees F or higher) conditions necessitate usage. Tubing shall be slipped over all soldered terminals of relays, connectors, and similar items that are not protected by insulated grommets or by potting. The tubing shall extend over the full length of the soldering end of the terminal and shall extend a distance equal to or greater than the tubing diameter above the stripped portion of the attached conductor. All route conductors in harness or box assemblies shall be protected at abrasion points by appropriate clear insulation tubing. Heat-shrink insulation tubing shall be made of a material that does not emit gases or chemicals that are detrimental to the soldered joint, the wire, or the insulation of the wire. Heat-shrink tubing shall not be used on components where the application of heat will damage the component. The solder joint must be visible through the tubing to facilitate trouble-shooting and inspection.

Revised Deviation: Insulation tubing. - "Insulation tubing shall be clear, flexible polyvinyl chloride sleeving conforming to type I of Specification MIL-I-7444. Teflon tubing conforming to Specification MIL-I-22129 shall be used in application where extremely high temperature (220 degrees F or higher) conditions necessitate usage. Tubing shall be slipped over all soldered terminals of relays, connectors, and similar items that are not protected by

insulated grommets or by potting. Leads attached by the side route to turret or bifurcated terminals need not be sleeved. The tubing shall extend over the full length of the soldering end of the terminal and shall extend a distance equal to or greater than the tubing diameter above the stripped portion of the attached conductor. All route conductors in harness or box assemblies shall be protected at abrasion points by appropriate clear insulation tubing. Heat-shrink insulation tubing shall be made of a material that does not emit gases or chemicals that are detrimental to the soldered joint, the wire, or the insulation of the wire. Heat-shrink tubing shall not be used on components where the application of heat will damage the component. The solder joint must be visible through the tubing to facilitate trouble-shooting and inspection.

Reasons: It is impossible to install insulation sleeving over component leads which are soldered to turret or bifurcated terminals because:

(a) sleeving bends are too sharp;
(b) sleeving large enough to go over the terminal would be much too large to fit component leads; conversely, sleeving which would fit the leads could not possibly fit over the terminals.

Effectivity: This deviation is applicable to all S-II Ground Support Equipment.

Deviation 123 Solvent

Requirement: MSFC-PROC-158A, 12 April 1962, paragraph VI. A. 1. e "Solvent used for removal of grease, oil, dirt, or excess flux shall be ethyl alcohol, conforming to MIL-A-6091 or MIL-E-463."

Deviation: Solvents used for removal of grease, oil, dirt, or excess flux shall be (1) ethyl alcohol, conforming to MIL-A-6091 or MIL-E-463, or (2) isopropyl alcohol conforming to MIL-I-10428.

Reasons: The additionally recommended solvent removes grease, oil, and dirt of excess flux more rapidly than ethyl alcohol. It is more economical and non-toxic. No permit is required for their use. No detrimental effect has been observed from use of this solvent.

Deviation 124 Wire

Requirement: MSFC-PROC-158A, 12 April 1962, paragraph VI.A.1.g "Wire shall be cut to length before soldering, and the wire ends shall not extend beyond the connection. Stranded wire shall be twisted in its original form after insulation removal."

Deviation: After a wire has been cut to length, the insulation stripped, and the wire trimmed and attached to a terminal, the excess pigtail shall be trimmed prior to soldering. After insulation removal, if the lay has been disturbed on the stranded wire, the wire shall be twisted to its original lay.

Reason: Thermal strippers generally do not disturb the wire.

Deviation 150 Thermal Strippers

Requirement: MSFC-PROC-158A, 12 April, paragraph VI.A.2.a(1) "Thermal type insulation strippers approved by MSFC ..."

Deviation: Thermal type insulation strippers shall be used on wire size No. 22 AWG (stranded wire gage) and smaller (see Figure 1). No. 20 AWG and larger wire may be stripped with thermal or precision type strippers provided the correct stripping hole for the corresponding gage of the wire shall be used. The setting of the cutter and the work produced shall be checked to assure that no nicks or cuts appear on the wire. Stripped wire with nicks or cuts shall not be used. Defective strippers shall not be used.

Reason: "MSFC approved" needs clarification.

Deviation 149 Precision Strippers

Requirement: MSFC-PROC-158A, 12 April 1962, paragraph VI.A.2.a(2) "Non-adjustable, factory-set, cutting-type insulation strippers shall be approved by MSFC ..."

Deviation: Non-adjustable, factory-set, cutting-type insulation strippers may be used when thermal strippers cannot be used; however, to prevent stretching the wire, avoid use on wire size No. 22 American Wire Gage (AWG) and smaller. The correct stripping hole for the corresponding gage of the wire shall be used. The setting of the cutter and the work produced shall be checked to assure that no nicks or cuts appear on the wire. Stripped wire with nicks or cuts shall not be used. Defective strippers shall not be used.

Reason: Meaning of "MSFC approved" not clear.

Deviation 146 Files

Requirement: MSFC-PROC-158A, 12 April 1962, paragraph VI. A. 2. c "Files for dressing coppertips shall be fine, single-cut, shear-tooth type."

Deviation: Files for dressing copper tips shall produce a smooth surface capable of being easily-tinned.

Reason: The call out is not definite enough. Double-cut and other type files will achieve the same result as single cut.

Deviation 130 Cleaning Tool

Requirement: MSFC-PROC-158A, 12 April 1962, paragraph VI. A. 2. e "An efficient cleaning tool utilizing 1/2-inch copper shielding braid for cleaning of component leads can be constructed as shown in Figure 5."

Deviation: An efficient cleaning tool utilizing 1/2-inch copper shielding braid can be constructed as shown in Figure 5. Abrasive ink erasers may also be used in the tool.

Reasons: The copper braid can be too harsh and remove the tinning on stainless steel lead wires. Ink erasers do a satisfactory cleaning job.

Deviation 129 Cleaning Printed Circuit Pads

Requirement: MSFC-PROC-158A, 12 April 1962, paragraph VI. A. 2. g "For cleaning printed circuit pads, a white pencil style typewriter eraser shall be used (see Figure 6)."

Deviation: For cleaning gold plated printed circuit pads, a white pencil style typewriter eraser shall be used (see Figure 6). An electric typewriter eraser may be used if the connecting circuit is protected by use of an erasing shield.

Reason: Use of an electric eraser reduces cleaning time by at least 50 percent.

Deviation 148 Soldering, Iron Tips

Requirement: MSFC-PROC-158A, 12 April 1962, paragraph VI. A.2.i. "Copper or MSFC approved plated tips shall be used."

Deviation: Copper or plated copper tips shall be used:

Reason: "MSFC approved" should be deleted until its meaning is clarified. Specific types should be called out.

Deviation 147a CAUTION

Requirement: MSFC-PROC-158A, 12 April 1962, paragraph VI. A. 3. a(2) "All soldering shall be performed in an area which is environmentally controlled to the satisfaction of MSFC."

Deviation: NAA's S-II manufacturing building No. 45, Compton Facility, electrical assembly areas, as presently constituted, shall be considered adequate to comply with requirements of this paragraph. The work area and benches shall be maintained in a clean and orderly condition. All dirt, grease, oil, solder splatter, wire and insulation cuttings, and other foreign matter shall be removed from the work area. The air conditioner filters shall be properly serviced and the air conditioner shall control the environment so that the integrity of workmanship will not degenerate due to perspiration deposit on work, or other degradation of fabricated articles, which could be caused by extreme weather conditions.

Reason: In accordance with agreement reached with NASA Resident Program Manager.

Deviation 392

Requirement: MSFC-PROC-158A, dated 12 April 1962, Paragraph VI.A.3.d(1) Insulation Removal. - "An approved thermal or precision mechanical stripper for insulation removal shall be employed. The conductor shall not be ringed, nicked, cut or otherwise damaged by the insulation stripping tool."

Deviation: An approved thermal or precision mechanical stripper for insulation removal shall be employed for 10-gage and smaller wires. Insulation removal for 8-gage and larger wire may be accomplished by hand, using a sharp cutting tool. When this method is used, a longitudinal cut shall be made through the entire length of the insulation to be removed. The insulation shall then be lifted from the conductor and a circumferential cut made to remove the insulation. The conductor shall not be ringed, nicked, cut, or otherwise damaged during the stripping operation.

Reason: Thermal strippers are not practical for the stripping of heavy gage wires because the heat required causes the insulation material to melt and flow into the strands of the wire causing contamination. Precision mechanical strippers are not readily available (if at all) for heavy gage applications. In addition, attempts to remove the insulation in tubular form have resulted in destroying the natural lay of the strands to the extent that repair effort is not practical.

Effectivity: All Saturn S-II Ground Support Equipment.

Deviation 134 Insulation Clearance

Requirement: MSFC-PROC-158A, 12 April 1962, paragraph VI.A.3.d (2) "Insulation clearance from terminal shall be a minimum of 1/32 inch and a maximum of the outside diameter of the wire insulation."

Deviation: Insulation clearance from terminal shall be:

(a) Wires having an insulation outside diameter of greater than 1/32 inch shall have a minimum clearance between the terminal and wire insulation of 1/32 inch and a maximum clearance equal to the insulation outside diameter plus 1/32 inch.
(b) Wires having an insulation outside diameter of less than 1/32 inch shall have a minimum clearance equal to the outside diameter of the insulation and a maximum clearance of 1/32 inch.

Reason: This tolerance is required because precision stripping would involve excessive costs.

Deviation 133 Tinning Conductors

Requirement: MSFC-PROC-158A, 12 April 1962, paragraph VI.A.3.d. (3) "... A thermal shunt shall be used to prevent the solder from wicking under the insulation ..."

Deviation: A thermal shunt shall be used to prevent the solder from wicking under the insulation. Thermal shunts may be omitted during dip tinning, if no wicking occurs under the insulation.

Reasons: Use of thermal shunts during dip tinning would incur excessive costs. Dip tinning can be performed in a satisfactory manner without thermal shunt.

Deviation 391

Requirement: (cf. Amendment 78) MSFC-PROC-158A, dated 12 April 1962, paragraph VI. A. 3. d (3) "Tinning conductors. - All portions of stranded wires coming in contact with the soldered area shall be tinned by the assembler as illustrated in Figure 7, or by other MSFC approved methods. A thermal shunt shall be used to prevent the solder from wicking under the insulation. Thermal shunts may be omitted during dip tinning if no wicking occurs under the insulation. Tinning on wire shall extend only far enough to take full advantage of the depth of the terminal or solder cup. Form the "hook" after tinning."

Deviation: . . . . . "hook" after tinning. Where 8-gage and larger wires are utilized, pretinning is not required provided said wire is properly cleaned with Isopropyl alcohol.

Reason: The pretinning of the large mass of wire utilized in conjunction with their counterpart soldering cups results in severe wicking by virtue of the necessary high heat transfer. A much more reliable and satisfactory connection can be realized without pretinning of these larger wire sizes.

Effectivity: All Saturn S-II Ground Support Equipment.

Deviation 272a Wire Length

Requirement: MSFC-PROC-158A, 12 April 1962, Paragraph VI-A-3-d-(5). "Solid hookup wire or solid bus wire shall not exceed 5/8-inch length between solder connections. This requirement does not apply to components with solid wire leads."

Deviation: Add to requirement: "Solid ground bus wire, external to the printed circuit board circuitry, may be used; however, the length between solder connections shall not exceed 3 inches."

Reason: Applicable stranded wire is not available for use on the effective units.

Effectivity: This deviation shall apply to the following GSE printed circuit board assemblies:

G7-853807	G7-853126	G7-853616
G7-852216	G7-853136	G7-853696
G7-852234	G7-853176	G7-853686
G7-852616	G7-853326	G7-853833
G7-852696	G7-853336	G7-854456
G7-852736	G7-853339	G7-871026
G7-852686	G7-853376	G7-871036
G7-852508	G7-853386	

These Printed Circuit Board Assemblies are to be used on the electromechanical mockup on Models C7-44, C7-48; and on the C7-100, C7-200, C7-300, C7-400, C7-500, and C7-800 series, and any EMM - ACE end item reallocated to Seal Beach which uses the above assemblies, and the C7-107 and C7-108 reallocated to MTO.

Deviation 92 Splicing

Requirement: MSFC-PROC-158A, 12 April 1962, paragraph VI.A.3.d. (6) "Unless otherwise specified, the splicing of conductors is prohibited."

Deviation: Cables interconnecting the C7-109 Isolation and Drive Rack with the C7-101 Automatic Checkout Computer main-frame and computer console of the Control Data Corporation 924A Computer Group will require a splice using ferrule sleeves (Burndy "Hyring") with jumper wire to accommodate a common termination of twisted wire signal return circuits.

Reason: The existing computer input and output buffer channels and the principle control console function use (24) twenty-four pin terminating connectors carrying (23) twenty-three signals and a single ground. The automatic checkout buffering equipment was designed by the Contractor to use the twisted pair concept to limit crosstalk and interference pickup with each signal having its own ground return. Therefore, at the computer input/output connectors a (46) forty-six wire signal and ground return cable must be mated to a (24) twenty-four pin connector. To accomplish this the Contractor proposes to terminate the ground wires of the twisted pairs using a "Hyring" in close proximity to the (24) twenty-four pin connector and teed the terminated grounds to the connector on a single pin. The use of the "Hyring" for terminations of the ground conductors is interpreted as a splice by the Contractor per MSFC-PROC-158A. The Customer verbally suggested that the (24) twenty-four pin connectors supplied by the Control Data Corporation be replaced with (61) sixty-one pin connectors on the computer main frame and control console. With the use of larger connectors, termination

of twisted wire pairs would be possible without resorting to splicing. The Contractor submits that the change suggested by the Customer is not a feasible solution due to the following:

1. Installation of larger connectors, as suggested by the Customer, is not feasible since connector space on the computer main frame chassis is limited and extensive rework of computer wiring would be required.

2. Modification by the Supplier or the Contractor would require prolonged computer downtime, creating serious schedule slippage at the CPDF and EMM facilities.

3. Technical Directive M-SAT-SII 74-63 directs the procurement of the Control Data Corporation 924A Computer Group as a commercial off-the-shelf item. This prevented NAA from specifying an interface compatible with NAA design criterion prior to the manufacture of the first two systems since an NAA design directive required NASA approval. Modification after delivery from the Supplier by the Contractor would void the Computer Group warranty. The modification would also make replacement of the computer by a second machine, in case of a complete machine failure, impossible without a second extensive modification requiring a prohibitive amount of system downtime.

Deviation 280 Splicing

Requirement: MSFC-PROC-158A, dated 24 May 1962, Paragraph VI.A.3.d.(6). "Unless otherwise specified, the splicing of conductors is prohibited."

Deviation: Paragraph VI. A. 3. d(6) shall not be a requirement for the C7-41 Power Distribution Rack Console Set.

Reason: Cables interconnecting at circuit breakers and power relays have a bombtail terminal cap (Amp P/N 36964). This cable is a four-conductor cable for 120/208-volt, 400 cps ac. This power is switched through a 3PST power relay. The neutral is terminated with a bombtail terminal on each power relay. This is also true for the three-phase circuit breakers. By utilizing the amp bombtail, the unshielded length of the neutral line can be kept to a minimum for RFI protection.

Effectivity: This deviation is applicable to GSE Model C7-41 Electromechanical Mockup and Battleship test facility.

Deviation 269a Splicing of Conductors

Requirement: MSFC-PROC-158A, April 12, 1962, paragraph VI-A-3-d(6). "Unless otherwise specified, the splicing of conductors is prohibited."

Deviation: The requirements of paragraph VI-A-3-d(6) shall not apply to printed circuit board ground bus wiring.

Reason: To prevent schedule slippages which could be caused by rework necessary to eliminate the use of splices on printed circuit board ground bus wiring. Possible damage to the printed board etched circuitry may occur during rework. Because of long lead procurement time for printed circuit boards, this could cause extensive schedule problems if scrappage results and replacement boards are not in stock. Even if the printed circuit boards are not damaged during rework, the time necessary to perform and document the rework would be enough to jeopardize present Electromechanical Mockup delivery schedules.

Effectivity: This deviation is applicable to all S-II Ground Support Equipment to be delivered to the electromechanical mockup and Battleship test facilities, and those GSE ACE end times reallocated to Seal Beach.

Deviation 440R1 Splicing of Conductors

Requirement: Specification MSFC-PROC-158A, dated 12 April 1962, Paragraph VI.A.3.d(6) "Unless otherwise specified, the splicing of conductors is prohibited."

Deviation: Splicing of conductors shall be acceptable, Amp part number 320559 shall be used for splicing AWG 20 wires. AMP part number 320562 shall be used for splicing AWC 16 wires. Splicing shall be accomplished in accordance with specification MA0613-005. Each conductor shall be identified by its number on each side of the splice. Part numbers affected shall be those listed on Contractor Non-Conformances and as controlled by end item top drawing numbers as follows:

Drawing Number	Contract End Item Model	Contract End Item Serial No.	CNC Number
G7-850035	C7-35	1	2-C35(R2)
G7-850035	C7-35	1	3-C35(R4)
G7-850038	C7-38	1	2-C38(R2)
G7-850040	C7-40	1	1-C40(R1)
G7-870041	C7-41	5	1-C41(R1)
G7-873602	C7-56	1	2-C56
G7-853159	C7-73	4	1-C73(R1)

SCN 196

Reason: Splicing is required to extend individual conductors of multi-conductor cables

1. Which have been cut and terminated into terminal distributor racks and are now too short due to changes in point of termination,

2. Which have been damaged, or

3. Which may be short due to errors in installation.

Effectivity: As called out in the deviation.

Deviation 286 Solder Application

Requirement: MSFC-PROC-158A, dated 12 April 1962, Soldering of Electrical Connections (High Reliability), Procedure for, Paragraph VI.A.4.C. (last sentence). "Flow (or dip) soldering is prohibited."

Deviation: in the soldering of coil magnet wires to lead wires inside of relay assemblies, dip soldering is permitted for Filtor, Inc. and Babcock Relays.

Reason: Dip soldering has been utilized in the manufacture of standard 2PDT relays with great success and reliability. Relays on which the dip solder process is used are listed in the preferred products list for ABMA-PD-R-187 (the NASA contractual relay specification which governs our relay procurement). The dip solder pot uses silver solder (95 percent tin, 5 percent silver) and Filtor uses Kester No. 215 resin solder flux. The silver solder is used to ensure reliability during high temperature operation. The solder pot temperature is maintained between 580 F and 620 F. Flux on solder joints is removed by isopropyl alcohol. The relays are standard off-the-shelf proprietary items for which no development costs were incurred by this program. If this deviation is not granted, the supplier will be forced to deviate from a process which, based upon past experience, has proven to be reliable for this specific application.

Effectivity: This deviation shall apply on all S-II Ground support equipment.

New Page

Deviation 132 Solder Application

Requirement: MSFC-PROC-158A, 12 April 1962, paragraph VI.A.4.c. "... Flow (or dip) soldering is prohibited."

Deviation: Flow (or dip) soldering is prohibited. The pre-tinning of stranded wire by dipping into a pot of molten tin-lead solder is permissible.

Reason: Misinterpretation is possible without sentence permitting dip tinning.

Deviation 369a Splicing

Requirement: MSFC-PROC-158A, dated 12 April 1962, Paragraph VI.B.1.b. "Splice. - Splicing of conductors shall not be permitted."

Deviations: Splicing of conductors shall not be permitted except on twisted pair wiring where the common return lines may be bussed together in a crimp splice (bombtail).

Reason: The use of twisted pair wiring for transfer of high frequency pulses over long distances reduces undesirable electromagnetic coupling. The termination of the common wires of the twisted pairs, at a drawer level, requires numerous terminals bussed to the logic signal return. The use of the bombtail affords an order of magnitude reduction in the number of terminals required for logic return bus termination. Application of crimp splices (bombtails) on EMM only will provide reliable wire termination. Except for EMM, bombtails will be eliminated by redesign of the affected drawer and rack wiring by using "Hy-Ring" or standard terminals for termination of the common wire.

Relocation of the C7-107 and C7-108 models from the EMM site for use at MTF without replacing the bombtails will provide reliable crimp wire termination without major drawer rework. The elimination of the bombtail terminations would necessitate scrapping the existing drawer harness assembly and adding numerous solder terminals to the drawer for the logic return wire termination. In addition, a new wire harness would be required.

The major rework required to replace the bombtail is not a functional requirement based on the satisfactory performance of the C7-107, and C7-108 recorded at the EMM site.

Effectivity: This deviation shall apply on the following S-II GSE Models for use with Electro-Mechanical Mockup: C7-102, C7-106, C7-107, C7-108, C7-109 and C7-401 or for any of the listed EMM ACE end items reallocated to Seal Beach, and Serial No. 1 of C7-107 and C7-108 reallocated to MTO.

Deviation 138 Solder Joint

Requirement: MSFC-PROC-158A, 12 April 1962, paragraph VI.B.1.d "... No solder shall spill over and adhere to the sides of the cup."

Deviation: ... No solder shall spill over and adhere to the outside of the cup. A slight tinning in the area of the soldering iron contact is permissible.

Reason: Extremely difficult and time consuming to solder the cup with a properly tinned iron without having some solder adhere to the cup.

Deviation 137 Mounting

Requirement: MSFC-PROC-158A, 12 April 1962, paragraph VI.B.2.c. "... will provide a snug fit ... The terminal board shall be free of cracks, cuts, scratches, delaminations, or other damage."

Deviations: ... will provide a tolerance of ±0.001 inch on the hole diameter ... The terminal board shall be free of cracks, cuts, scratches, delaminations or other damage that will degrade electrical resistance, except that 0.005 inch delamination for drilling and 1/16 inch delamination for swaging or soldering is permissible.

Reasons: (1) Snug fit is interpreted as ±0.0002 inch. Holding drilled holes to this tolerance would greatly increase cost. (2) Unless this amount of delamination is allowed, an extremely high rejection rate can be anticipated.

Deviation 128 Flux

Requirement: MSFC-PROC-158A, 12 April 1962, paragraph VI.B.2.g "After soldering, any excess flux shall be removed ..."

Deviation: After soldering, all flux shall be removed ...

Reason: No flux rather than any excess flux should be specified.

Deviation 151a Turret Terminal

Requirement: MSFC-PROC-158A, Paragraph VI. B. 3. a. "A half-wrap (180 degrees) shall be used to attach wires."

Existing Deviation: "A half-wrap (180-200 degrees) shall be used to attach wires."

Requested Deviation: The bend to attach a wire or lead to a turret terminal shall be no smaller than 180 degrees and no larger than 270 degrees.

Reason: Extremely difficult to measure, cut, solder, and inspect within existing deviation parameters. The 180-270 degree tolerance would still ensure no mechanical connection.

Effectivity: All Saturn S-II GSE applications.

Deviation 383

Requirement: MSFC-PROC-158A, paragraph VI. B. 3. b(1). - "Side Route - The wire shall. . . . . An area of 20 percent free space shall be allowed at the top of the bifurcated terminal."

Deviation: Delete "An area of 20 percent free space shall be allowed at the top of the bifurcated terminal."

Reason: Digital logic circuitry by its very nature is highly susceptible to false triggering from high line transients. For this reason, it is essential that the ground returns approach zero resistance as nearly as possible. In an attempt to achieve this near zero condition, the Automatic Checkout Equipment printed circuit carrier cards were designed using the largest ground return wire possible.

In order to meet the above requirements, it would be necessary to reduce the size of this wire by a considerable amount, thus creating a condition contrary to good digital logic design practice.

Effectivity: The following listed carrier cards and other cards with similar circuit requirements that may be designed for GSE:

G7-852044	G7-853334
G7-852214	G7-853342
G7-852233	G7-853374
G7-852614	G7-853384
G7-852694	G7-853614
G7-852734	G7-853696
G7-852842	G7-853684

G7-852504 G7-853365
G7-853124 G7-854454
G7-853134 G7-871024
G7-853174 G7-871034
G7-853324

Deviation 126 Presoldering

Requirement: MSFC-PROC-158A, 12 April 1962, paragraph VI.B.5.b "An inspection of the printed circuit board shall be made before mounting the components to be soldered. The presence of . . ."

Deviation: Presoldering and postsoldering requirements. An inspection of the printed circuit board shall be made before mounting components to be soldered and after soldering operation has been completed. The presence of . . ."

Reason: Item (7) implies some work has been done on the board.

Deviation 135 Cleaning

Requirement: MSFC-PROC-158A, 12 April 1962, paragraph VI.B.5.c (1) "Regardless of visual appearance, all component leads and terminals shall be cleaned just prior to soldering."

Deviation: Regardless of visual appearance, all component leads and terminals shall be cleaned within 24 hours of soldering.

Reasons: "Just prior" is indefinite. The 24 hour period would permit cleaning of parts on a prior shift. Parts would be stored in cellophane bags after cleaning.

Deviation 360 Clearances for Crystal Can Relays

Requirement: MSFC-PROC-158A, 12 April 1962, Paragraph VI.B.5.c(3). ". . . . The minimum distance from component end seal to the start of bend shall be 1/16-inch. . . ."

Deviation: Crystal can relays may have bends and clearances less than 1/16 inch whenever space does not permit the required distances.

Reason: Babcock and Filtor crystal can relays are limited in space. The addition of a diode and resistor to these relays to meet contractual transient protection requirements would necessitate increasing the size, and therefore would impose development costs and schedule delays. This deviation is not intended to relieve the subject vendors from quality or reliability requirements originally specified.

Effectivity: This deviation is applicable to all S-II ground support equipment.

Deviation 139 Component Mounting

Requirement: MSFC-PROC-158A, 12 April 1962, paragraph VI.B.5.d "... suitable retaining clamp (see Figure 17(a), (b), and (c) ..."

Deviation: ... suitable retaining clamp [see Figure 17(a), (b), and (c)]. Vertically mounted components between two stacked boards or stacked components in a "cordwood" arrangement are acceptable when properly supported in incapsulation.

Reason: Mounting of components between two vertically-stacked boards is common practice in module miniaturization.

Deviation 127 Solder Coverage

Requirement: MSFC-PROC-158A, 12 April 1962, paragraph VI.B.5.f "... and no excess flux or solder ..."

Deviation: "... and no flux or excess solder."

Reason: No flux rather than no excess flux should be specified.

Deviation 141a Terminal Shank Tolerance

Requirement: MSFC-PROC-158A, paragraph VI.B.5.i(1) (Amendment 86). "A tolerance of ±0.001 inch on the hole diameter shall be permissible."

Deviation: The clearance shall not exceed 0.007 inch between the diameter of the terminal shank and the diameter of the hole.

Reasons: Manufacturers state that printed circuit boards with plated-through holes cannot be made with tolerance required because (1) close tolerances are attainable on holes drilled in metal, but the fibrous materials of which the printed circuit boards and terminal boards are made frays when drilled, making close tolerance difficult to attain; (2) plating thickness of holes is not uniform, and meeting the minimal requirements of plating thickness will vary the tolerance of each hole; (3) solder reflow thickness varies with the temperature of solder, period of immersion, and temperature of board at time of reflow. For these reasons, close tolerances are not possible. If we adhere to existing tolerances, an accumulation of variations from these causes will result in excessive rejections of printed circuit boards.

Deviation 114 Swaging Tool

Requirement: MSFC-PROC-158A, 12 April 1962, paragraph VI. B. 5. i. 5 and Figure 21. "An alternate . . .; place 60-degree . . ."

NOTE

Swaging tool . . . 60-degree . . . shown in Figure 21.

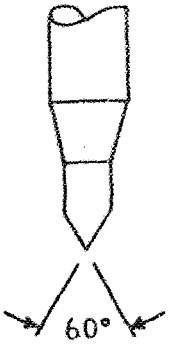


Figure 21. Swaging Tool

Deviation: An alternate . . .; place 48 degrees ± 12 degrees . . .

NOTE

Swaging tool . . . 48 degrees ± 12 degrees shown in Figure 21.

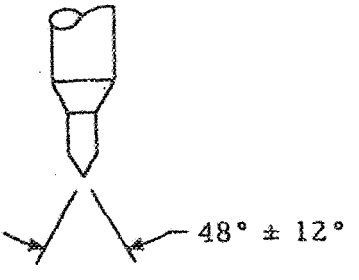


Figure 21. Swaging Tool

Reasons: Cracks are developing in the terminals when 60-degree swages are used.

1. The 60-degree swaging operation increases the periphery of the terminal cove 100 percent more than the 48 degree ± 12 degree swage.

2. The 48 degree ± 12 degree swaging operation creates the same diameter at the point of contact with the terminal board as the 60-degree swage, which provides the same contact pressure.

Deviation 145 Coating

Requirement: MSFC-PROC-158A, 12 April 1962, paragraph VI. B. 5. j "... The protective coating shall be Hysol 12-007 (Manufactured by Hysol Corp., Olean, N. Y.), or equivalent."

Deviation: The protective coating shall be flexible polyurethane resin. Hysol 12-007 (manufactured by Hysol Corp., Olean, N. Y.), or equivalent, shall be used for coating manufacturer's identification of component parts and for bonding of component parts. If a component has a glass envelope, the only approved protective coating shall be flexible polyurethane resin. Refer to MSFC-PROC-293, "Coating, Conformal (Polyurethane), Printed Circuit Assemblies."

Reason: Hysol 12-007 becomes brittle after drying. Cracking may occur from stresses during flight.

Deviation 245a Coating

Requirement: MSFC-PROC-158A, Paragraph VI. B. 5. j. "Coating - After wiring, functional checkout, and acceptance by inspection, the board shall receive a clean transparent insulative protective coating on both sides. The protective epoxy coating shall be Hysol 12-007 (manufactured by Hysol Corp., Olean, N. Y.), or equivalent."

Deviation: Delete the requirement of this paragraph as applicable to the S-II ground support automatic checkout equipment used on the electromechanical mockup.

Reason: The electromechanical mockup ground support automatic checkout equipment will be the first production-type system to be placed in operation. Because of this, it is expected that many electrical changes will be required during systems de-bugging. It should be noted that changes to a printed circuit board having a conformal coating are much more difficult to make than a board not having such a coating; also, to rework a coated board, the exposed areas of the board would have to be re-coated.

Parts will be identified for electromechanical mockup only.

Effectivity: All S-II Automatic Checkout Equipment: C7-44, C7-48, C7-100, C7-200, C7-300, C7-400, C7-500, and C7-800 series equipments for use on the electromechanical mockup only, and those EMM ACE end items reallocated to Seal Beach.

Deviation 365 Polyurethane Potting Procedures

Requirement: MSFC-PROC-186A, dated 5 December 1962, Potting and Molding Cable Assemblies, using Polyurethane, Procedure for.

Deviation: Delete the requirement for compliance with MSFC-PROC-186A in its entirety and substitute the requirements of MSFC-PROC-256, Electrical Fabrication, Procedure for, dated 1 March 1964, as applicable to the following items:

NAA SCD Control No. ME181-0111, Relay Distribution Panel Assembly
NAA SCD Control No. ME455-0100, Plug-in Module Relay Assembly

Reason: Parts ME181-0111 and ME455-0100 are to be manufactured by Brown Engineering Co., Inc., of Huntsville, Alabama. Brown Engineering shop personnel are certified by NASA to perform electrical fabrication operations in accordance with MSFC-PROC-256.

Effectivity: As called out in the deviation.

Deviation 364 Potting Procedure

Requirement: MSFC-PROC-196, dated 12 April 1962, Potting Cable Assemblies, using Epoxy, Procedure for.

Deviation: Delete the requirement for compliance with MSFC-PROC-196 in its entirety, and substitute the requirements of MSFC-PROC-256, Electrical Fabrication, Procedure for, dated 1 March 1964, as applicable to the following items:

NAA SCD Control No. ME181-0111, Relay Distribution Panel Assembly
NAA SCD Control No. ME455-0100, Plug-in Module Relay Assembly

Reason: Parts ME181-0111 and ME455-0100 are to be manufactured by Brown Engineering Co., Inc., of Huntsville, Alabama. Brown Engineering shop personnel are certified by NASA to perform electrical fabrication operations in accordance with MSFC-PROC-256.

Effectivity: As called out in the deviation

Deviation 378a

Requirement: MSFC-SPEC-164(1), dated 15 June 1964, Paragraph 3.2.11 "Aluminum foil. - Aluminum foil used to protect cleaned surfaces shall be dry annealed foil conforming to Specification MIL-A-148."

Deviation: A liquid oxygen-compatible fluorohalocarbon film (Aclar 33c or Aclar 191), as cleaned to the same level as the part, shall be used for the packaging of items cleaned for use in liquid oxygen systems.

Reason: Foils meeting the subject specification have contaminated known precision cleaned items. The aluminum when used against a part made from a dissimilar metal creates a condition under which galvanic corrosion becomes a problem. Creases developed in the aluminum foil during wrapping of a part mar fine finishes and cut or otherwise damage plastic sealing surfaces.

Effectivity: This deviation shall apply to all S-II Ground Support Equipment.

Deviation 247 Cable Lay Patterns

Requirement: MSFC-SPEC-332A, dated 16 March 1964, Paragraph 3:1. "Detail requirements for individual cables: - Detail requirements, or exceptions applicable to particular types of cables, shall be as specified in the individual cable specification sheets..."

Deviation: It is requested that cable lay patterns listed below be included in the supplement to MSFC-SPEC-332, and that individual specification sheets for these be issued and included in the specification.

Reason: The cable lay patterns listed below are not covered by the original or the most recent revision of MSFC-SPEC-332. Since these lay patterns are a part of the design, and equipment is already in production and acceptance stages, this deviation, therefore, requests their immediate inclusion. Details of the additional lay patterns required are:

1. 3 No. 4 AWG SC with O/S
2. 3 No. 8 AWG SC with O/S
3. 5 No. 8 AWG SC with O/S

4. 1 No. 16 AWG TPSJ no O/S

5. 6 No. 16 AWG TPSJ and 1 No. 16 AWG SC - with O/S

6. 21 No. 16 AWG SC with O/S

7. 32 No. 20 AWG SC with O/S

8. 61 No. 20 AWG SC with O/S

9. 27 No. 20 AWG TP and 1 No. 20 AWG - with O/S

10. 60 No. 16 AWG SC with O/S

11. 2 No. 4 AWG SC with O/S

12. 30 No. 16 AWG with DO/S

13. 5 No. 12 AWG TQSJ and 20 No. 16 AWG - with DO/S

14. 3 No. 1/0 AWG SC with O/S

15. 3 No. 1/0 AWG; 3 No. 4 AWG; 5 No. 16 AWG TPSJ; and 3 No. 16 AWG TP - with DO/S

16. 8 No. 16 AWG SC with O/S

17. 19 No. 20 AWG SC with O/S

18. 1 No. 8 AWG SC with O/S

19. 23 No. 22 AWG TP with O/S

20. 20 No. 20 AWG TPSJ with O/S

21. 8 No. 20 AWG TTSJ; 2 No. 20 AWG TPSJ; 2 No. 20 AWG SSJ; and 24 No. 20 AWG SC - with O/S

22. 54 No. 20 AWG SSJ with O/S

23. 60 No. 16 AWG SSJ with DO/S

24. 5 No. 16 AWG TPSJ and 50 No. 16 AWG SSJ - with DO/S

25. 4 No. 4 AWG; 14 No. 16 AWG TT; and 1 No. 16 AWG TP - with DO/S

The abbreviations used above have the following meanings:

SC = single conductor
SSJ = single conductor, shielded and jacketed
TP = twisted pair
TPSJ = twisted pair, shielded and jacketed
TTSJ = twisted triad, shielded and jacketed
TQSJ = twisted quad, shielded and jacketed
O/S = overall RFI shield
DO/S = double overall RFI shield

Effectivity: This deviation shall be effective on all GSE deliverable to MTO and AMR.

Deviation 246 Delete Requirements

Requirement: MSFC-STD-105A, Synthetic Rubber, Age Control of, Standard For, dated 21 December 1962.

Deviation: Delete the requirements for compliance to MSFC-STD-105A in its entirety and substitute the requirements of ABMA 10509311 as applicable to the following items:

NAA/SID Control No.	ME284-0091-0201 (first 15 units)
(Adjustable Compressed	ME284-0091-0202 (first 13 units)
Gas Pressure	ME284-0091-0203 (first 4 units)
Regulators)	ME284-0091-0205 (first unit)

Reason: The items listed were manufactured to the requirements of ABMA 10509311 prior to imposition of MSFC-STD-105A. The rubber diaphragms used are to the requirements of ABMA 10509311. To invoke the requirements of MSFC-STD-105A at this time would involve a schedule slippage of about 4 months in delivery time. All units manufactured or being manufactured after the listed units will comply with the requirements of MSFC-STD-105A. When the diaphragms presently incorporated in the listed items are replaced, they will be replaced with diaphragms complying with the requirements of MSFC-STD-105A.

Effectivity: As called out in the deviation.

Deviation 248 Rubber Diaphragms

Requirement: MSFC-STD-105A, Synthetic Rubber, Age Control of, Standard For, dated 21 December 1962.

Deviation: Delete the requirements for compliance to MSFC-STD-105A in its entirety and substitute the requirements of ABMA 10509311 as applicable to the following items:

NAA/SID Control No.	ME284-0099-0001 (first 2 units)
	ME284-0082-0001 (first 3 units)
	ME284-0079-0002 (first 9 units)
	ME284-0080-0001 (first 12 units)
	ME289-0011-0001 (first 3 units)
	ME289-0011-0004 (first 7 units)
	ME289-0011-0005 (first 22 units)
	ME289-0011-0002 (first 20 units)
	ME289-0011-0003 (first 32 units)

Reason: The items listed were manufactured to the requirements of ABMA 10509311 prior to imposition of MSFC-STD-105A. The rubber diaphragms used are to the requirements of ABMA 10509311. To invoke the requirements of MSFC-STD-105A at this time would involve a schedule slippage of about 4 months in delivery time. All units manufactured or being manufactured after the listed units will comply with the requirements of MSFC-STD-105A. When the diaphragms presently incorporated in the listed items are replaced, they will be replaced with diaphragms complying with the requirements of MSFC-STD-105A.

Effectivity: As called out in the deviation.

Deviation 409 Vented Grill

Requirement: MSFC-STD-110A, add the following new paragraphs:

3.1.14 Vented Grill. - A vented grill is defined as the front plate of an assembly that provides for intake or exhaust of air required for cooling the electronic/electrical parts located in a rack. Electronic controls and indicating devices are not normally mounted on a vented grill.

5.2.7 Vented Grill. - The steel vented grill assembly shall be: (1) Stone & Smith Inc., radio frequency interference shielded type part number 690049 or approved equal. (2) North American Aviation designed special application vented grills shall conform with the requirements of paragraph 5.2, 5.2.1, 5.2.2 and 5.2.3 (3) Vented grill integral with the blower assembly shall be McLean Engineering Laboratory. Models R2EB412C, R2EB512G, and RC1EB800G 1 or equal.

Reason: The use of commercially procured R.F.I. vented grill assembly from the same source as the R.F.I. rack assures R.F.I. integrity of GSE end items.

Special application grills designed by North American Aviation are required to match the different cooling requirements of the various sites.

Effectivity: All GSE.

Deviation 180

Requirement: MSFC-STD-110A, 16 March 1962

Deviation: Delete the requirements for compliance to standard MSFC-STD-110A in its entirety as applicable to Type I and Type II transporters.

Reasons: The vehicle transporters have been assigned Criticality Category IV. As such, compliance to MSFC-STD-110A is considered impractical. Investigation has shown that a considerable cost impact and schedule delay will be incurred if MSFC-STD-110A is invoked. Specifications for the Type I and Type II Transporters are called out in NAA/S&ID Procurement Specification MC183-0014A.

Deviation 249a GSE Models H7-8 and H7-18

Requirement: MSFC-STD-110A, dated 16 March 1962.

Deviation The requirements of Specification MSFC-STD-110A shall not apply to GSE Models H7-8 and H7-18. Good commercial practices shall be used in lieu of the requirements of this specification as the design and fabrication criteria for these models.

Reason: Compliance with Specification MSFC-STD-110A is impractical because these pieces of equipment have been assigned to Criticality Category IV. Investigations by the supplier indicate that a considerable cost increase and a schedule slippage will result if the requirements of this specification are applied.

Effectivity: This deviation is applicable only to GSE Models H7-8 Aft Interstage Dolly, and H7-18 Transport Illumination Set.

Deviation 26b

Requirement: MSFC-STD-110A, 16 March 1962, paragraph 4.1. - "All assemblies and units shall be mounted on sliding components so as to be easily removed from the housing. All panels shall be mounted perpendicular to the chassis."

Old Deviation: Limited special application panel assemblies shall not be subject to slide mounting provisions. The following are understood as special application panel assemblies:

a. Indicating and control type panel assemblies where no additional circuitry is provided except by the panel face.

b. Large assemblies such as patch panels where either weight or wiring limitations or both preclude slide mounting provisions.

Reason: Indicating and control type panel assemblies are of low weight; they have little or no interior wiring and mechanically have no requirement for a chassis either to support or to contain additional electrical components. Examples:

Assembly No.	Nomenclature	Model Usage
G7-872692	Propellant systems assembly	C7-801
G7-872655	Side load arresting mechanism	C7-801
G7-852176	Destruct systems display	C7-802
G7-852126	Destruct systems control	C7-802
G7-856594	Power control panel	C7-106

Since bulky assemblies such as patch panels have a large quantity of wires terminating inside the rack or bay, retraction of mating cable assemblies cannot be accomplished within the limiting dimensional volume that is provided without modification of supplier items, rack modification, and complex, unproven wiring techniques. Examples:

Assembly No.	Nomenclature	Model Usage
G7-859935	Panel assembly, systems patch	C7-44
G7-872700	Patch panel assembly	C7-802
G7-872167	Patch panel assembly	C7-210

New Deviation: Limited special-application panel assemblies shall not be subject to slide mounting provisions. The following are understood to be special application panel assemblies:

a. Indicating and control-type panel assemblies where little or no circuitry is provided except by the panel face. Meter shunts and connectors may be mounted on a short wrap-around chassis.

b. Large assemblies such as patch panels where either weight or wiring limitations, or both, preclude slide mounting provisions.

Reason: Indicating and control-type panel assemblies are of low weight; they have little or no interior wiring; and mechanically, they have no requirement for a chassis either to support or to contain additional electrical components, except meter shunts and connectors. Examples:

Assembly No.	Nomenclature	Model Usage
G7-872695	Propellant systems assembly	C7-801
G7-872655	Side load arresting mechanism	C7-801
G7-852176	Destruct systems display	C7-802
G7-852126	Destruct systems control	C7-802
G7-856594	Power control panel	C7-106
G7-871190	Power control panel	C7-48

Since bulky assemblies such as patch panels have a large quantity of wires terminating inside the rack or bay, retraction of mating cable assemblies cannot be accomplished within the limiting dimensional volume that is provided without modification of supplier items, rack modification, and complex, unproven wiring techniques. Examples:

Assembly No.	Nomenclature	Model Usage
G7-859935	Panel assembly, systems patch	C7-44
G7-872700	Panel panel assembly	C7-802
G7-872167	Patch panel assembly	C7-210

Effectivity: This deviation shall be effective on S-II GSE assemblies equal or identical to those given in the examples:

Deviation 381a

Requirement: MSFC-STD-110A, dated 16 March 1962, Paragraph 4.1: "All assemblies and units shall be mounted on sliding components so as to be easily removed from the housing. All panels shall be mounted perpendicular to the chassis."

Deviation: MSFC-STD-110A, dated 16 March 1962, Paragraph 4.1: "All drawer assemblies shall be mounted on sliding components so as to be easily removed for service except drawers commercially procured, designed to rack mount using the front panel. A caution decal as shown in Figure 1 shall be conspicuously located on the front panel of drawer assemblies that are not mounted on slides. All panels shall be mounted perpendicular to the chassis."

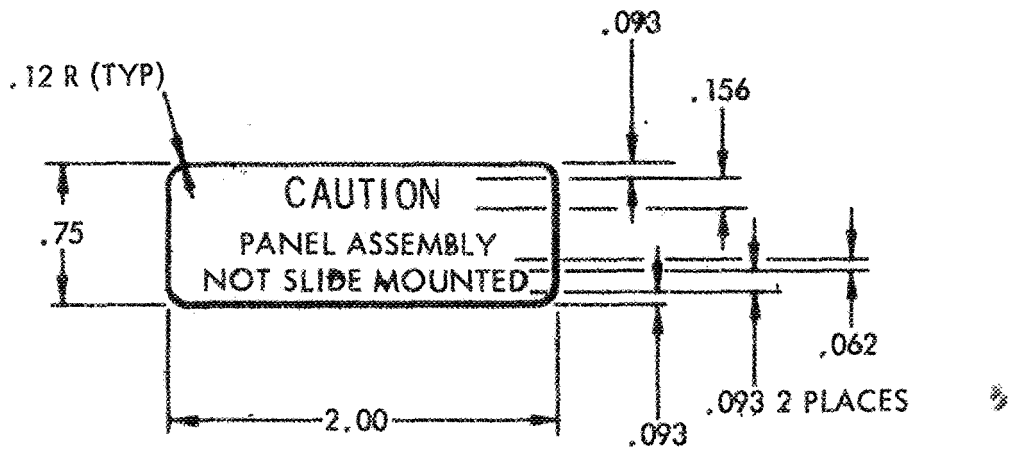


Figure 1. Caution Decal

MATERIAL: Elastomeric film per MIL-D-8634, Type II (Pressure sensitive adhesive)

NOTES:

1. Balance format about vertical centerline of plate.

2. Colors: Background yellow number 23655 per FED-STD-595. Lettering black number 17875 per RED-STD-595.

3. Identify by rubber stamping part number on backing material using .12 high characters.

Reason: Commercially procured drawers (Example: F.M. Signal Generator, W. W. V. Receiver) are designed to rack mount using the standard 19 inch front panel. Modification of the commercial part for slide mounting will create schedule impact due to the added time required for redesign and alteration of an off the shelf item. Drawers designed using transistor circuits are typically small and lightweight, consequently do not require slide mounting due to high reliability. In general, commercial equipment is being procured with slide mounting capability if available.

Deviation 429 Mounting

Requirement: MSFC-STD-110A, Paragraph 4.1 "Mounting. - All assemblies and units shall be mounted on sliding components so as to be easily removed from the housing . . . ."

Deviation: Slides shall not be used for mounting assemblies and units.

Reason: Design of the units preclude the requirement of slides as components are mounted on a vertical plate and are readily accessible by opening a door in the front.

Effectivity: Model A7-35, Serial No. 001 and subsequent.

Deviation 410

Requirement: MSFC-STD-110A, paragraph 4.3 "Identification. - All assemblies, units. . . . as specified in Standards MC347 and. . . . ."

Requirement: MC 347, dated August 6, 1962, note 4L. - "The unpackaged weight of the item in pounds (to the hundredths). Example 0.18, 5.18, etc."

Deviation: The unpackaged weight of the item in pounds ±1 lb.

Reason: Due to the large size of various articles of GSE, which weigh approximately 1500 pounds, the tolerance specified is impractical and the cost involved would be prohibitive.

Effectivity: All GSE.

Deviation 403

Requirement: MSFC-STD-110A, dated 16 March 1962, paragraph 4.3.1, Electrical Symbols. -"Representative symbols of electronic and electrical components on diagrams, schematics, and drawings shall conform to Drawings A10443376 and A10443377."

MSFC-Dwg. 10443376, dated 15 September 1961, paragraph 4.5.2, Advanced schematic. -"An advanced schematic is a schematic diagram that contains additional information for exact terminal numbers and wire connections, but without exact physical location of components. The exact bus connections shall be shown in a separate portion of the drawing in order to enhance circuit configuration. The advanced schematic shows all of the information of a wiring diagram except for wire routings. This type of schematic is most useful for maintenance and trouble location."

Deviation: MSFC-Dwg. 10443376, paragraph 4.5.2, Advanced schematic. - An advanced schematic is a . . . . shows all of the information of a wiring diagram except for wire routings and wire numbers. This type . . . . location.

Reason: S&ID Design Engineering makes a double entered harness assembly drawing to control the manufacture of GSE wired assemblies and sub-assemblies. This document provides an effective method for control of wire identification and wire specification. In addition, the harness assembly serves as a reference index of all interconnections for use in maintenance and manufacture. The number of wire connections on a part and each conductor's destination from a part may be readily determined by using the applicable harness assembly drawings. This is due to the part reference designation being listed in alpha-numeric sequence. Each wire number is listed twice in the automated harness assemblies. Adding the wire number to GSE drawer schematics drawings will not be required for the following reasons:

1. Changes to the wire list that affect wire specification will require assignment of a new wire number. This type of change will require revision to the harness assembly only, provided the advanced schematic does not include the wire number as redundant information. This provides reduced drawing maintenance costs.

2. Due to high density packaging, 40% of the GSE drawer wiring is less than 3 inches in length. Therefore, no wire number is physically stamped on the wire. Placing a wire number on the

schematic which does not exist on the wire in the associated drawer will cause unnecessary confusion in trouble shooting by implying that a numbered wire should exist.

3. In trouble shooting the drawer wiring, a continuity check will be made by a point to point resistance measurement. A typical example would be checking from a wire termination point on a socket contact to the termination point of the conductor on a terminal board. This type of test may be performed without the aid of a wire number on the advanced schematic.

Deviation 282 Reference Designations

Requirement: MSFC-STD-110A, dated 16 March 1962, Paragraph 4.3.2. "Reference Designations. - Parts, units, assemblies, and subassemblies shall be assigned reference designations as specified in Standard MSFC-STD-141."

Paragraph 4.3.3. "Component Identification. - Each component of a unit, assembly and subassembly shall be identified with legible marking as specified in Standard MSFC-STD-141 and located in a conspicuous place adjacent to the component."

Deviation: Delete references to MSFC-STD-141 in Paragraphs 4.3.2 and 4.3.3, and substitute "MA0303-1032."

Reason: Standard MSFC-STD-141 is not sufficiently clear or complete in defining electrical designator requirements for use in S-II ground support equipment.

Effectivity: This deviation shall apply to all S-II ground support equipment.

Deviation 18 Connectors

Requirement: MSFC-STD-110A, 16 March 1962, paragraph 4.4. "Electrical Design. Electrical equipment design shall conform to the requirements of standard MSFC-STD-163..."

Deviation: Paragraph 5.1.2 of standard MSFC-STD-163; removable contact connectors which are accessible after assembly and installation need not have contacts of a box-mounted connector terminate individually at a terminal board.

Reason: If connectors are accessible, terminal boards are not required.

Deviation 231 Drawing Room Manual

Requirement: MSFC-STD-110A, dated 16 March 1962, paragraph 4.4. "Electrical equipment design shall conform to the requirements of Standard MSFC-STD-163...."

MSFC-STD-163, dated 15 March 1962, paragraph 4.2. "Drawings. - All drawings provided as official documentation shall be prepared with symbols and abbreviations as approved by the cognizant MSFC electrical design activity and in compliance with the MSFC Drawing Room Manual."

Deviation: All Electrical drawings provided as official documentation shall be prepared with symbols as specified in MSFC Drawing 10443376, dated September 15, 1961, and abbreviations as specified in MIL-STD-12B, dated 18 May 1959.

Reason: Modification No. 15 to Contract NAS7-200 requires compliance with MSFC Drawing 10443376 for electrical symbols. Paragraph 2.1 of Specification MIL-D-70327, Amendment No. 1, dated 1 July 1959, requires compliance with MIL-STD-12B for electrical abbreviation. The MSFC Drawing Room Manual is not a firm specification in that it is subject to change. Such changes are not recorded against the basic Manual by change letter or other means of identification required to conduct contractual negotiation.

Deviation 236a Spare Connector Contacts

Requirement: MSFC-STD-110A, dated 16 March 1962, Paragraph 4.4. "Electrical equipment design shall conform to the requirements of Standard MSFC-STD-163 ...."

MSFC-STD-163, dated 15 March 1962, Paragraph 5.1.2: "Connectors. - Each contact of a box-mounted connector shall be individually terminated at a terminal board."

Deviation: Paragraph 5.1.2 of MSFC-STD-163 shall not be a requirement for digital logic equipment internal to a rack or bay.

Reason: Since digital systems design does not require spare circuitry in the same manner of standard analog systems design, a large measure of flexibility is achieved within S&ID equipments by using vertical signal distributors and patch panels. In addition, the use of crimp-type removable contact connectors adds to the design change flexibility of the equipment. Therefore, rewiring of drawer systems for design changes will not be required since the drawer wiring will encompass the total digital capability.

In order to reduce the supply stocks and the number of connector sizes that had to be maintained, a connector standardization had been implemented which, in some cases, resulted in a large percentage of spare contacts. If each spare connector contact is to be wired, there would be a need for many terminal boards which would necessitate design changes.

Thus, this technique meets the design intent, although not the detail requirement level of Paragraph 5.1.2.

This deviation request has already been approved in principle. Deviation 18, SID 61-367, against Paragraph 5.1.2, removes the requirement for wiring spare contacts to terminal boards when box-mounted removable contact (crimp-type) connectors are used.

The present deviation, therefore, requests the same exemption to be applied to solder-type connectors which are presently being used in EMM (electromechanical mockup) equipments.

Past experience with solder-type connectors had indicated a greater reliability with these connectors over the crimp-type. However, recent studies have indicated that crimp-type connectors have been developed to a point where they are now deemed equivalent to solder-type connectors.

Effectivity: This deviation shall be effective on the C7-44, C7-48, and C7-100, and C7-200, C7-300, C7-400, C7-500, and C7-800 series equipments only on the electromechanical mockup, and those EMM end items reallocated to Seal Beach.

Past experience with solder-type connectors had indicated a greater reliability with these connectors over the crimp-type. However, recent studies have indicated that crimp-type connectors have been developed to a point where they are now deemed equivalent to solder-type connectors.

Effectivity: This deviation shall be effective on the C7-44, C7-48, and C7-100, and C7-200, C7-300, C7-400, C7-500 and C7-800 series equipments only on the Electro-Mechanical Mockup.

Deviation 237 Multiple Branch Wiring

Requirement: MSFC-STD-110A, dated 16 March 1962, paragraph 4.4: "Electrical equipment design shall conform to the requirements of Standard MSFC-STD-163. . . ."

MSFC-STD-163, dated 15 March 1962, paragraph 5.3.2: "Multiple branch. - Junction boxes and distributors shall be used in lieu of multi-branch cables in ground support equipment."

Deviation: Paragraph 5.3.2 shall not be a requirement for digital logic equipment internal to a rack or bay.

Reason: Since digital systems design does not require spare circuitry in the manner of standard analog systems design, a large measure of flexibility is achieved within S&ID equipments by using vertical signal distributors and patch panels. In addition, the use of crimp-type removable contact connectors adds to the design change flexibility of the equipment. Therefore, rewiring of drawer systems for design changes will not be required since the drawer wiring will encompass the total digital capability.

Another factor which has determined the S&ID harnessing design concept were the contractual reliability requirements. The multi-branch harness type of wiring used by S&ID employs fewer connection points in the harnessing system, thereby increasing the overall reliability of the equipments. Furthermore, although multi-branch wiring is used, the equipment design gives easy access to all termination points necessary for incorporating possible design changes.

Thus, this technique meets the design intent, although not to the detail requirement level, of paragraph 5.3.2.

Effectivity: This deviation is effective on all S-II Automatic Checkout Equipment: C7-44, C7-48 and C7-100, C7-200, C7-300, C7-400, C7-500 and C7-800 series equipments.

Deviation 238 Pin Wiring

Requirement: MSFC-STD-110A, dated 16 March 1962, paragraph 4.4. "Electrical equipment design shall conform to the requirements of Standard MSFC-STD-163..."

MSFC-STD-163, dated 15 March 1962, paragraph 5.3.5: "Wiring of Pins. - On ground support equipment cable assemblies, all connector pins shall be fully wired."

Deviation: Paragraph 5.3.5 shall not be a requirement for digital logic equipment internal to a rack or bay.

Reason: Since digital systems design does not require spare circuitry in the manner of standard analog systems design, a large measure of flexibility is achieved within S&ID equipments by using vertical signal distributors and patch panels. In addition, the use of crimp-type removable contact connectors adds to the design change flexibility of the equipment. Therefore, rewiring of drawer systems for design changes will not be required since the drawer wiring will encompass the total digital capability.

In order to reduce the supply stocks and the number of connector sizes that had to be maintained, a connector standardization had been implemented which, in some cases, resulted in a large percentage of spare contacts. If each spare connector contact is to be wired, there would be a need for many terminal boards which would necessitate design changes.

Thus, this technique meets the design intent, although not to be the detail requirement level, of paragraph 5.3.5.

Effectivity: This deviation is effective on all S-II Automatic Checkout Equipments: C7-44, C7-48 and C7-100, C7-200, C7-300, C7-400, C7-500 and C7-800 series equipments.

Deviation 239 Circuit Leads

Requirement: MSFC-STD-110A, dated 16 March 1962, paragraph 4.4 "Electrical equipment design shall conform to the requirements of Standard MSFC-STD-163. . . ."

MSFC-STD-163, dated 15 March 1962, paragraph 5.4.2. "Circuits carrying dc. - Where both the positive and negative circuit leads are carried through a connector, the number(s) or letter(s) for contacts used to carry the negative shall precede in sequence the number(s) or letter(s) used for the positive."

Deviation: Paragraph 5.4.2 shall not apply to S-II Ground Support Equipment.

Reason: The practice of assigning the higher number or letter pin for positive voltage is standard among power supply manufacturers. In order to obtain off-the-shelf designs, the NAA procurement specification for power supplies was created with positive output leads assigned to a higher number pin than the negative lead. The intent of MSFC-STD-163, Paragraph 5.4.2, has been followed whenever facility dc power is utilized by assigning the +28 volts return to pin 1 and +28 volts to pin 2 at the rack interface feed-thru connector.

Effectivity: This deviation is effective on all S-II Ground Support Equipment.

Deviation 240a Connector Wiring

Requirement: MSFC-STD-110A, dated 16 March 1962, paragraph 4.4. "Electrical equipment design shall conform to the requirements of Standard MSFC-STD-163. . . ."

MSFC-STD-163, dated 15 March 1962, paragraph 5.4.4. "Connector to terminal board. - Ground support equipment wiring of connector contacts to the respective terminal board terminals shall proceed in corresponding numerical or alphabetical sequence. Terminal board terminals shall be lettered or numbered corresponding to their respective connector contacts. Where possible, the terminal board designation number shall correspond to the connector designation number. EXAMPLE: J4 contact G is wired to TB4 terminal G."

Deviation: Connector to terminal board. - Ground support equipment wiring of connector contacts to the respective terminal board terminals shall preferably proceed in corresponding numerical or alphabetical sequence.

Terminal board terminals shall preferably be lettered or numbered corresponding to their respective connector contacts. It is preferred that the terminal board designation number shall correspond to the connector designation number. EXAMPLE: J4 contact G is wired to TB4 terminal G.

Reason: In many parts of the S&ID equipments, there is not a one-to-one relationship of connector contacts to terminal board terminals. Therefore, if terminal board terminal letters correspond with connector contact letters, the terminal board markings would not be consecutive, and thus be confusing if marked for this condition. There are a number of reasons for which S&ID does not have a one-to-one relationship of connector contacts to terminal board terminals. These reasons are delineated in the following paragraphs for the end items affected.

In portable test equipment, such as the C7-70 S-II Pneumatic Console Test Set as defined in Contract Change Order 88, TD-110A, packaging in suitcase type units prohibits this connector to terminal board identification method due to the miniaturization of terminal blocks.

The limited volume available for the electrical junction boxes on the S7-41 S-II Pneumatic Servicing consoles requires a compact internal wiring layout. In order to realize this approach, it is necessary to assign pins from different connectors to the same terminal board. Since the connectors being used differ

in the manner in which pins are identified (numerically, alphabetically), it is not possible to comply with the above-mentioned connector-to-terminal-board wiring.

The S7-42, Pneumatic Servicing Electrical Console, uses terminal blocks only for distribution of power to patch panels through 60 conductor harness assemblies. In order to obtain a large number of terminations in a minimum of space, high density terminal blocks will be required and portions of more than one connector will be terminated on one terminal block.

The C7-603, Pneumatic Checkout Console, has limited space in a number of areas, making it necessary to terminate wires from more than one connector on each terminal board. This makes it impossible to comply with 5.4.4 of MSFC-STD-163 in a number of areas.

The C7-41, Power Distribution Rack, has limited space in a number of areas due to large gage wire size, although the sequence numbering of terminal board to connector was accomplished in most areas of the design it was impossible to comply with 5.4.4 of MSFC-STD-163 due to limited space. In some areas of design the connectors being used differ in the manner in which pins are identified.

Effectivity: All GSE.

Deviation 241 Wiring Shields

Requirement: MSFC-STD-110A, dated 16 March 1962, paragraph 4.4. "Electrical equipment design shall conform to the requirements of Standard MSFC-STD-163...."

MSFC-STD-163, dated 15 March 1962, paragraph 5.4.5. "Shields. - For ground support equipment where wiring shields are passed through connectors, the last numbered or lettered contact shall be used or reserved for the shield. (See Drawing D10440217.) Where overall shields are used in addition to wiring shields, the overall shield contact shall immediately precede the ground contact."

Deviation: Shields. - For ground support equipment, where wiring shields are passed through connectors and connected together (daisy-chained), the last numbered or lettered contact should be used or reserved for the shield (See Drawing D10440217). If each shield is passed through the connector through a separate contact, then a contact adjacent to the associated

functional conductor shall be used or reserved for the shield (see Drawing D10440217). Where overall shields are used in addition to wiring shields, a standardized method shall be used to assign the overall shield contact.

Reason: Electrical design experience at S&ID has shown that it is good practice to pass each wiring shield through the connector on a separate contact. The fact that more connector pins are utilized was considered when this design approach was decided upon. This S&ID design technique has the same end effect, functionally, and has been standardized throughout the S&ID design.

Because of this design approach, it follows that the use of only one connector contact is inadequate to accommodate each wiring shield separately. Therefore, reserving the last lettered or numbered connector contact for the shield cannot be applied to the S&ID separate shield approach.

Effectivity: This deviation is effective on all S-II Automatic Checkout Equipment: C7-44, C7-48, and C7-100, C7-200, C7-300, C7-400, C7-500, and C7-800 series equipments.

Deviation 242 Chassis Ground

Requirement: MSFC-STD-110A, dated 16 March 1962, paragraph 4.4. "Electrical equipment design shall conform to the requirements of Standard MSFC-STD-163. . . ."

MSFC-STD-163, dated 15 March 1962, paragraph 5.4.6. "Chassis Ground. - For ground support equipment where chassis ground is carried through connectors, the next to last numbered or lettered contact shall be used or reserved for the ground."

Deviation: Chassis Ground. - For ground support equipment where chassis ground is carried through connectors, it is preferred that the next to last numbered or lettered contact or a standard numbered or lettered contact be used or reserved for the ground.

Reason: Since the main purpose for using the next to last connector contact number or letter is to standardize, it is believed standardization in some other manner meets the design intent of the customer. The use of the same lettered contact has the advantage of knowing which connector contact has the chassis ground without having to know the connector contact configuration.

Where the next to the last number or letter contact is used, the number or letter callout will vary with each different sized connector. On the equipments in question, letter contacts E or P were used in all cases, but only one letter is used throughout an end item.

Effectivity: This deviation is effective on all S-II Automatic Checkout Equipment: C7-44, C7-48 and C7-100, C7-200, C7-300, C7-400, C7-500, and C7-800 series equipment.

Deviation 262a Spare Connector Contacts

Requirement: MSFC-STD-110A, dated 16 March 1962, Paragraph 4.4. "Electrical equipment design shall conform to the requirements of Standard MSFC-STD-163. . . ."

MSFC-STD-163, dated 15 March 1962, Paragraph 5.1.2: "Connectors. - Each contact of a box-mounted connector shall be individually terminated at a terminal board."

Deviation: Paragraph 5.1.2 of MSFC-STD-163 shall not be a requirement for the C7-41 remote power distribution rack or the C7-603 motorized switch circuitry.

Reason: The wiring of circuitry directly from the box-mounted connectors in the console interface to the multiple isolation switch and thence to terminals meets the intent of the contractual specification, though it does not meet the letter of Paragraph 5.1.2. The existing terminal boards provide for future wiring changes between the multiple switches and the remainder of the console circuits. Flexibility to change wiring between the console interface connector and the multiple switch is not necessary because this wiring by nature need never be changed. All the circuits available have already been wired.

Because the multiple switches are required to simultaneously open or close GSE/stage circuits for isolation purposes only, no reconnection of existing switches is necessary. The C7-41 equipment consists primarily of individually mounted high current relays, high current circuit breakers, and bus bars. These components, by nature, contain individual terminals designed to be connected directly to the rack interface connector. The wiring within the rack consists of individual, large-diameter power cables and a small number of control cables. The use of additional terminal boards in the wiring between the components and the interface connectors is not normal practice in this equipment.

The present design provides terminal boards only for the spare circuits coming from the interface connectors. This practice provides for an economical use of terminal boards.

Reliability is a major consideration in this model of equipment. Several circuits have a criticality rating of I. The addition of terminal boards between the control circuits and the components serves only to degrade the existing level of reliability.

Effectivity: This deviation shall be effective on the C7-41 Remote Power Distribution Rack and the C7-603 Motorized Switch Circuitry.

Deviation 263a Pin Wiring

Requirement: MSFC-STD-110A, dated 16 March 1962, Paragraph 4.4. "Electrical equipment designed shall conform to the requirements of Standard MSFC-STD-163. . . ."

MSFC-STD-163, dated 15 March 1962, Paragraph 5.3.5: "Wiring of Pins. - On ground support equipment cable assemblies, aft connector pins shall be fully wired."

Deviation: Paragraph 5.3.5 shall not be a requirement for C7-41 control circuit or C7-603 stage isolation switch circuitry.

Reason: The wiring of circuits directly from the box-mounted connectors in the console interface to the multiple isolation switch and thence to terminals, meets the intent of the contractual specification, though it does not meet the letter of Paragraph 5.3.5. The existing terminal boards provide for future wiring changes between the multiple switches and the remainder of the console circuits.

Flexibility to change wiring between the console interface connector and the multiple switch is not necessary because this wiring will never need to be changed. All the circuits available have been wired.

Because the multiple switches are required to simultaneously open or close GSE/stage circuits for isolation purposes only, no reconnection of existing switches is necessary. The C7-41 consists primarily of individually mounted high current relays, high current circuit breakers, and bus bars. These components, by nature, contain individual terminals designed to be connected directly to the rack interface connector.

The wiring within the rack consists of individual, large-diameter power cables and a small number of control cables. The use of additional terminal boards in the wiring between the components and the interface connectors is not normal practice in this equipment. The present design provides for terminal boards for the spare circuits coming from the interface connectors. This practice provides for an economical use of terminal boards. The present design is flexible in that it allows for additional control circuits to be readily added in the field.

Reliability is a major consideration in this model of equipment. Several circuits have a criticality rating of I. The addition of terminal boards between the control circuits and the components serves only to degrade the existing level of reliability.

Effectivity: This deviation is applicable to the C7-41 Control Circuit and C7-603 Stage Isolation Switch Circuitry.

Deviation 264 Chassis Ground

Requirement: MSFC-STD-110A, dated 16 March 1962, paragraph 4.4. "Electrical equipment design shall conform to the requirements of Standard MSFC-STD-163. . . ."

MSFC-STD-163, dated 15 March 1962, paragraph 5.4.6. "Chassis Ground. For ground support equipment where chassis ground is carried through connectors, the next to last numbered or lettered contact shall be used or reserved for the ground."

Deviation: For all Ground Support Equipment, where chassis ground is carried through connectors, it is preferred that the next to last numbered or lettered contact or a standard numbered or lettered contact be used or reserved for the ground.

Reason: Since the main purpose for using the next to last connector contact number or letter is to standardize, it is believed standardization in some other manner meets the design intent of the Customer. The use of the same lettered contact has the advantage of knowing which connector contact has the chassis ground without having to know the connector contact configuration. Where the next to the last number or letter contact is used, the number or letter callout will vary with each different size connector.

Effectivity: This deviation is effective on GSE Models C7-41 and C7-603.

Deviation 277 Connector to Terminal Board

Requirement: MSFC-STD-110A, dated 16 March 1962, Paragraph 4.4. "Electrical equipment designed shall conform to the requirements of Standard MSFC-STD-163. . . ."

MSFC-STD-163, dated 15 March 1962, Paragraph 5.4.4. "Connector to terminal board. - Ground support equipment wiring of connector contacts to the respective terminal board terminals shall proceed in corresponding numerical or alphabetical sequence. Terminal board terminals shall be lettered or numbered corresponding to their respective connector contacts. Where possible, the terminal board designation number shall correspond to the connector designation number.

Example: J4 contact G is wired to TB4 terminal G.

Deviation: Paragraph 5.4.4 of MSFC-STD-163 shall not be a requirement for C7-41 control and power circuits.

Reason: The wiring of circuits directly from the box-mounted connectors in the console interface to terminal boards with corresponding numerical or alphabetical sequence meets the intent of the contractual specification, although the sequence numbering of terminal board and terminals does not correspond to the connector and connector pin numbers. This item will be corrected on units 3 and subs.

Effectivity: This deviation shall be effective on the C7-41 for the Electro-mechanical Mockup and Battleship test facility.

Deviation 292 Solder-Type Connectors

Requirement: MSFC-STD-110A, dated 16 March 1962, Paragraph 4.4. "Electrical equipment design shall conform to the requirements of Standard MSFC-STD-163 . . . ."

MSFC-STD-163, dated 15 March 1962, Paragraph 5.1.2. "Connectors - Each contact of a box-mounted connector shall be individually terminated at a terminal board."

Deviation: Paragraph 5.1.2 of MSFC-STD-163 shall not be a requirement for digital logic equipment internal to a rack or bay when employing removable contact (crimp-type) connectors or the following solder-type connectors which were used in the original design and do not have an equivalent removable contact (crimp-type) connectors available:

1. Pyle National facility power connectors P201352, P201354, P201374

2. Cannon Electric connectors RWK-3-22C-5/16-A95, RWK-13666-2, DPX-25-C3-33S, DPX-25-C3-34P (for Models C7-205 and C7-514)

3. Amphenol connectors 126-216, 126-223, 57-30500, 57-40500 (for Models C7-205 and C7-514)

4. Coaxial-type connectors

Reason: Since digital systems design does not require spare circuitry in the same manner as standard analog systems design, a large measure of flexibility is achieved within S&ID equipment by using vertical signal distributors and patch panels. In addition, the use of crimp-type removable contact

connectors, where possible without redesign, adds to the design change flexibility of the equipment. Therefore, rewiring of drawer systems for design changes will not be required since the drawer wiring will encompass the total digital capability.

In order to reduce the supply stocks and the number of connector sizes that had to be maintained, a connector standardization had been implemented which, in some cases, resulted in a large percentage of spare contacts. If each spare connector contact were to be wired, there would be a need for many terminal boards, which would necessitate design changes. Thus, this technique meets the design intent, although not the detail requirement level, of Paragraph 5.1.2.

This deviation request has already been approved in principle. Deviation No. 18 to SID 61-362, Paragraph 5.1.2, removes the requirement for wiring spare contacts to terminal boards when box-mounted removable contact (crimp-type) connectors are used.

The present deviation, therefore, requests the same exemption to be applied to solder-type connectors which were used in the original design and do not have an equivalent removable contact (crimp-type) connector available. S&ID will employ crimp-type connectors in place of solder-type connectors where possible without causing redesign, i.e., where a crimp connector is completely interchangeable with the original solder connector.

Only three conditions prevent replacement of solder-type connectors with crimp-type connectors on the automatic checkout equipment. In one case, facility power connectors (Pyle National P201352, P201354, and P201374) are used which employ solder-type contacts of No. 8 size or larger. Pyle National does not manufacture an interchangeable connector having removable (crimp-type) contacts. Changing to another connector of a crimp type would necessitate changes to interconnecting cabling in addition to the effect on the equipment itself. The inherent sturdiness of such large pin connectors in itself reduces the probability of having pin push-out problems, which sometimes arise with solder-type connectors.

A second condition which prevents replacement of solder-type connectors with crimp-type connectors concerns those connectors which are used on commercial off-the-shelf equipment and its related mating connectors. A relatively small proportion of vendor equipment which is part of end item Models C7-205 and C7-514 has incorporated solder-type interface connectors within its designs. Upon investigation, it was found that the connector manufacturer did not make equivalent crimp-type connectors. The specific connectors of this type with the mating connectors are as follows:

1. Cannon Electric RWK-3-22C-5/16-A95, RWK-13666-2, DPX-25-C3-335, DPX-25-C3-34P

2. Amphenol 126-216, 126-223, 57-30500, 57-40500

Changing these connectors would require redesign effort by the vendors in addition to redesign effort by S&ID in the interface areas.

The third and last condition involves coaxial-type connectors. Up to this time, there is not sufficient reliability information on crimp-type coaxial connectors to warrant a changeover from the more standardized solder-type coaxial connectors.

Effectivity: This deviation shall apply on the C7-44, C7-48, and C7-100, C7-200, C7-300, C7-400, C7-500, and C7-800 series of equipment.

Deviation 434

Requirement: MSFC-STD-110A, Paragraph 4.4, "Electrical equipment design shall conform to the requirements of MSFC-STD-163....."

MSFC-STD-163, Paragraph 5.9.6, "Controls to be used or operated in emergencies shall be located in the lower right-hand area of the panel."

Deviation: Add the following sentence:

"Emergency controls on the propellant systems panel may be located in the lower center area of the panel."

Reason: The controls on this panel were grouped into two functional areas, LOX and LH_2. The emergency controls were placed in such a position as to be closely associated with their respective functional areas rather than placed in the lower right-hand corner. This was done in order to conserve limited panel and rack space and maintain an orderly appearance and functional grouping on the panel. Safety and operational aspects as set forth in MSFC-STD-163 have not been compromised by the relocation of the switches.

Deviation 425 Indicator Lamp Color Code

Requirement: MSFC-STD-110A (4.4) " Electrical Design - Electrical equipment design shall conform to the requirements of Standard MSFC-STD-163 with the exception of connector potting requirements."

MSFC-STD-163 (5.9.8) " Indicator Lamp Color Code - Indicator lamps shall be color coded as follows:

(a) Red - indicates failure, danger, or condition prohibiting operation; for example: AIR OR INVERTER OFF.

(b) Yellow or amber - indicates caution, technical hold, or controlled temporary interruption; for example: HOLD.

(c) . . . . .

(d) . . . . ."

Deviation:

(a) Red - indicates . . . . . OR INVERTER OFF (Note, the "power on" indicator lamp for commercially procured drawers may be red).

(b) Yellow or amber - indicates . . . . . HOLD (Note, the "power on" indicator lamp for commercially procured drawers may be yellow or amber)."

Reason: The commercial electronic equipment industry typically uses red or amber lights to indicate when the equipment power switch is in the "on" position. Electronic test equipment manufacturers use of red or amber to caution the maintenance personnel that the equipment has 110V - 60 cycle applied to the power transformer. The technically trained personnel operating and maintaining the ground support equipment must have been schooled in the use of complex test instruments which utilize red or amber for indicating "power on." In addition, mobile test equipment used at each site to calibrate and troubleshoot the ground support equipment will contain commercial test equipment (frequency counters, oscilloscopes) which utilize a red or amber light to indicate power on. The functional designation "POWER ON" is clearly printed above the indicator light and associated power switch to prevent personnel unfamiliar with the equipment operation from misinterpreting the red or amber light. The purpose of the test conductor console is to monitor, display, and control the significant system details of the S-II stage during test.

The affected GSE racks are not physically located close to the test conductor console (Figure 2), therefore, no conflict with the hazardous monitor color coded legend lights will exist. Figure 1 shows the location of the drawer assemblies in the C7-518 which use red or amber for indicating "Power On." Replacing the red and amber colored lens with a white lens will

necessitate re-identification of the hardware due to the different indicator part number. This change would require new S&ID drawings and associated modification kits for delivered end items.

Effectivity: Models C7-48, C7-204, C7-205, C7-208, C7-210, C7-307, C7-401, C7-510, C7-511, C7-512, C7-513, C7-515, C7-518, and end items 1 and subsequent.

Deviation 16 Steel Rack

Requirement: MSFC-STD-110A, 16 March 1962, paragraphs 5.1.1, 5.1.1.1, 5.1.1.2, and 5.1.1.3:

5.1.1 Steel rack. Steel rack components shall be as specified:

5.1.1.1 Frame. The rack basic frame shall be Emcor Model FR-28A, or approved equal. Frame dimensions shall be 85.875 inches high (including pontoon base) by 22 inches deep. The frame shall be capable of accommodating a standard 19-inch panel.

5.1.1.2 Pontoon base. Each rack shall be furnished with a pontoon base number PB-22A, or approved equal.

5.1.1.3 Rear door. Unless otherwise specified, each rack shall accommodate a rear door, Emcor number DO-788 or DO-788RH, or approved equal. The suffix RH shall indicate right-side mounting hinges.

Deviations:

5.1.1 Steel rack. The rack assembly shall meet the requirements of Specification MIL-I-6181D.

5.1.1.1 Frame. Frame dimensions shall be 85.875 inches high (including pontoon base) by 22 inches deep. The frame shall be capable of accommodating a standard 19-inch panel.

5.1.1.2 Pontoon base. Each rack shall be furnished with a pontoon base if an integral base is not provided with the rack assembly.

5.1.1.3 Rear door. Unless otherwise specified, each rack shall accommodate a rear door.

Reasons: System operation requires elimination of RF interference. Emcor racks do not meet these requirements.

Deviation 189 Frame

Requirement: MSFC-STD-110A, dated 16 March 1962, paragraph 5.1.1.1 "The steel rack basic frame shall be Amco Engineering Company radio frequency interference shielded (R. F. types), 1400 series equipment enclosures or approved equal. Frame dimensions shall be 86.25 inches high (including pontoon base) by 25.50 inches deep. The frame width shall be capable of accommodating a standard 19 inch panel."

Deviation: The steel rack basic frame shall conform to the requirements of S&ID Specification Control Drawing ME181-0021. The lower panel opening shall be 19.31 inches, and the upper panel opening shall be 19.31 inches. Depth of the console shall be 30.00 inches, and the overall height shall be 51.81 inches.

Reason: The human engineering requirements for a writing surface 25.56 inches above the floor level shall require the lower panel opening to be reduced to 19.31 inches.

To accommodate the alpha-numeric display 19.00-inch cathode ray tube, the upper panel opening shall require the increase of 19.31 inches and the depth of the console increased to 30.00 inches.

The reduction of the overall height to 51.89 inches is the result of the previous changes and the incorporation of standard console structural members into the console design.

Effectivity: This deviation is applicable to GSE Model C7-102 Test Conductor Console.

Deviation 387

Requirement: MSFC-STD-100A, dated 16 March 1962, paragraph 5.2.- "Rack or console-mounted panels shall be constructed of 0.125-inch thick aluminum conforming to condition 6061-T6 to Specification QQ-A-327."

Deviation: Rack or console-mounted panels shall be constructed of 0.125-inch thick aluminum conforming to condition 6061-T6 of Specification QQ-A-250/11c.

Reason: Specification QQ-A-327 was cancelled by the Government on 16 December 1963 and Specification QQ-A-250/11 was released to supersede it. The new specification covers the same alloy and guarantees the same mechanical and physical properties as the old one; therefore, this deviation can have no effect on the intent of MSFC-STD-110A.

Effectivity: All GSE.

Deviation 368 Panel Height

Requirement: MSFC-STD-110A, Paragraph 5.2.1.
"Height: Panel height shall conform to Drawing E 10443999." Drawing E 10443999 catalogs panel height, "A" dimension, as 3.5 - 5.25 - 7.0 - 8.75 - 10.5 - 12.25 - 14.0 - 15.75 - 17.5 - 19.25 - 21.0 inches."

Deviation: Add to the above height requirements of Drawing E 10443999: 24.5 inches.

Reason: The operational sequence by which the checkout procedure for Saturn S-II is performed makes it necessary to group legend light indicators in families, i.e., engine, ignition, pressure, electrical, etc. This has been done on the discrete display checkout equipment.

Due to the quantity of displays required on Model C7-212, three 24.5-inch panels are used on units 3 and subs, and two on the EMM. By totaling panel heights, we find 73.5 inches required for 3 and subs and 49.0 inches on the EMM. To provide the same number of displays using 17.5-inch panels, which is required to mount the display lights, six separate panels would be required on 3 and subs, totaling 93.0 inches and 62.0 inches on the EMM. With supporting hardware, this would require one additional rack for the EMM and one additional rack for the 3-and-subs equipment.

Panel height limits as set forth in Drawing E 10443999 will not allow the following:

1. Proper grouping of operational sequence per panel

2. Making the best use of space allotment per rack

3. Reduction of hardware requirements

4. Reduction of floor space requirement at facility

5. Rendering maximum dollar's worth for dollars spent

6. Minimization of the documentation of hardware

7. Compliance with the simplicity requirement as set forth in Paragraph 5.1.5, MSFC-STD-163

8. Conservation of physical effort during countdown

Effectivity: This deviation shall apply on GSE Model C7-212, Discrete Display Rack.

Deviation 219b Panel Lettering

Requirement: MSFC-STD-110A, 16 March 1962, paragraph 5.2.4.1 "Lettering - Panel lettering shall be upper-case and shall conform to Drawing C8987495."

Note No. 6 on Drawing C8987495 "All lettering shall be Alternate Gothic #2 style in upper-case letters."

Deviation: Lettering: Panel lettering shall be upper-case and shall conform to Drawing C8987495 in its entirety, or to Drawing C8987495 except for lettering style which shall be upper case Gothic letters and Arabic numerals without serifs.

Reason: Initially released panel drawings did not specify the exact style of lettering to be used. Consequently, a style of lettering was used which had proved satisfactory on other NAA programs and for which lettering equipment was on hand. This style of lettering was upper case Gothic and Arabic numerals without serifs.

Extending the effectivity for the C7-107 and C7-108 end item 1 to MTF will afford relocating existing EMM hardware without major rework to the drawer front panels and associated internal wiring. The upper-case Gothic letters and Arabic numerals without serifs have been used on the front panel lettering at EMM and the panel functional nomenclature is communicated in a satisfactory manner.

Effectivity: This deviation shall be effective on all S-II Ground Support Equipment to be used on the electromechanical mockup and Battleship, and those EMM ACE end items reallocated to Seal Beach, and Serial No. 1 of C7-107 and C7-108 reallocated to MTO.

Deviation 220b Lettering Style

Requirement: MSFC-STD-100A, 16 March 1962, paragraph 5.2.4.1.1 " Style: Lettering style shall be in accordance with Drawing D8990403."

Note No. 2 on Drawing D8990403 " Letter style shall conform to Alternate Gothic No. 2."

Deviation: Lettering style shall be in accordance with Drawing D8990403 or be upper case Gothic letters and Arabic numerals without serifs.

Reason: Initially released panel drawings did not specify the exact style of lettering to be used. Consequently, a style of lettering was used which has proved satisfactory on other NAA programs and for which lettering equipment was on hand. This style of lettering was upper-case Gothic letters and Arabic numerals without serifs.

Extending the effectivity for the C7-107 and C7-108 end item 1 to MTF will afford relocating existing EMM hardware without major rework to the drawer front panels and associated internal wiring. The upper-case Gothic letters and Arabic numerals without serifs have been used on the front panel lettering at EMM and the panel functional nomenclature is communicated in a satisfactory manner.

Effectivity: This deviation shall be effective on all S-II Ground Support Equipment to be used on the electromechanical mockup and Battleship, and those EMM ACE end items reallocated to Seal Beach, and Serial No. 1 of C7-107 and C7-108 reallocated to MTO.

Deviation 377 Panel Lettering

Requirement: MSFC-STD-110A, Paragraph 5.2.4.1.6. "Application. - The method of applying all lettering shall conform to Drawing B10423785."

Deviation: Add the following paragraph to Drawing B10423785:

> "6. Minor nomenclature additions or changes may be made to panel assembly by using either the silk screen patch or cut-stencil technique."

Reason: No provision has been made for minor repair or rework of the painted surface of rack-mounted panels used on GSE hardware.

Effectivity: This deviation shall apply to all Saturn S-II GSE.

Deviation 41 Rack Title Panels

Requirement: MSFC-STD-110A, 16 March 1962, Paragraph 5.2.5 "Rack title panels and the panel lettering shall conform to Drawing C8990272."

Deviation: The rack (or console) title panel shall consist of:

(a) Model designation
(b) Functional description

Reason: Display of the model designation as well as the functional title of a rack or console on the title panel would not only serve to differentiate efficiently those racks and consoles having identical or similar functional titles, but would generally facilitate written and oral communication.

Deviation 27c Chassis Construction

Requirement: MSFC-STD-110A, 16 March 1962, Paragraph 5.3 "The chassis and all supporting members shall be constructed of aluminum conforming to condition H-32 (5052-H-32) of Specification QQ-A-318."

Deviation: The chassis and all supporting members will utilize as prime requisites materials best suited for simplicity of operation, maintenance, and construction, in that order. Aluminum shall be used and shall be 6061-T4, 6061-T6, 6063-T5, 5052-H-32, or 5052-H-34 depending upon usage.

Reason: To increase design flexibility and use materials best suited for structural and manufacturing purposes. The 5052-H-34 has been added to provide a higher strength material because of space limitations in certain areas of the cabinetry.

Effectivity: This deviation is applicable to all S-II ground support equipment.

Deviation 268 Chassis Construction

Requirement: MSFC-STD-110A, 16 March 1962, paragraph 5.3. "The chassis and all supporting members shall be constructed of aluminum conforming to condition H-32 (5052-H-32) of Specification QQ-A-318."

Deviation: Where limited special application requiring materials of high shear and tensile strength is required, low carbon steel with surfaces protected as specified in Specification MIL-STD-171 shall be used.

Reason: The reason for using low carbon steel can be illustrated by the following typical special applications.

Example No. 1 - G7-853624 Module Mounting Tray. In order to achieve the component packaging density in a given drawer, it was necessary to utilize materials of higher shear and tensile strength which had the desired characteristics for punch press blanking operations and would accept small radii without corner fracturing during hydropress or brake forming operations while still fulfilling the original design requirements.

Example No. 2 - G7-854221 Cable Retractor Assembly. This assembly is used to support the cables between the cable raceway and the connector panel at the rear of each drawer in a rack. The dimensional limitations of the volume behind the drawers necessitated using materials of higher shear strength to keep the physical size of the retractor to a minimum and still retain its structural integrity under the loads imposed on the retractor by the flexing of cables during the opening or closing of a drawer.

Example No. 3 - G7-859914 Chassis Assembly - Patch Panel. This chassis is used to support a large patch panel in which several hundred wires are inserted. The limited usable space in the rack and the size of the patch panel restricted the design of the chassis and necessitated a material of higher shear and tensile strength with spot-welded strengthening members. The structural properties of the steel enabled the chassis to meet the size limitation and still be structurally sound under the load imposed on the chassis by the weight of the wire and the insertion pressure of the patch boards when installed into the patch panel.

Effectivity: This deviation is effective on all S-II Ground Support Equipment.

Deviation 95 Subminiature

Requirement: MSFC-STD-110A, 16 March 1962, paragraph 5.4.1.3.1 "Subminiature type pushbutton switches shall be Micro-Switch, or Electro-Snap items, or approved equal."

Deviation: The Contractor requests approval to use a Micro-Switch, BA-3ST pin plunger type switch in the emergency shutdown circuit and push-to-test pilot light circuit as installed on the C7-601 hydraulic power console.

Reasons: The Micro-Switch will be used to control the coil circuit of power relays in the push-to-test circuit line and in the console control power line. The use of this switch for the press-to-test circuit will be limited to the

first three end items only, while the emergency shutdown usage will be for all end items. This type switch is beyond the scope of MSFC-STD-110A.

Deviation 97 General Purpose

Requirement: MSFC-STD-110A, 16 March 1962, paragraph 5.4.2.1 "General-purpose or 28-volt direct current (vdc) relays shall be plug-in type and shall be in accordance with specification ABMA-PD-R-187 except 4PDT, 7.5 amp relays which shall be Hart Mfg., Inc., items, part number R-130-BIP-1C-607, or approved equal."

Deviation: Where approved Hart Mfg., Inc., part number R-130-BIT-91C, may be used instead of the specified number R-130-BIP-1C-607.

Reasons: The Hart Mfg., Inc., part number R-130-BIT-91C differs from the specified relay in that it is equipped with flat and pierced contacts instead of pins. The relay was used in place of the specified relay because of a space restriction in the C7-601 drawer assemblies. Use of this relay permits the socket to be omitted with the wires soldered directly to the flat and pierced contacts, thereby increasing the wiring space.

Deviation 401

Requirement: MSFC-STD-110A, dated 16 March 1962, paragraph 5.4.2.1: "General purpose or 28-volt direct current (vdc) relays shall be plug-in type and shall be in accordance with Specification ABMA-PD-R-187, except 4 PDT, 7.5a relays which shall be Hart Mfg. Inc. item, part number R-130-BIP-1C-607, or approved equal."

Deviation: In special applications where manufacturing limitations prohibit the use of the Hart 4 PDT plug-in type relay, the approved equal solder-type relay, meeting the electrical requirements set forth in ABMA-PD-R-187 and its associated Technical Specification Sheet 4-GS-3-21, shall be used.

Reason: Due to space limitations in the S-II GSE Model S7-42, the mounting of the 4 PDT relay is such that it prohibits the use of plug-in type relay.

Effectivity: This deviation shall apply on S7-42, item number 1 and subs.

Deviation 380a

Requirement: MSFC-STD-110A, dated 16 March 1962, paragraph 5.4.2.1. "General-purpose or 28-volt direct current (vdc) relays shall be plug-in type and shall be in accordance with Specification ABMA-PD-R-187 except 4PDT,

7.5 A, relays which shall be Hart Mfg., Inc., items, part number R-130-B1P-1C, R-130-B1P-1C-607, or approved equal."

Deviation: General-purpose or 28-volt direct current (vdc) relays shall be plug-in type and shall be in accordance with Specification ABMA-PD-R-187, except 4PDT, 7.5 A. relay which shall be Hart Mfg., Inc. items, part number R-130-B1P-1C-607, or approved equal.

Relays per ME455-0002-0001 (Union Switch and Signal Part No. UN379325-001), may be used where captive mounting screw plug in relays are required. The relay design application shall conform with the following performance and environmental requirements:

Condition	ME455-0002-0001	6GP-2-2
Acceleration	10 g	20 g
Operate Time	17 milliseconds maximum	15 milliseconds maximum
Shock	30 g, 11 ± 1 milliseconds	50 g, 11 ± 1 milliseconds
Vibration	5 - 500 CPS, 10 g	10 - 2000 CPS, 20 g

Reason: The relay with captive-mounting screws per ME455-0002-0001 has the same pin arrangement as the relay part no. 6GP-2-2 per ABMA-PD-R-187. Although the vibration specification of ME455-0002 relay will be lower than the similar NASA relay, it is acceptable in the limited GSE applications. The captive-mounting screw design affords removal and replacement of the relay without the attendant problem of mounting hardware being lost as the mounting screw remains an integral part of the relay. Socket requirements for this relay meet the requirements of MSFC-STD-110A, paragraph 5.4.2.8 (d). Design of new ground support equipment will utilize relays as specified in ABMA-PD-R-187. Redesign of drawers using relay ME455-0002-0001 on unit one and subsequent will incur a schedule impact.

Effectivity: This deviation shall apply on all end-items of GSE Models C7-44, C7-102, C7-109, C7-202, C7-204 and C7-205.

Deviation 25 Sensitive Relays

Requirement: MSFC-STD-110A, 16 March 1962, Paragraph 5.4.2.4. "Sensitive relays shall be as specified herein, or approved equal:

(b) Sigma, series 22 KNCC (miniature)."

Deviation: Sigma, series 22 JNP 3C relays shall be used where mounting requirements of 22 KNCC are not compatible with equipment design.

Reason: Mounting design of the 22 JNP 3C relay is better suited to the particular design application. The electrical characteristics of the 22 JNP 3C and 22 KNCC relays are equal.

Deviation 94 Power Relays

Requirement: MSFC-STD-110A, March 16, 1962, paragraph 5.4.2.5.1 "Table III, Power Relays."

Deviation: Add the following to Table III:

Ampere Rating	Type	Standard	Cutler-Hammer Part Number
50	3 PST	MS24376-D2	6042H146
100	*3 PST	MS24168-D1	6042H161

Reason: Specific ac and dc circuit requirements of the C7-601 hydraulic power console requires relays listed above which were not included in the original Table III.

Deviation 105 Hermetically Sealed

Requirement: MSFC-STD-110A, 16 March 1962, Paragraph 5.4.2.5.1 "Hermetically sealed power relays with interlocking or auxiliary contacts used in power circuits shall be as specified in Table III, or approved equal."

Deviation: Table III shall specify the following two additional relays:

Ampere Rating	Type	Standard	Cutler-Hammer Part Number
25	3PST	MS24143-A1	6042H143
50	3PST	MS24376-A1	6042H147
100	3PST	MS24168-D2	6042H162

Reason: The S7-37 Portable Vacuum Pump Unit has no 28 vdc control voltage. Control is accomplished utilizing 120 vac nominal 60 cycle power. The contact currently capacity of the ac relay specified in MSFC-STD-110A is insufficient for the desired application.

The C7-603 Pneumatic Checkout Unit requires a 100 amp 3PST 28 vdc relay with auxiliary contacts for indication and control circuitry. Relay of this type is not indicated in the approved listing.

Deviation 66 Time Delay

Requirement: MSFC-STD-110A, dated 16 March 1962, paragraph 5.4.2.7 "Time-delay relays shall be the plug-in type."

Deviation: Time-delay relays shall be the plug-in type, except that time-delay relays for critical-time circuits with a visual adjustment for timing cycle shall be A. W. Hydon Company type R11471, part numbers R11471-P1 (5 to 30 sec), R11471-Pa (0.5 to 5 min), R11471-P3 (2 to 20 min), and R11471-P4 (10 to 60 min) or approved equal as they apply to the C7-605 pneumatic servicing console set.

Reasons: Ranges of the time-delay relays specified in MSFC-STD-110A are not suitable for all timing ranges required in the circuit design of the C7-605 pneumatic servicing console set. To standardize on mounting, replaceability, operating procedures, maintenance, to allow for greater flexibility and ease of adjustment of the timing range and increase the reliability of the relays in the shock, vibration, and acoustical noise areas, the Haydon Company timer is deemed more advantageous in this application.

Deviation 103 Lamp Assemblies

Requirement: MSFC-STD-110A, 16 March 1962, Paragraph 5.4.3.1 "Wherever possible, panel indicating light shall utilize lamps conforming to Standard MS25237-327. Where not possible to use the specified lamps, General Electric type 1820 lamps, or approved equal, shall be used."

Deviation: LH79 and LH80 indicating lamps to Specification MIL-L-3661/10 and lenses style LC21 to Specification MIL-L-3661-21 and lamp types MS15569 and MS15567 may be used where greater illumination is required.

Reason: The S7-6 Hydraulic Fluid Servicing Unit requires a light source for background illumination of a visual flow indicator. The MSFC-STD-110A approved units do not supply sufficient power for adequate illumination. The requested assemblies also provide for 120 vac nominal applications as used in the S7-37 Portable Vacuum Pump Unit without the aid of voltage dropping devices. Both of the applications require bulbs which will withstand vibration produced by operation of motors and pumps.

Deviation 430 Color Code

Requirement: MSFC-STD-110A Paragraph 5.4.3.2.1 Color Code. - " The legend shall be visible whether the light is illuminated or not. The lens color shall be determined by the following code:

(a) ----------
(b) White (steady) - indicates an operation is in progress; for example: PRESETTING
(c) ----------

Deviation: Paragraph 5.4.3.2.1 Color Code----------

(b) Color code for master control panel (subassembly A3) switch lights shall be blue for clockwise control and yellow for counter clockwise control. Color code for platform control unit (subassembly A5) switch lights shall be blue for clockwise rotation and yellow for counter clockwise rotation.

Reason: The model A7-35 LH_2 tank servicing mechanism is used internally within the LH_2 tank. With its requirements of vertical and horizontal adjustments for proper servicing it is necessary that the operator reposition the work platform by use of the motor control switches.

Difficulty in making the vertical adjustment is not anticipated and rotation or horizontal adjustment difficulty can be reduced or eliminated by use of the color system of directional control. As the servicing mechanism is used within the LH_2 tank, reference points would be required for clockwise and counterclockwise. These would probably be either the top or bottom of the tank or both, in the latter event one would be contra to the other.

By use of the blue switch lights for clockwise and yellow switch lights for counterclockwise directional control all operations will have uniform control by pressing the switch of the corresponding color to the color of the handrail in which direction it is desired to rotate. The colors blue and yellow were selected by Human Engineering as being the most visible in dim light conditions and have been accepted as the most logical colors for this use.

Effectivity: Model A7-35, Serial No. 001 and subsequent.

Deviation 293a Meter Face Colors

Requirement: MSFC-STD-110A, 16 March 1962, Paragraph 5.4.4.1.5 "Face. - Except for zone marks, the meter face shall be white with black scale markings and lettering."

Deviation: The meter face shall be white with black scale markings and letters, except for zone marks and expanded-scale ac voltmeters. Expanded-scale ac voltmeters may use a black meter face with green fluorescent markings and numbers.

Reason: Power control panels for S-II GSE have been designed with an expanded-scale dc voltmeter (Phasotron part no. 100-09504) and an expanded-scale ac voltmeter (Phasotron part no. 100-08392). Both meters were selected from the same source and of the same physical size per MSFC-STD-110A, Paragraph 5.4.4.1.3. In order to obtain an off-the-shelf meter, the only standard ac voltmeter available from Phasotron was the type with a black face and green fluorescent scale markings and numbers. The use of the ac voltmeters with black face and green fluorescent scale markings for EMM only will afford satisfactory legibility.

Purchase of off-the-shelf meters was required to meet the EMM schedule. Redesign of the power control panel on a 1-and-subs basis will incur a schedule impact.

Effectivity: This deviation shall apply to the following GSE models to be used on the electromechanical mockup. C7-44, C7-48, C7-201, C7-202, C7-208, C7-211, C7-212, C7-213, C7-307, C7-510, C7-511, C7-513, C7-514, and C7-515, and any EMM ACE end items of those listed which are reallocated to Seal Beach.

Deviation 99 Elapsed-Time Indicators

Requirement: MSFC-STD-110A, 16 March 1962, paragraph 5.4.4.3. "Elapsed-time indicators shall be Cramer Controls Corp., 640E items or Bowmar Instrument Corp., part number X-1896 (1000 hrs, 115 volts, 400 cycles), or approved equal."

Deviation: Elapsed-time indicator for the C7-601 hydraulic power console shall be Cramer #634E-9999-9H-28 vdc and shall be restricted to use on the first end item only.

Reasons: The MSFC-STD-110A elapsed-time indicator specified (Cramer #640E) has been superseded by a commercial meter, Cramer #633. The military version of the Cramer #633 is Cramer #634E. The 28-vdc meter is covered by NAA Specification Control Drawing ME432-8000-0001.

Deviation 159 Cartridge Fuse

Requirement: MSFC-STD-110A, 16 March 1962, paragraph 5.4.5.1.

Deviation: Add the following to paragraph 5.4.5.1. "A. C. circuit fuses shall be rated at 500 volts maximum and shall be style F60 to the requirements of MIL-F-15160/60. The style F60 fuses shall be 0.406 inch maximum ±0.004 by 1.50 ± 1/32 inch."

Reasons: The F60-type fuse is required for 440 volt AC circuit protection in the C7-601 hydraulic power console. MSFC-STD-110A does not include high-voltage fuse specifications. For the first C7-601 unit only, MS15249-type fuses, since superseded by F60 type, will be used.

Deviation 98 Circuit Breakers

Requirement: MSFC-STD-110A, 16 March 1962, paragraph 5.4.5.2. "All circuit breakers shall be companion or common-trip and trip-free. Where interrupting capacity will not exceed the values specified in Table V, Heinemann AM series circuit breakers shall be used or an approved equal. When the interrupting capacity exceeds the values specified in Table V, industrial-type (common-trip) circuit breakers conforming to the applicable N. E. M. A. standards shall be used."

Clarification: Approval is requested for use of the following N. E. M. A. standard circuit breakers as manufactured by General Electric Co:

Poles	Rating	Type
3	100A 440 vac	GETEF136M1100WLFP
1	50A 28 vdc	GETE11105WLFP

Reasons: MSFC-STD-110A does not include circuit breakers for 3ϕ, 440-vac service, which is a requirement of the C7-601 hydraulic power console. The 3ϕ, 440-vac circuit breaker (for which approval is requested) is covered by an NAA Specification Control Drawing No. ME454-8000-0001. Approval is also required on the 1-pole, 50-amp, 28-volt circuit breaker which is covered by the same NAA Specification Control Drawing No. ME454-8000-0002. This circuit breaker is utilized in place of a Heinemann type because it is alongside the 100-amp ac circuit breaker and a human engineering problem would evolve if the dissimilar Heinemann circuit breaker were used.

Deviation 96

Requirement: MSFC-STD-110A, 16 March 1962, Paragraph 5.4.5.3

Deviation: Add the following subparagraph: 5.4.5.3.4 High Voltage. - High voltage alternate current fuseholders shall be Bussman type 3555, or approved equal.

Reasons: Circuit requirements and panel space limitation require fuse blocks for the 440-volt, 3-ampere fuses to be located within the C7-601 hydraulic power console. Dash numbers indicate the number of fuse provisions in each block (e.g., -3 indicates a 3 fuse block). The high-voltage-type fuse block or fuseholder is not covered by MSFC-STD-100A.

Deviation 294c Back Shell Connectors

Requirement: MSFC-STD-110A, dated 16 March 1962, Paragraph 5.4.6. "Electrical Connectors. - Electrical connectors shall be as specified. Bendix SM-E, Cannon series CT, and any connector series utilizing a short back shell shall not be used in any circuit. Back shell configuration does not apply where connectors are molded in accordance with 5.4.6.9 since back shells are either discarded or connector fronts obtained without back shells for this purpose."

Deviation: Electrical connectors shall be as specified. Bendix SM-E, Cannon series CT, and any connector series utilizing a short back shell will not be used in any circuit unless the wire solder connections are protected from foreign particles. Back shell configuration does not apply where connectors are molded in accordance with 5.4.6.9, since back shells are either discarded or connector fronts obtained without back shells for this purpose."

Reason: The power control panels have been designed to provide control of 30 amps ac and 30 amps dc for the drawer and blower power requirements. In order to obtain the high current-carrying capacity and high packing density required, the type MS 3102 connector was selected for use in the power control panel. The high packing density is required due to the rack blower being physically mounted in back of the power control panel. The short back shell of the MS 3102 connector provides the necessary space economy due to its smaller size.

The connectors have large-gage wires terminated in their contacts; consequently, the use of long back shells with insert fillers will not be required for wire support. The power control panel chassis protects the back side of the connector from foreign particles.

Effectivity: This deviation shall apply to the electromechanical mockup for connectors used on the following power control panel assemblies: G7-871190, G7-871191, G7-871192, and G7-856195; and on power distribution assemblies G7-856189 and 856191, and for any EMM GSE end items using the listed assemblies which are reallocated to Seal Beach. This deviation shall also apply to end item C7-28, unit one only, designed for use at MTF.

Deviation 112a Quick Disconnect

Requirement: MSFC-STD-110A, 16 March 1962, Paragraph 5.4.6.1. "Where not prohibited by the circuit load, quick disconnect electrical connectors for the interconnection of assemblies, sub-assemblies and racks within environmentally protected areas shall be miniature types per MS3110E, MS3114E, or MS3116P with the following exceptions:"

Deviation: Where not prohibited by the circuit load, quick disconnect electrical connectors for the interconnection of assemblies, subassemblies and racks making up GSE Automatic Checkout Equipment within environmentally protected areas shall be miniature types MS3110E, MS3114E, MS3116P, or the thru-bulkhead type connector MS3119E (or their equivalents), with the exceptions stated in paragraph 5.4.6.1 (a), (b), (c), and (d).

Reason: The use of the thru-bulkhead connector is advantageous for the following reasons:

1. With the interface rack connectors at the bottom of the rack, accessibility is enhanced thru the use of the thru-bulkhead connector which, in turn, results in greater ease of installation and trouble shooting of the Automatic Checkout Equipment. The use of the thru-bulkhead connector will allow a quick disconnect between the bulkhead and rack wiring. In addition, the use of the thru-bulkhead type will allow a quick disconnect between the bulkhead and the exterior cabling.

2. The use of thru-bulkhead connectors increases accessibility. The accessibility of GSE equipment components and systems in a primary design objective as specified in SID 61-362 (GSE Model Specification), paragraph 3.3.5.2.

3. The use of miniature, thru-bulkhead connector conforming to MIL-C-0026482B is in accordance with a deviation from Specification ABMA-PD-E-53 which was granted by the Customer and appears in SID 61-367 (Applicable Specifications and Deviations Document), and Section II, "S-II GROUND SUPPORT EQUIPMENT METHODS AND MATERIALS DOCUMENTS WITH DEVIATIONS." It is anticipated that with submittal of this deviation any question as to the application of the requirements of MSFC-STD-110A as opposed to those of ABMA-PD-E-53 will be avoided.

Effectivity: This deviation is applicable to all GSE Automatic Checkout Equipment.

Deviation 287 Molding and Potting Cable Assemblies

Requirement: MSFC-STD-110A, dated March 1962, Paragraph 5.4.6.9.1. "Potting and molding using polyurethanes shall conform to Specification MSFC-PROC-186." Paragraph 5.4.6.9.2. "Potting using epoxies shall conform to Specification MSFC-PROC 196."

Deviation: The requirements of MSFC-PROC-186A (minus Appendix A) and MSFC-PROC-196 shall apply to the Saturn S-II program in lieu of Specification Drawing A8931070.

Reason: In reply to NAA letter 64MA7812, dated 26 June 1964, NASA resident contracts personnel requested submittal of a contract specification, approval of which would show mutual agreement as to status of MSFC-PROC-186A and MFSC-PROC-196.

Effectivity: Requirements of MSFC-PROC-186A (minus Appendix A) and MSFC-PROC-196 shall apply to all S-II ground support equipment.

Deviation 70 Crimp Type Terminals

Requirement: MSFC-STD-110A, dated 16 March 1962, Paragraph 5.4.7.5 "Crimp-type solderless terminals shall be used wherever possible for terminating harness wiring, cables, or trunk wiring. Spade lug terminations shall not be used."

Deviation: Insulated end caps, Thomas & Betts types RA-15, RB-15 and RC-15 and Knife-Disconnects, Amp Types 32445 and 32446 shall be used to provide connections between the solenoid valve and position indicator, switches and the main feeder wires in the conduit distribution system of the mechanical sections of the C7-605 Pneumatic Servicing Console Set.

Reason: Due to the compactness of the mechanical assemblies of components in the mechanical sections of the C7-605 Pneumatic Servicing Console Set, where space is at a minimum, terminal blocks cannot be utilized for termination of wires. Crouse-Hinds type OE junction condulets shall be used to consolidate the wiring extensions and keep the conduit and wiring distribution system to a minimum. The condulets are not large enough to accommodate terminal strips or connectors. Insulated end caps will be the preferred type of wire junction; however, in instances where the probability exists for completely disconnecting a valve or regulator equipped with position indicator switches, the knife-disconnect type terminations protected by insulated sleeving, shall be used. Microswitch failures, valve replacement, electrical

short and open isolation are the conditions which create the need for requiring a method to quickly open the feeder lines in the conduit system without shortening and ultimately replacing the feeder wire system. The requirements of paragraphs 5.4.7.5.1 and 5.4.7.5.2 shall be complied within this installation.

Deviation 53 Special Circuit Terminal Blocks

Requirement: MSFC-STD-110A, Dated 16 March 1962, paragraph 5.4.8.2.2 "Terminal blocks used for terminating wire of special circuits up to AWG size 10 shall be Curtis Development and Manufacturing type CDM items, or Kukla types 600, 600A, 609 and 699. The terminal blocks for special circuits up to AWG 16 shall be Amp Incorporated "53" series Taper Pin Blocks or approved equal.

Reason: Kukla terminal blocks and Amp Taper Pin Blocks will save space and weight without sacrificing reliability.

Deviation 6 revised Composition Resistors

Requirement: MSFC-STD-110A, 16 March 1962, Paragraph 5.4.12.5

"Composition type resistors shall be in accordance with Specification MIL-R-11."

Deviation: Resistors shall be ceramic-case-type conforming to Specification MIL-R-22684.

Reason: Resistors procured to Specification MIL-R-11 are very hygroscopic and if stored for a period of time, must be baked in an oven at 100 degrees C for 48 hours to be stabilized.

Deviation 405

Requirement: MSFC-STD-110A, paragraph 5.4.14.1 "Exterior cable shall be fabricated . . . . . to a minimum jacket thickness of 0.063 inches."

Deviation: Exterior cable shall be fabricated in accordance with MSFC-SPEC-332A/21A and /77A.

Reason: The C7-70 cables for which this specification would be made applicable, are used on the MILA Launcher Umbilical Tower and on the MTF Load Platform, both exterior locations. MSFC-SPEC-332A is the applicable specification for MSFC furnished cabling at the MILA LUT. Both lay patterns utilized in the C7-70 cables, /21A and /77A, are specified in MSFC-SPEC-

332A and are readily available from one of the suggested suppliers. Use of the same bulk cable for MTF will prevent change of part numbers for the end item and will not create a logistics spare problem.

Effectivity: C7-70

Deviation 278 Wire

Requirement: MSFC-STD-110A, dated 16 March 1962, Paragraph 5.4.14.2. "Cables located in an enclosed or protected area shall be fabricated in accordance with Specification MIL-C-13777 except that the conductors shall be Specification MIL-W-16878, Type B or Specification MIL-W-5086 and the outer jacket shall be either polychloroprene or polyvinylchloride. Jacket thickness shall be in accordance with Specification MIL-C-3432, Table IX, Duty M (medium) except that all thicknesses shall be decreased by 0.031 inches to a minimum jacket thickness of 0.047 inches."

Deviation: Paragraph 5.4.14.2 shall not be a requirement for the power distribution console rack set (C7-41).

Reason: Wire required for the necessary a-c circuitry housed in the C7-41 demands a four-conductor shield cable with No. 10GA wire. This wire was not available in MIL-W-16878, so NAA Specification MB0150-006 was used.

Effectivity: This deviation is applicable to GSE Model C7-41 for the Electromechanical Mockup and Battleship test facility.

Deviation 404

Requirement: MSFC-STD-110A, paragraph 5.4.14.2 "Cables located in an enclosed . . . . to a minimum jacket thickness of 0.047 inches."

Deviation: Cables located in an enclosed . . . . . to a minimum jacket thickness of 0.047 inches; or in lieu of the foregoing requirements cables located in an enclosed and protected area may be fabricated in accordance with MSFC-SPEC-332A/5A.

Reason: Approximately 250 solenoid valves, pressure switches and position indication switches in the S7-41 Pneumatic Console Set are equipped with three pin connectors compatible with the three conductor No. 20 MSFC-SPEC-332A/5A cable. The bulkcable is readily available from one of the suggested suppliers. MSFC-SPEC-332A is the applicable specification for MSFC furnished cabling at the MILA LUT. Approval to allow use of MSFC-SPEC-332A bulk cable will prevent change of part numbers for the end items and will not create a logistics space problem.

Effectivity: S7-41

Deviation 433 Interior Cables

Requirement: MSFC-STD-110A, Paragraph 5.4.14.2 "Interior. - Cable located in an enclosed or protected area shall be fabricated in accordance with Specification MIL-C-13777 except that the conductors shall be Specification MIL-W-16878, Type B or Specification MIL-W-5086 and the outer jacket shall be either polychloroprene or polyvinylchloride. Jacket thickness shall be in accordance with Specification MIL-C-3432, Table IX, Duty M (Medium) except that all thicknesses shall be decreased by 0.031 inches to a minimum jacket thickness of 0.047 inches."

Deviation: Interior. - Cables located in an enclosed or protected area shall be fabricated in accordance with Specification MIL-C-13777 except that the conductors shall be Specification MIL-W-16878, Type B or Type J or Specification MIL-W-5086 and the outer jacket shall be either polychloroprene or polyvinylchloride. Jacket thickness shall be in accordance with Specification MIL-C-3432, Table IX, Duty M (Medium) except that all thicknesses shall be decreased by 0.031 inches to a minimum jacket thickness of 0.047 inches.

Reason: Type J wire was the only type available without a long procurement delay and subsequent schedule slippage. NAA Specification MB0150-028 "Cable, Electrical, Multiconductor, Special Purpose" has been approved and it specifies Type J. The cables fabricated with Type J are protected by a heavy jacket or molded backshell and will meet all the environmental requirements. Type J wire was used for jumper wire to be compatible with the bulk cable.

Effectivity: Saturn S-II GSE

Deviation 426b Interior Multi-Conductor Cable

Requirement: MSFC-STD-110A, Paragraph 5.4.14.2 "Interior - Cables located in an enclosed or protected area shall be fabricated in accordance with Specification MIL-C-13777 except that the conductors shall be Specification MIL-W-16878, Type B or Specification MIL-W-5086 and the outer jacket shall be either polychloroprene or polyvinylchloride. Jacket thickness shall be in accordance with Specification MIL-C-3432, Table IX, Duty M (Medium) except that all thicknesses shall be decreased by 0.031 inches to a minimum jacket thickness of 0.047 inches."

Deviation: Interior - Cables located in an enclosed or protected area shall be National Wire and Cable Co. Multiconductor cables, part numbers NW-1916SJ, NW-3718SJ, NW-3716SJ, NW-1220SJ and NW-720-J which conform to Specification MIL-W-16878, Type C, or Multiconductor cable 12 AWG, 4 conductor, and 18 AWG, 26 conductor, 600V, geoprene covered, General Electric Type SO.

Reason: The type C and type S0 cables were readily available from the suppliers and are considered superior to the type B cables for usage on the A7-35. The jacket thickness of the type C cables was not reduced in thickness.

Effectivity: GSE Model No. A7-35, Serial 001 and subsequent.

Deviation 394

Requirements: MSFC-STD-110A, dated 16 March 1962, paragraph 5.4.14.4- "Cables and harness assemblies shall be identified by a black nylon band conforming to Thomas and Betts Co., part numbers TY42, or 695-50981-3-0 using TY-8 ties, or approved equals. The applicable reference designation shall be hot-stamped in white letters on the black nylon band."

Deviation: Harness assemblies shall be identified by a black nylon band conforming to Thomas and Betts Co., part numbers TY42, or 695-50981-3-0 using TY-8 ties, or approved equals. Identification of cable assemblies shall be in accordance with Specification ABMA-PD-C-711A, paragraph 3.9.

Reason: Nylon bands are not suitable for high temperature application. Nylon bands may be lost in handling. Hot-stamped sleeving or hot stamping on the sheath is more permanent. The nylon bands will be used to add reference designations to the cable assemblies on installation of the assembly.

Effectivity: All GSE.

Deviation 196a Electrical Hookup Wire

Requirement: MSFC-STD-110A, 16 March 1962, paragraph 5.4.15

"(a) Sizes AWG 16 through AWG 22 where identification by stamping is required shall conform to Specification MIL-W-5086, except having 19 strand minimum with no outer jacket, or Specification MIL-W-16878 type B (color white) except having 19 strands minimum with no outer jacket."

(b) Sizes AWG 16 through AWG 32 where identification by color is required shall conform to Specification MIL-W-16878 type B (see 5.4.15.2) 19 strands minimum except with no outer jacket and shall be solid color (non-striped)."

Deviation:

(a) Sizes AWG 16 through AWG 22 where identification by stamping is required shall conform to Specification MIL-W-5086, except having 19 strand minimum with or without nylon outer jacket, or Specification MIL-W-16878, Type B (color white) except having 19 strands minimum with or without nylon outer jacket.

(b) Sizes AWG 16 through AWG 32 where identification by color is required shall conform to Specification MIL-W-16878 Type B (see 5.4.15.2) 19 strands minimum except with or without nylon outer jacket and shall be solid color (non-striped).

Reasons:

(1) Jacketed wire is superior in performance because of its insulation qualities, its resistance to moisture and oil, and its non-fraying ends.

(2) The nylon jacket restricts cold flow of PVC insulation when wires are combined into harness assemblies.

(3) The nylon jacket provides protection against insulation damage by abrasion due to vibration and handling.

(4) The nylon jacket affords protection against attack by plasticizers in other insulating and grommet materials such as neoprene and rubber.

(5) The improved nylons now used are not as susceptible to cracking as previous compounds.

(6) The stiffness added to the wires by addition of the nylon jacket does not create a handicap to manufacturing. The bend radius is controlled by NAA Specification MA0113-011, a requirement for each drawing containing harness wiring. The specific paragraph, 4.3, states: "The minimum radius of bend shall not cause insulation disruption or affect normal cable life or characteristics. The minimum radius of bend for power distribution cables or wires shall be ten (10) times the outside diameter of the cable or wire, except that at terminal strips or where the cable is suitably supported, the radius may be three times the diameter of the cable or wire. Where it is impractical to install wires and cables within the radius requirements, the bend shall, with approval of Engineering, be enclosed in insulation sleeving and securely fastened in place." Verification with NAA shops indicates that following this installation practice eliminates any possibility of wire damage through kinking.

(7) Nylon jacketed wire is a standard stock item at NAA, with purchasing, inspection and manufacturing procedures in operation for use. Except for isolated cases where special procedures would be used, a complete changeover to use of unjacketed wire would require new ordering, manufacturing and inspection procedures. Major reworks would be required on units already in manufacturing.

Effectivity: This deviation is applicable to all GSE automatic checkout equipment for the electromechanical mockup, and those EMM ACE end items reallocated to Seal Beach.

Deviation 100b Electrical Hookup Wire

Requirement: MSFC-STD-110A, 16 March 1962, paragraphs 5.4.15 and 5.4.15.2.

"(a) Sizes AWG 16 through 22 where identification by stamping is required shall conform to Specification MIL-W-5086, except having 19 strand minimum with no outer jacket, or Specification MIL-W-16878 type B (color white) except having 19 strands minimum with no outer jacket.

(b) Sizes AWG 16 through 32 where identification by color is required shall conform to Specification MIL-W-16878 type B (see 5.4.15.2) 19 strands minimum except with no outer jacket and shall be solid color (non-striped)."

Deviation:

(a) Sizes AWG 16 through 22 where identification by stamping is required shall conform to Specification MIL-W-5086, except having 19 strand minimum with or without nylon outer jacket, or Specification MIL-W-16878, Type B (color white) except having 19 strands minimum with or without nylon outer jacket.

(b) Sizes AWG 16 through AWG 32, where identification by color is required, shall conform to Specification MIL-W-16878, Type B (see 5.4.15.2) 19 strands minimum except with or without nylon outer jacket and shall be solid color (non-striped).

Reasons:

(1) Jacketed wire is superior in performance because of its insulation qualities, its resistance to moisture and oil, and its non-fraying ends.

(2) The nylon jacket restricts cold flow of PVC insulation when wires are combined into harness assemblies.

(3) The nylon jacket provides protection against insulation damage by abrasion due to vibration and handling.

(4) The nylon jacket affords protection against attack by plasticizers in other insulation and grommet materials such as neoprene and rubber.

(5) The improved nylons now used are not as susceptible to cracking as previous compounds.

(6) The stiffness added to the wires by addition of the nylon jacket does not create a handicap to manufacturing. The bend radius is controlled by NAA Specification MA0113-001, a requirement for each drawing containing harness wiring. The specific paragraph, 4.3, states: "The

minimum radius of bend shall not cause insulation disruption or effect normal cable life or characteristics. The minimum radius of bend for power distribution cables or wires shall be ten (10) times the outside diameter of the cable or wire, except that at terminal strips or where the cable is suitably supported, the radius may be three times the diameter of the cable or wire. Where it is impractical to install wires and cables within the radius requirements, the bend shall, with approval of Engineering, be enclosed in insulation sleeving and securely fastened in place." Verification with NAA shops indicated that following this installation practice eliminates any possibility of wire damage through kinking.

(7) Nylon-jacketed wire is a standard stock item at NAA, with purchasing inspection and manufacturing procedures in operation for use. Except for isolated cases where special procedures would be used, a complete change-over to use of unjacketed wire would require new ordering, manufacturing and inspection procedures. Major reworks would be required on units already in manufacturing.

Effectivity: This deviation is applicable to all S-II Ground Support Equipment.

Deviation 427 Electrical Hookup Wire

Requirement: MSFC-STD-110A, Paragraph 5.4.15(c) "Size AWG 14 and larger shall conform to Specification MIL-W-5086 with 19 strands minimum (type and jacket to be specified)."

Deviation: PWC-Canada-TEW 105°C-600V-#14-105°C-AWM shall be used on the reel assembly #WTG 34532C when installed on the GSE Model A7-35.

Reason: The reel assembly was purchased as a standard commercial part. The wire used on the WTG 34532C reel assembly is considered more than adequate for its intended usage.

Effectivity: GSE Model No. A7-35, Serial 001 and subsequent.

Deviation 108d Electrical Hookup Wire

Requirement: MSFC-STD-100A, 16 March 1962, paragraphs 5.4.15 and 5.4.15.2 "5.4.15 Wire, electrical hookup. -

(a) Sizes AWG 16 through AWG 22 where identification by stamping is required shall conform to Specification MIL-W-5086, except having 19 strand minimum with no outer jacket, or Specification MIL-W-16878 Type B (color white) except having 19 strands minimum with no outer jacket."

"5.4.15.2 Identification. - Wire designation or color coding shall conform to Specification MIL-W-5088 or MIL-W-8160 as applicable. The following requirements are mandatory:

(b) On a given panel assembly, there shall be no intermixing of color coding and wire stamping."

Deviation: 5.4.15 Wire, electrical hookup. -

(a) Where identification by stamping is required, sizes AWG 16 through AWG 22 shall conform to Specification MIL-W-5086, except for having 19 strands minimum with no outer jacket; or to Specification MIL-W-16878 Type B, except for having 19 strands minimum with no outer jacket.

5.4.15.2 Identification. - Wire designation or color coding shall conform to Specification MIL-W-5088 or MIL-W-8160 as applicable. The following requirements are mandatory:

(b) There shall be no intermixing of color coding and wire stamping on a given panel. Where all wiring on a given panel assembly is to be identified by stamping, solid colored wire may be used provided that a given circuit function or voltage shall carry the same color throughout and that no color, except white, shall be used for more than one function. When color coded wires are used for DC circuit identification, the following color standards shall be applied:

Plus 12 volts:	Yellow
Plus 6 volts:	Red
Minus 6 volts:	Green
Minus 12 volts:	Orange
Common:	Black
(Ground or return)	

Reason: The use of colored wire within a drawer where identification by stamping is utilized is required for the following reasons: to facilitate manufacturing, to simplify maintainability, and to aid checkout.

The design philosophy of high density circuits within a drawer or panel assembly imposes many problems during the assembly of wiring harnesses. Module sockets within a drawer are installed on 0.80 inch centers and wires between pins of adjacent sockets are less then one inch long. Specification MIL-W-5088 requires all wiring to be identified on a drawing (Wire List) but does not require marking wires which are less than 3 inches long. Since it is impractical to mark wires less than 3 inches long, the use of all white wire within a drawer will, therefore, result in producing many units with 50 percent or more of the wiring not identified in any manner whatsoever. Unidentified wiring will create manufacturing difficulty in wiring, inspection, and checkout of units.

The use of colored wire will greatly facilitate wiring, inspection, and maintenance of equipment. Pins on logic module sockets are less than 0.15 inches part and pin identity may be obscured after installation of the wiring harness. Therefore, standard colors for dc power wiring were established as an aid in checking out and testing.

It is the contention of the contractor that the use of colored wire in a given assembly where all wiring is required to be identified per Specification MIL-W-5088 does not violate the intent of MSFC-STD-110A inasmuch as the contractor does not intend the color to be the basis for identifying the wire.

Effectivity: This deviation is effective on the C7-400 Series, C7-100 Series, and C7-44 end items only.

Deviation 217c Wire Identification

Requirement: MSFC-STD-110A, dated 16 March 1962, paragraph 5.4.15.2. "Wire designation or color coding shall conform to Specification MIL-W-5088 or MIL-W-8160 as applicable. The following requirements are mandatory..."

Deviation: Add the following subparagraph to paragraph 5.4.15.2:

(d) For external wiring, e.g. wire in harness or cable assemblies between drawer assemblies within a bay assembly, between a drawer and a bay interface, between a drawer and a terminal board, and between a drawer and a rack interface, etc., the individual wires shall be identified by the wire numbering method. The circuit function letter "U" shall be used as part of the wire identification number where differentiation between panel wiring and rack wiring is a requirement. An abbreviated wire number may be used on rack wiring and panel wiring where the panel wire bundles interconnect with the rack harness at a plug and receptacle. EXAMPLE of an abbreviated wire number is 238A22 (wire No. 238, separator "A", gage 22). Wire segment letters shall not be used as part of such wire identification numbers. Instead, the letter "A" shall be used in the position normally occupied by the segment letter, i.e. as a separator between the wire number and the wire gauge.

(e) For internal wiring, e.g. wiring within a drawer or wiring contained within an assembly or sub-assembly the individual wires shall be identified by either the method of paragraph 5.4.15.2(d) or by a number only.

Reason:

1. Due to the complexity and quantity of S-II Electrical/Electronic Ground Support Equipment, assignment of variable function and variable segment letters per MIL-W-8150D or MIL-W-5088B would result in a high degree of unintelligibility.

2. If wires are marked with variable function and/or variable segment letters and functional changes are introduced into the equipment, the affected wires must be removed and replaced with new wires bearing new markings. Otherwise serious maintenance problems will be created.

3. S-II Electrical/Electronic GSE assemblies contain reasonably high Electro-Mechanical packaging density and wire runs in the form of harness assemblies which are confined to relatively

short lengths. Therefore, variable segment letters are of little practical value in maintenance of the assemblies.

*Reason: Wire numbers inside a drawer cannot be assigned in accordance with the requirements of MIL-W-5088 when the system of paragraph 5.4.15.2 (d) is used for the external wiring.

Effectivity: This deviation is applicable to all S-II Ground Support Equipment.

Deviation 179 "Insulation Sleeving"

Requirement: MSFC-STD-110A, 16 March 1962, paragraph 5.4.17. "Snug fitting electrical insulation sleeving shall be applied over pins and terminals of components. The sleeving shall be vinyl plastic, transparent, flexible material in accordance with Type I of Specification MIL-I-7444. Teflon shall be used for circuits subjected to high temperature."

Deviation: Snug fitting electrical insulation sleeving shall be applied over pins and terminals of components. The sleeving shall be vinyl plastic, transparent, flexible material in accordance with Type I of Specification MIL-I-7444. Where a heat-shrinkable tubing is desired, a thermally stabilized, irradiated polyolefin sleeving or a modified polytetrafluoroethylene sleeving (both to MB0150-007) shall be used. For circuits subjected to high temperature, Teflon or an uncoated braided, glass yarn sleeving (to NA2-41101) may be used. The latter sleeving may be used only where a low dielectric strength and low voltage application is required.

Reason: (1) The heat-shrinkable tubing can be installed more quickly than MIL-I-7444 sleeving and affords equivalent protection. (2) The glass yarn sleeving is capable of withstanding greater temperatures (up to 650 C) than the Teflon Sleeving. (3) Application of MIL-I-7444 sleeving requires the use of a dilator fluid which is both toxic and flammable; therefore, the use of this type of sleeving requires the installation of an adequate ventilation system.

Effectivity: This deviation is applicable to all Ground Support Equipment.

Deviation 266b Insulation Sleeving

Requirement: MSFC-STD-110A, dated 16 March 1962, paragraph 5.4.17. "Insulation Sleeving. - Snug fitting electrical insulation sleeving shall be applied over pins and terminals of components. The sleeving shall be vinyl plastic, transparent, flexible material in accordance with Type I of Specification MIL-I-7444. Teflon shall be used for circuit subjected to high temperature.

Deviation: The requirements of paragraph 5.4.17 shall not apply to turret, bifurcated or similar type terminals wherein the design intent of the terminal is such that the conductor enters the terminal at approximately a 90 degree angle.

Reason: It is not feasible to slip snug fitting electrical insulation sleeving over terminal joints where the conductor joins the terminal at approximately 90 degree angle. Sleeving bend radii would be too sharp to allow a good fit over both the wires and terminal. Sleeving large enough to go over the terminal would be too large for proper fit to the conductor or conversely, sleeving which would fit the conductor would not fit the terminal. Covering up of a joint restricts the verification of quality of the connection. Visual inspection being the first order of quality control.

Effectivity: This deviation shall apply to all S-II Ground Support Equipment.

Deviation 17 Mounting Slides

Requirements: MSFC-STD-110A, 16 March 1962, paragraph 5.5.1. "Mounting slides. Slides for chassis mounting shall be as specified on drawing E10421511."

Deviation: Slides for chassis mounting shall be as specified on drawing E10421511; Stone and Smith, Inc., slide model 70-150; or approved equal.

Reasons: Slides specified per drawing E10421511 must be adapted for use with Amco cabinets; Stone and Smith slides are superior to slides required by drawing 10421511.

Deviation 402 Mounting Slides

Requirement: MSFC-STD-110A, dated 16 March 1962, paragraph 5.5.1, "Mounting Slides. - Slides for chassis mounting shall be as specified on Drawing E10443999".

Deviation: Slides shall be mounted in accordance with MSFC Drawing E10443999 except that location of the centerline of chassis slide shall be as indicated in Enclosure 1.

Reason: The standard GSE logic drawer uses a 5.25-in.-high front panel. The slide mounting dimension for 5.25-in. panels shown on MSFC Drawing E10443999 is not compatible with the equipment rack specified in the S-II Contract for GSE. The available slide mounting dimension using the standard E.I.A. hole spacing on rack equipment mounting rails does not

provide a mounting hole for the 2.624-in. dimension as shown on MSFC Drawing E10443999. Slide mounting dimensions as shown in Enclosure 1 will match the standard E.I.A. hole pattern. Slide mounting flexibility affords maximum utilization of available rack space which in turn affords the advantages of shorter interconnections, reduced signal propagation time and less electromagnetic interference. The slide mounting dimensions as specified in Enclosure 1 will be the design intent for GSE chassis mounting.

Effectivity: All S-II GSE.

Deviation 393

Requirement: MSFC-STD-110A, Paragraph 5.5.3. - "Handles. - Except for the 1.75-inch panels, panels shall be provided with handles conforming to Drawing E10443999."

Deviation: Panels shall be provided with handles conforming to Drawing E10443999, except for the 1.75-inch panels and commercially procured drawers which are not designed to accommodate handles.

Reason: Commercially procured drawers (Example: Wide Range Oscillator, Electronic Counter) are designed to rack mount using the standard 19-inch front panel without handles. Commercial test equipment electronic circuits are packated and calibrated in a given physical arrangement for optimum linearity and frequency response. Physical alteration of a commercial drawer by reworking for handle mounting may degrade the functional performance of the test equipment. Modification of the commercial test equipment by the vendor will create schedule impact due to the added time required for redesign and alteration of an off the shelf item. In general, commercial equipment is being procured with handles if available.

Effectivity: All S-II GSE.

Deviation 413

Requirement: MSFC-STD-110A, dated 16 March 1962, paragraph 5.5.3, Handles - Except for the 1.75-inch panels, panels shall be provided with handles conforming to Drawing E10443999.

Deviation: Paragraph 5.5.3 shall not be a requirement for the C7-41 Circuit Status Indicator Light Panels (Ref. Drawing No. G7-850306).

Reason: The Circuit Status Panel Assemblies consists of indicator lights only; and are not slide mounted. Handles would have no function on these panels. The presence of handles could in fact cause maintenance personnel

to assume that the panels are slide mounted and possibly result in equipment damage if an attempt was made to pull the panels under the mistaken assumption that they are slide mounted.

Effectivity: C7-41 Remote Power Distribution Rack, End Item 1 & Subs.

Deviation 31 Panel Fasteners

Requirement: MSFC-STD-110A, 16 March 1962, paragraph 5.5.5. "Panel fasteners shall conform to Drawing E10443999."

Deviation: Panel fasteners shall conform to SOUTHCO 53-16-710-24.

Reasons: SOUTHCO part number 53-16-710-24 is required to engage with number 10-32 thread on AMCO series 1400 rack and Stone and Smith Inc. Rack Model number 99981-RFI-78-25. SOUTHCO screw 12-13-204-14, called out by drawing E10443999, has an Acme thread which is not compatible with the above rack hardware.

Deviation 10 Panel Mounting Screws

Requirement: MSFC-STD-110A, 16 March 1962, paragraph 5.5.7.1. "Screws used for mounting hardware on panels or on the chassis shall be flat head, 100-degree, carbon steel, cadmium-plated, and where possible shall conform or be similar to Standard AN507 or AN509 except that the cadmium plate shall be Type II of Specification QQ-P-416 (supplementary chromate treatment) and the heads shall be slotted. The screw head shall be painted the same color as that of the panel or chassis in which the screws are mounted."

Deviation: Screws used for mounting hardware on panels or on the chassis shall be pan-head and shall conform or be similar to Standard MS35216 or MS35217. Flat Phillips-head recess, 100-degree, screws shall be used where interference occurs (i.e., rotating switch knob).

Reasons: Pan-head screws will eliminate countersinking of panels and most of the misalignment problems associated with the use of countersink screws. It is impractical to mount hardware on the chassis with recessed screws since many items are mounted on the top of the chassis. AN507 and AN509 screws have been inactive standards since 17 February 1959. The intent of the Armed Services standardization program calls for the use of Phillips-head recess on all screws up to, but not including, 160,000 psi.

Deviation 11a

Requirement: MSFC-STD-110A, dated 16 March 1962, paragraph 5.5.7.2, amended by Deviation 11 to read as follows: "Phillips-head screws shall be used for all screw applications up to but not including 160,000 psi."

Deviation: Phillips recessed screws shall be used for all screw applications below 140,000 psi.

Reason: Deviation is necessary to conform to the S&ID Threaded Fastener Policy. Screw with strengths of 140,000 to 200,000 psi shall be torque-set; above 200,000 psi shall have external wrenching head configurations.

Effectivity: All GSE.

Deviation 12 Self-Locking Nuts

Requirement: MSFC-STD-110A, 16 March 1962, paragraph 5.5.7.3. "Only self-locking nuts shall be used for fastening screws and shall conform to Standards MS20364, MS20365, AN363; and for smaller and high temperature, or corrosion resistant applications MS21042 shall be used."

Deviation: Self-locking nuts for fastening screws shall conform to standard MS21042, alloy steel, or standard MS21043, CRES.

Reason: To conform with S&ID hardware standardization policy, the intent of Armed Services hardware standardization program, MS21042 issued 24 September 1959, and MS21043 issued 29 November 1960.

Deviation 13 Stationary Nuts

Requirements: MSFC-STD-110A, 16 March 1962, Paragraph 5.5.7.4. "Stationary nut plates shall conform to Standard AN361, AN362, or AN373.

Deviation: Stationary nuts plates shall conform to NAS1033, NAS1024, NAS1023, and NAS681.

Reason: As the result of S&ID hardware standardization program NAS parts supersede AN parts. The following changes have been made:

AN256 superseded by NAS1033
AN361 superseded by NAS1024
AN352 superseded by NAS1023
AN373 superseded by NAS681

NAS parts universally and functionally replace AN parts, but AN parts can not universally and functionally replace NAS parts. Use of NAS parts reduce additional hardware stocking requirements.

Deviation 32 General-Purpose Screws

Requirement: MSFC-STD-110A, 16 March 1962, paragraph 5.3.7.8. "General-purpose screws shall be pan-head, slotted, carbon steel, cadmium-plated, and shall conform to Standard MS35223 or MS35224."

Deviation: General-purpose screws shall be Phillips-head, carbon steel, cadmium-plated items. The screw head shall conform to the specific design requirements.

Reason: The intent of the armed services standardization program calls for the use of Phillips-head recess on all screws up to (but not including) 160,000 psi.

Deviation 284 Printed Circuit Boards

Requirements: MSFC-STD-110A, dated 16 March 1962, Paragraph 5.6:

"(a) Printed contacts are required on the printed circuit (P.C.) boards."

"(b) Floated busing mounted connectors shall be used (see 5.4.6.7)."

"(d) The package shall provide a method of holding P.C. boards into their connectors."

"(f) Provisions must be made to prevent plugging of wrong P.C. boards into connectors or plugging of boards in reverse position."

Deviation: The above requirements for printed circuit board design and packaging shall not be applicable to the following large carrier-type boards or similar boards which may be designed for use on GSE:

Drawing No.	Part Name
G7-852044	Subaddress decoder
G7-852214	Test point selector
G7-852233	Memory control logic
G7-852614	Measurement display
G7-852694	Data transistor logic
G7-852734	Station buffer
G7-852842	Single shot control
G7-852504	Automatic display logic
G7-853124	Counter timer

Drawing No.	Part Name
G7-853134	Digital multimeter
G7-853174	Time code generator
G7-853324	Glock driver
G7-853334	Output register No. 1
G7-853342	Output register No. 2
G7-853374	Echo check
G7-853384	Control instruction decoder
G7-853614	Echo check display
G7-853696	UCT buffer
G7-853684	Clock driver
G7-853365	Input register
G7-854454	Decoder driver
G7-871024	Data selector decoder No. 1
G7-871034	Data selector decoder No. 2

Reason:

For MSFC-STD-110A, Paragraph 5.6(a):

1. The reasons for this deviation are based on the prime differences between the large carrier-type printed circuit boards involved and the general purpose printed circuit board, which incorporates printed contacts for mating with standard edge-type connector receptacles.

2. It will be shown that the above requirement should not apply to large carrier-type printed circuit boards as they are used on S-II ground support equipment.

   Carrier printed circuit boards are not the same as general purpose printed circuit boards which interconnect to other circuitry through edge type connectors. A general purpose printed circuit board usually mounts electronic components and interconnects them by means of etched or printed wiring. Usually one or more complete subcircuits (such as a flip-flop, AND gate, NOR gate, etc.) are mounted within the confines of one board or card. This card is often interconnected to other circuitry by means of an edge-type connector which mates with printed contacts on the printed circuit card itself.

   However, the carrier printed circuit board's prime purpose is to interconnect general purpose subcircuit modules similar to those

with edge-type connectors described above. The carrier board can be considered to be a "module carrier board" or a "printed wiring harness" for subcircuit modules. When considered in this light, the reasons for this deviation will become self-evident.

3. As noted above, the carrier printed circuit boards in question are basically printed wiring harnesses as normally used with chassis wiring. The smallest carrier board used is 10 inches wide by 16 inches long and 1/8 inch thick. The number of interface connection points on the carrier boards varies from 50 to approximately 220. Providing an edge-mounted connector to mate properly with such a large number of printed contacts would be a major design problem in itself, since there is not a reliable standard connector available with this number of contacts. Because of its size, the large number of interface points, and the basic use for which it is intended, it would be impractical to provide quickdisconnect connectors (or other similar connection devices) for the interconnection of the carrier board with the remainder of the system. Therefore, such connectors have not been provided on the carrier boards.

4. In view of the above, it can be seen that the requirement to provide printed contacts on the carrier printed circuit boards is not feasible or necessary.

For MSFC-STD-110A, Paragraph 5.6 (b):

1. Same as 1 above

2. Same as 2 above

3. In view of the above, it can be seen that the requirement to use floating bushing-mounted connectors is not applicable, since the carrier printed circuit board does not interconnect with the remainder of the system through a quick disconnect, hard-mounted connector.

For MSFC-STD-110A, Paragraph 5.6 (d):

1. Same as 1 above

2. Same as 2 above

3. Since a quick disconnect connector was not provided for the carrier printed circuit board for the reasons given above, the requirement to provide a method of holding the carrier boards into their connectors is not applicable for the boards concerned.

For MSFC-STD-110A, Paragraph 5.6 (f):

1. Same as 1 above

2. Same as 2 above

3. Since a quick disconnect connector was not provided for the carrier boards for the reasons given above, the requirements to made provisions to prevent plugging of wrong boards into connectors or plugging of boards in reverse position is not applicable for the carrier boards concerned.

For MSFC-STD-110A, Paragraph 5.6 (i):

1. Same as 1 above

2. Same as 2 above

3. The requirement to design the printed circuit package such that the boards can be readily replaced should not be applicable to the carrier boards as they are used on S-II ground support equipment. Since connectors are not used with the carrier board design for the reasons noted above, the boards do not have a plug-in capability. However, almost all electronic circuit components on GSE are mounted within plug-in modules.

Effectivity: This deviation shall apply to all S-II ground support equipment.

Deviation 275a Printed Circuit Boards

Requirement: MSFC-STD-110A, paragraph 5.6(j) "Mounting of relays on printed circuit boards with other components shall be avoided."

Deviation: Paragraph 5.6(j) shall not be a requirement for C7-41, Remote Power Distribution Rack, and C7-603, Pneumatic Checkout Console Set.

Reason: It is good design practice to mount arc suppression diodes as close as possible to the relay coil; these diodes were mounted on the printed circuit boards adjacent to the relays. This eliminated the use of external diode boards.

Effectivity: This deviation is applicable to GSE Models C7-41 and C7-603. End items 1 and subsequent.

Deviation 244 Conformal Coating of Printed Circuit Boards

Requirement: MSFC-STD-110A, Paragraph 5.6(k). "After final checkout of the Printed Circuit Boards, the boards shall be ruggedized with a compound (Hysol 12-007 or equivalent), that can be removed to replace a faulty component."

Deviation: Delete the requirements of this paragraph as applicable to S-II ground support automatic checkout equipment used on the Electromechanical Mockup.

Reason: The Electromechanical Mockup ground support automatic checkout equipment will be the first production-type system to be placed in operation. Because of this, it is expected that many electrical changes will be required during system debugging It should be noted that changes to a printed circuit board having a conformal coating are much more difficult to make than to a board not having such a coating; also, to rework a coated board, the exposed areas of the board would have to be recoated.

Parts will be identified for Electromechanical Mockup only.

Effectivity: All S-II automatic checkout equipment: C7-44, C7-48, C7-100, C7-200, C7-300, C7-400, C7-500 and C7-800 series for use on the Electromechanical Mockup only.

Deviation 258 Reference Designations

Requirement: MSFC-STD-141, 14 August 1961, paragraph 4.1. "The electrical and electronic parts or components represented on schematics and other drawings shall be identified by the short-sign adjacent to the part or component. The reference designation of the assembly shall be located in the title block of the drawing for assembly schematics. On elementary and advanced system schematics the assembly reference designation shall be shown in the appropriate area of the drawing."

Deviation: Delete second sentence, which reads: "The reference designations of the assembly shall be located in the title block of the drawing for assembly schematics."

Reason: The title block would require updating due to additions stemming from multiple usage of the related assembly. In some cases, the title block area would not be sufficient to accommodate all of the reference designations required.

Effectivity: This deviation is applicable on all Saturn S-II Ground Support Equipment.

Deviation 226 Equipment Marking

Requirement: MSFC-STD-141, 14 August 1961, paragraph 4.2. "The components shall be identified on the equipment with the short-sign mark directly adjacent to the component, in the most conspicuous place."

Deviation: The components shall be identified on the equipment with the shortsign mark directly adjacent to the component in the most conspicuous place except where high-density packaging precludes such marking.

Reason: In the Digital Data Acquisition Station, high-density packaging was used on the printed circuit cards for the current driver and pulse generator circuits that operate the ferrite core memory. The high-density packaging assures the inter-connecting wire lengths will be less than 1/10 wave length of the highest frequency encountered in the associative memory circuits.

This design objective has reduced RFI problems by preventing the associative memory interwiring from forming a quarter wave stub at the high frequencies encountered in the read-and-inhibit pulse.

An additional reason for using high-density packaging is to assure minimum pulse propagation time from read-inhibit current drivers to the core matrix. Also, minimum pulse propagation differences between the numerous drivers and the core matrix will be guaranteed by the short inter-connecting wires attendant with high-density packaging. In high-density packaging, the reference designator is obscured by the body of the components, thus eliminating their usefulness.

When space limitations preclude marking component short-sign designations on the printed circuit card, a diagram showing the location of parts shall be included in the technical data (handbook) for the set. MIL-STD-16C implements marking of short-sign reference designations in the above manner.

Effectivity: This deviation is applicable only to the C7-400 series.

Deviation 156 Quality Program Documentation

Requirement: NPC 200-2, 20 April 1962, page B-i, Appendix B,

1. "The contractor shall submit the following for approval by the cognizant NASA installation:

   a. Qualification Status List 4.3.5
   b. End-Item Test Plan 7.4.2.1
   c. End-Item Test and Inspection Procedures . . . 7.4.2.2

2. The contractor shall submit the following for review:

   a. Quality Program Plan 3.1
   b. Test and Inspection Procedures 7.3.1
   c. Process Control Procedures 7.5.4
   d. Results of Special Measuring and Test Equipment Evaluations 9.4
   e. Storage Procedures for End Items 11.5
   f. Special Sampling Plans; Application of Sampling . . 12.3

3. The contractor shall submit the following for information:

   a. Monthly Quality Status Report 14.2.1
   b. Quarterly Summaries of Quality Program Performance Audits . . . . . 15.2"

Deviation: Page B-i, Appendix B, Quality Program Documentation.

1. The contractor shall submit the following for approval by the cognizant NASA installation:

   a. End-Item Test Plan (Submitted as part of General Test Plan). 7.4.2.1
   b. End-Item Test and Inspection Procedures (The initial submittal only will require approval. Revisions and modifications will be submitted for review.) 7.4.2.2

2. The contractor shall submit the following for review:

   a. Quality Program Plan
   b. Qualification Status List
   c. Test and Inspection Procedures
   d. Process Control Procedures
   e. Storage Procedures for End Items
   f. Special Sampling Plans; Application of Sampling

3. The contractor shall submit the following for information:

   a. Monthly Quality Status Report 14.2.1
   b. Quarterly Summaries of Quality Program Performance Audits 15.2

Reasons: (1) The "Qualification Status List" has been changed from Type I documentation to Type II documentation by Amendment 105 to SID 61-367. (2) The requirements for official submittal of "Results of Special Measuring and Test Equipment Evaluations" have been deleted by Amendment 108 to SID 61-367.

Deviation 158 Qualification Status List

Requirement: NPC 200-2, 20 April 1962, paragraph 4.3.5. "The contractor shall prepare and maintain a qualification status list showing the planned and completed qualification status of each part, component, subassembly, and higher level of assembly. The basis for any omission of qualification tests shall be shown. Where qualification is based on tests conducted under the applicable contract, reference shall be made to the pertinent test reports or data. The qualification status list and changes thereto shall be submitted for approval in accordance with paragraph 2.2 and Appendix B at intervals mutually agreed upon with the NASA installation."

Deviation: The contractor shall prepare a Saturn S-II Qualification Status List in accordance with the format of SID 62-1224, reissued 1 April 1963, "Saturn S-II Qualification Status List." The qualification status list shall show the planned and completed qualification status of each part, component, subassembly, and higher-level assembly. The basis for any omission of qualification tests shall be shown. Where qualification is based on tests conducted under the applicable contract, reference shall be made to the pertinent test plan number or document. The acceptability of prior test history shall be coordinated with NASA, when required, in all cases where qualification is judged to be unnecessary due to previous testing. Applicable pages of Section II, Component/End Item Qualification Status of SID 62-1224 will be updated monthly to indicate results of tests conducted and submitted to the NASA Resident Manager for review. The qualification status list shall be updated and submitted on a semiannual basis to MSFC for review.

Reasons: Subjecting the Qualification Status List to the requirements of an approval (Type I document), rather than to the requirements of a review (Type II document), would result in the following additional effort:

(1) A specific form requirement for approval would obsolete effort already expended on the document.

(2) Additional coordination for negotiating changes and revisions would be required.

(3) Schedule and milestone problems would develop if approval or disapproval ran beyond the specified two-week period.

(4) If revision were required, additional effort and schedule slippage would result.

(5) Formal release procedures would result in a QSL at least three months out-of-date at the time of release.

Deviation 153 Suppliers of Materials

Requirement: NPC 200-2, 20 April 1962, paragraph 5.3.1.d(2). "Suppliers of materials, parts and components (including off-the-shelf items) shall be required as a minimum to follow NASA Quality Publication NPC 200-3."

Deviation: Paragraph 5.3.1.d(2). Suppliers of materials, parts, and components (including off-the-shelf items) shall be required as a minimum to follow NASA Quality Publication NPC 200-3, except where the NASA Resident Quality Assurance Representative determines the requirements need not be invoked. The Quality Assurance and Reliability requirements imposed on suppliers by NAA in the purchase orders or subcontracts shall be used as a basis in making this decision.

Reasons: (1) The requirements of NPC 200-3 are presently applied to all equipment covered by a procurement specification. (2) All materials controlled by a "specification control drawing" are reviewed, and the application of NPC 200-3 is based on cost, complexity and the ability to inspect in-house. (3) NPC 200-3 cannot be applied to all commercial procurements. In many instances, commercial parts and raw materials can only be procured through distributors. The distributor cannot set up a system to control quality as required by NPC 200-3, nor can the contractor enforce the requirements on the manufacturer because of lack of contract.

Deviation 154 Articles of Suppliers Design

Requirements: NPC 200-2, 20 April 1962, paragraph 5.3.1.k. "The supplier shall notify the contractor of any proposed changes in design, fabrication method, or process and obtain approval of the change from the contractor before making the change. Appropriate identification of those articles on which the change is incorporated shall be required."

Deviation: Paragraph 5.3.1.k Articles of Supplier Design. The contractor shall require that all suppliers obtain approval of all changes in fabrication methods or processes which are a part of design definition; i.e., call-outs on basic drawings. All other supplier fabrication methods and processes must be initially approved by the contractor, and thereafter continuously monitored to assure acceptability. Appropriate identification of those articles on which the change is incorporated shall be required.

Reasons: Notification of all changes in fabrication methods and processes would:

1. Tie-down all development and detailed action review.

2. Minimize the responsibility of the supplier.

3. Incur significant costs through delays and extensive administrative processes.

4. Develop serious schedule problems through approval time cycles.

Deviation 155 Evaluation

Requirement: NPC 200-2, 20 April 1962, paragraph 9.4. "Evaluation . . . Results of all evaluations shall be submitted to the cognizant NASA installation and its designated representative for review in accordance with paragraph 2.2 and Appendix B."

Deviation: Test and measuring equipment in use as of 21 May 1962 will not require re-evaluation, but those initial evaluations of in-use equipment shall be made available to the NASA S-II Resident Project Office upon request. S&ID shall inform the NASA S-II residency in writing when any other evaluation of inspection, measuring, or test equipment has been completed. The contractor's records of these evaluations are required for this NASA S-II residency's review at the contractor's or subcontractor's facilities upon request.

Reason: Elimination of unnecessary effort by previous mutual agreement of the parties.

Deviation 157 Quality Program Provisions

Requirement: NPC 200-2, 20 April 1962, paragraph 14.2.4 ". . . The report shall identify the model and serial number of the end item . . ."

Deviation: The requirements of this report shall be met by supplying appropriate historical data (including, but not limited to total, operating hours of time-significant items associated with each system and subsystem) from the inspection records, together with other pertinent data obtained during manufacture and final acceptance tests of the S-II Stage, ground support equipment,

propulsion engines, etc. These data shall be assembled in a package which will accompany the end items as loose equipment. The packages shall be updated during interim handling and operational testing of the end items, and will provide a means for post-flight total-stage evaluation by MSFC. The data listed herein shall be recorded in a table of contents in such a manner as to provide ready reference, by end item, to the appropriate section of the data package. Data packages shall include the following elements of data, as appropriate:

a. Operational Data - Information to be provided shall include stage checkout and other final acceptance test results (i.e., variable data, actuator setting, and pre-static and poststatic firing checkout documentation).

b. Operational Time Data - Operating time records will be provided for major hardware such as control system, telemeter packages, etc., and for those subsystems and components with varied or critical useful time/cycle life characteristics.

c. Configuration and Serialization Data - Such information will consist of indenture number, identity by part number, part name and serial number, and a listing of drawing change letters or Engineering Orders that have been incorporated in each part.

d. Replacement Data - Information concerning replacements made during installation, testing, or final checkout shall be provided. Documentation shall include positive identity of the part that was removed, and the replacement part that is installed.

e. Failure and Malfunction Records - This shall consist of documentation of failures or malfunctions occurring during final test or checkout of the end-items.

f. Corrective Action - Information shall be provided relative to corrective action that was taken, or that which is pending, concerning troubles, malfunctions, deficiencies and failures experienced during installation, testing, and final checkout.

g. Weight and Balance Record - Information concerning the total weight and horizontal, vertical, and lateral C.G. shall be provided.

h. Waiver and Deviation - Documentation to reflect approved waivers and deviations which authorize delivery of an end item in which a variation exists shall be provided.

i. Preservation Data - This shall include information relative to the preservation measure accomplished, the time span durability expectancy, or additional preservation measures that are required to preclude damage or deterioration during subsequent handling, shipping or interim storage.

j. Unaccomplished Test Record - Should shipment of an end item be effected without completion of all prescribed tests, at the direction of the Contracting Officer, documents shall be provided defining the test or tests that were not performed and the reasons therefor.

k. Record of Material Review Actions - A summary compilation report of all MRB dispositions concerning the respective end item will be provided.

l. Engine Log Book - Significant historical data concerning the engines will be provided (i.e., installation or removal, record of associate equipment, rework and modification, records or transfer, special inspections, and alignment data).

m. Alignment Data Report - Information relative to the alignment of all critical components with respect to the basic stage reference centerline and fin planes shall be provided.

n. Propellant Tank Loading Data - This information will provide verification of the sensing equipment installation, the performance of tank calibration, and the functional accuracy of sensing instrumentation.

o. Shipping Data - This shall consist of packing lists, certifications and certificates of conformance, where required, special handling instructions, and shortage records.

p. Drawings - Copies of the latest revised drawings that are necessary for operation and maintenance of the respective end-item will be provided.

Reason: To definitize the content of the "Narrative End Item Report."

Deviation 455 Cable Shielding

Requirement: MA0113-013, May 31, 1966, Paragraph 4.4.1.1 - When a shielded cable terminates at a terminal board, the shielding shall be stripped back not less than one inch nor more than 5 inches.

Deviation: Cables having shields stripped back to the point of entry in the terminal distribution rack shall have the shield of each individual wire combed out and a 20 gage wire terminated to the shield using AT&B Hyring and insulated with a piece of PVC tubing. The wire which has been terminated to the shield shall then be routed to the correct termination point within the TDR and terminated.

If the occasion arises whereas the signal that is carried through a particular conductor is of a critical nature and must be shielded, at that time a shielded conductor shall be installed and spliced at the point of entry in the TDR. This splice shall be identified by cable number and wire number.

Reason: The installing contractor, in error, stripped the shields back to the point of cable entry into the terminal distribution rack.

III. NONAPPLICABLE DOCUMENTS

The following are design-level documents and method specifications, standards, and drawings. The design-level documents were indicated in the NASA Statement of Work. All are considered nonapplicable for reasons listed.

Specification, Standard, or Drawing No.	Title
MIL-R-8573	Reservoirs, Air, Non-shatterable Steel

Reason: The nonshatterable requirement is inconsistent with S-II stage requirements. Reservoirs for the S-II stage will be designed with appropriate safety margin and quality assurance for intended usage.

Specification, Standard, or Drawing No.	Title
MSFC DWG-10490600	Saturn Launch Complex and Vehicle Systems

Reason: Not a requirement for S-II stage; applicable to SA-1 only.

Specification, Standard, or Drawing No.	Title
MSFC DWG-10490602	Description of Saturn Launch Complex and Vehicle Systems Block I

Reason: Present concept utilizes launch complex 39.

Specification, Standard, or Drawing No.	Title
MSFC DWG-10490603	SA-1 Operational Sequences

Reason: Not a requirement for S-II; applicable to Saturn C-1 (SA-1 only).

Specification, Standard, or Drawing No.	Title
MSFC DWG-10419925	Containers, Propellant

Reason: The weld joints of MSFC Drawing 10419925 are based on containers of 70 and 105 inch diameters. S-II stage containers will be in excess of 70 and 105 inch diameters.

Specification, Standard, or Drawing No.	Title
MIL-STD-210A	Climatic Extremes for Military Equipment

Reason: The S-II stage is not being designed for worldwide operations. Therefore environments shall be tailored for California, Mississippi, and Florida climates.

Specification, Standard, or Drawing No.	Title
MSFC DWG-10509303	Fitting Process, Threaded Flared Tube Connectors, Standard For

Reasons: The MSFC Drawing 10509303 is too limited in coverage, and lists outdated items. Torque values indicated for corrosion-resistant steel tubing are too low to prevent leakage.

Specification, Standard, or Drawing No.	Title
ABMA-STD-18	Torque Specifications; Threaded Fasteners

Reason: Values provided in LA0101-001 have been established and adjusted on the basis of empirical information gained and maintained for a period of 20 years.

Specification, Standard, or Drawing No.	Title
MIL-H-5440	Hydraulic Systems; Design, Installation and Test of Aircraft, (General Specification for)

Reason: Specification MIL-H-5440 is applicable to aircraft systems only. Therefore, it is not applicable to ground support equipment.

Specification, Standard, or Drawing No.	Title
MIL-P-5518	Pneumatic Systems; Design, Installation and Tests in Aircraft

Reason: Specification MIL-P-5518 is applicable to aircraft systems only. Therefore, it is not applicable to ground support equipment.

Specification, Standard, or Drawing No.	Title
MIL-I-8500	Interchangeability and Replaceability, Physical, of Component Parts for Aircraft (Including Guided Missiles)

Reason: Specification MIL-I-8500 is applicable to aircraft only. Therefore, it is not applicable to ground support equipment.

Specification, Standard, or Drawing No.	Title
MIL-R-8573	Reservoirs, Air, Non-shatterable Steel

Reasons: The nonshatterable requirement is inconsistent with S-II requirements. Reservoirs for S-II will be designed with appropriate safety margin, and quality assurance for intended usage. Pressure vessels in ground support equipment will be ASME coded.

Specification, Standard, or Drawing No.	Title
MIL-P-19692	Pumps, Hydraulic, Variable Delivery, General Specification for

Reason: Specification MIL-P-19692 is applicable to airborne vehicles only. Therefore, it is not applicable to ground support equipment.

Specification, Standard, or Drawing No.	Title
MIL-V-27162	Valves, Servo-Control, Electro-Hydraulic, General Specification for

Reason: Specification MIL-V-27162 is applicable to aircraft only. Therefore, it is not applicable to ground support equipment.

Specification, Standard, or Drawing No.	Title
MSFC DWG-10490600	Saturn Launch Complex and Vehicle Systems

Reason: Not a requirement for S-II ground support equipment, and is applicable to SA-1 only.

Specification, Standard, or Drawing No.	Title
MSFC DWG-10490602	Description of Saturn Launch Complex and Vehicle Systems Block I

Reason: Present concept utilizes launch complex 39.

Specification, Standard, or Drawing No.	Title
MSFC DWG-10419925	Containers, Propellant

Reason: The weld joints of MSFC Drawing 10419925 are based on containers of 70 and 105 inch diameters. S-II stage containers will be in excess of 70 and 105 inch diameters.

Specification, Standard, or Drawing No.	Title
NASA TN D-556	Investigation of the Cape Kennedy, Florida, Wind Magnitude and Wind Shear Characteristics in the Ten-Fourteen Kilometer Altitude Region

Reason: Technical note NASA TN D-556 is applicable to airborne vehicles only. Therefore, it is not applicable to ground support equipment.

Specification, Standard, or Drawing No.	Title
NASA TN D-560	Idealized Wind Profiles for the Study of Vehicle Performance between 60 KM and 80 KM Altitude, Cape Kennedy (AMR), Florida

Reason: Technical note NASA TN D-560 is applicable to airborne vehicles only. Therefore, it is not applicable to ground support equipment.

Specification, Standard, or Drawing No.	Title
NASA TN D-595	Atmosphere for Patrick AFB, Florida (Annual)

Reason: Technical note NASA TN D-595 is applicable to airborne vehicles only. Therefore, it is not applicable to ground support equipment.

Specification, Standard, or Drawing No.	Title
MIL-STD-210A	Climatic Extremes for Military Equipment

Reason: The S-II stage ground support equipment is not being designed for worldwide operations, therefore environments shall be tailored for California, Mississippi, and Florida climates.

Specification, Standard, or Drawing No.	Title
ABMA-P-2	Cleaning and Passivation of Materials for H_2O_2 Service

Reason: Specification ABMA-P-2 is not applicable to S-II ground support equipment, because H_2O_2 will not be used in the ground support equipment.

Specification, Standard, or Drawing No.	Title
ABMA DWG-10415463	Procedure for Testing, Handling and Cleaning of Onboard Hydraulic System Components, Excluding Filter Elements and Hydraulic Fluid (Whatman Method).

Reason: ABMA Drawing 10415463 is applicable to aircraft systems only. Therefore, it is not applicable to ground support equipment.

Specification, Standard, or Drawing No.	Title
MSFC DWG-10419900	Environmental Protection of Vehicle and Support Equipment Components and Assemblies, Procedure for

Reason: MSFC Drawing 10419900 is applicable to airborne vehicles and associated components. Therefore, it is not applicable to ground support equipment.

Specification, Standard, or Drawing No.	Title
MSFC DWG-10509303	Fitting Process, Threaded Flared Tube Connectors, Standard for

Reason: MSFC Drawing 10509303 is too limited in coverage, and lists outdated items. Torque values indicated for corrosion-resistant steel tubing are too low for ensuring against leakage.

Specification, Standard, or Drawing No.	Title
(Material deleted)	

IV NR PROCESS, MATERIAL, AND QUALITY CONTROL SPECIFICATIONS

CONTRACTOR PROCESS SPECIFICATIONS

The NR process, material and quality control documents listed herein detail specific requirements and practices to be employed in meeting the objectives and requirements of the Government documents as noted, and/or include additional requirements. These Contractor documents shall be applicable for use per NR Drawings. These documents may also be used for subcontractor application when deemed necessary.

Appendix C gives an index of S-II Stage and Ground Support Equipment applicable documents and their related NR specifications.

Number and Date	Title
LAO-101-007A June 30, 1965	Bearings, Sintered, Oil-Impregnated, Storage, Machining, Processing and Installation
MA0102-010 May 7, 1965	Elevated Temperature Forming of Steel Ports
MA0105-004E December 19, 1966 Amendment MD-1 April 7, 1967	Elevated Temperature Resistant, Glass Fabric Reinforced, Phenolic Sandwich Construction, Fabrication of
MA0105-010C December 17, 1965	Laminates, Polyester Resin Preimpregnated Glass Fabric, High Strength, Fabrication of

Supersedes page 254 of March 10, 1969

Number and Date	Title
MA0105-013A June 29, 1966	Fabrication of Compressed Molded Parts, Phenolic, Glass-Fiber Filled
MA0105-029 February 24, 1967	Phenolic Laminates, Nylon Fabric, Fabrication of
MA0105-049E November 29, 1967	Fabrication and Installation of Organic Edge Seals on Cryogenic Insulation SCN 117
MA0105-054B July 10, 1968	Fabrication of High Strength Laminates From Epoxy Resin Preimpregnated Glass Fabric (Supersedes MA0105-026 for S-II)
MA0105-057B August 28, 1967 Amendment MD-1 March 6, 1968	Fabrication of Elevated Temperature Resistant Glass Fabric - Phenolic Laminates (Supersedes MA0105-002 for S-II)
MA0106-015C June 15, 1966	General Purpose Sealing for Areas with Operating Temperatures from -75 to 500 F
MA0106-023D June 28, 1966 Amendment MD-1 June 5, 1967	Bonding with Low Temperature Curing Adhesive for Service at -250 to 500 F
MA0106-030D June 23, 1966	Bonding with Low Temperature Curing Adhesive for Cryogenic Usage

Number and Date	Title
MA0105-013A June 29, 1966	Fabrication of Compressed Molded Parts, Phenolic, Glass-Fiber Filled
MA0105-029E February 24, 1967	Phenolic Laminates, Nylon Fabric, Fabrication of
MA0105-049E November 29, 1967	Fabrication and Installation of Organic Edge Seals on Cryogenic Insulation
MA0105-054B July 10, 1968	Fabrication of High Strength Laminates From Epoxy Resin Preimpregnated Glass Fabric (Supersedes MA0105-026 for S-II)
MA0105-057B August 28, 1967 Amendment MD-1 March 6, 1968	Fabrication of Elevated Temperature Resistant Glass Fabric - Phenolic Laminates (Supersedes MA0105-002 for S-II)
MA0106-015C June 15, 1966	General Purpose Sealing for Areas with Operating Temperatures from -75 to 500 F
MA0106-023D June 28, 1966 Amendment MD-1 June 5, 1967	Bonding with Low Temperature Curing Adhesive for Service at -250 to 500 F
MA0106-030E February 6, 1969	Bonding with Low Temperature Curing Adhesive for Cryogenic Usage

SCN 239

Number and Date	Title
MA0106-032D April 19, 1967	Bonding with Low-Temperature Curing Polyurethane Adhesive for Usage from -423F to +120 F
MA0106-033H March 15, 1968	Bonding Metallic, Metal-Composite, and Non-Metallic Structures for Cryogenic and Heat-Resistance Applications
MA0106-045F July 18, 1967 Amendment MD-1 October 9, 1967 Amendment MD-2 October 9, 1968	Application of Adhesive Primer for Usage from -423 F to 300 F
MA0106-046E August 17, 1966	Bonding with Low Temperature Curing Adhesive for Cryogenic and Elevated Temperature Usage
MA0106-051A May 19, 1965	Liquid Tight Sealing of Pressurized Compartments with Normal Operating Temperature from -65 to 250 F
MA0106-060C June 22, 1966	Application of Honeycomb Core Filler Material
MA0106-063A August 16, 1965 Amendment MD-1 January 10, 1966	Adhesive Bonding of Metal, Sandwich, and Miscellaneous Assemblies

SCN 212

Number and Date	Title	
MA0106-065C September 20, 1968	Foaming of Multi-Component Rigid or Flexible Polyurethane Materials	
MA0106-070A February 22, 1967	General Purpose Bonding and Sealing for Service At -75 to 550 F	
MA0106-072 July 13, 1966	Electrical Connector Potting for Service at Temperatures Between -160 and 600 F (Supersedes MA0106-036 for Electrical potting connector applications)	
MA0107-002F April 3, 1967	Resistance Welding	
MA0107-007H September 25, 1967	Brazing of Aluminum and Aluminum Alloys	SCN 86
MA0107-013B June 1, 1964	Brazing, High Temperature (Above 1700 F)	
MA0107-016H January 1, 1969	Machine Fusion Welding of Aluminum Alloys for Saturn S-II Vehicle	SCN 210R1
MA0108-009G January 29, 1968	Application of Epoxy-Polyamide Primer Coating	

Number and Date	Title	
MA0106-045F 18 July 1967 Amendment MD-1 4 October 1968	Application of Adhesive Primer for Usage from -423 F to 300 F	SCN 116
MA0106-046E 17 August 1966	Bonding with Low Temperature Curing Adhesive for Cryogenic and Elevated Temperature Usage	

Number and Date	Title	
MA0108-014A August 6, 1963	Application of Strippable Vinyl Coating	SCN 157
MA0108-021 March 11, 1964	Application of Corrosion Barriers Between Dissimilar Metals (Supersedes AA0108-005 for S-II)	
MA0109-004E December 15, 1967	Electroless Nickel Plating	SCN 157
MA0109-006C June 24, 1964	Cadmium Plating-Cyanide Process	
MA0109-008C June 24, 1964	Cadmium Plating, Fluoborate Process	
MA0109-009C October 27, 1964	Chromic Acid and Sulfuric Acid Anodizing	
MA0109-010B March 10, 1966	Hard Chrome Plating	SCN 157
MA0109-013C October 19, 1966	Silver Plating	SCN 157

Number and Date	Title
MA0107-013B 1 June 1964	Brazing, High Temperature (Above 1700 F)

Number and Date	Title
MA0109-014A December 18, 1964	Hard Anodizing Aluminum Alloys
MA0109-015 December 15, 1964	Thin Dense Chromium Plating
MA0109-017B March 1, 1966	General Procedure for Brush Type Electroplating
MA0109-018A November 1, 1967	Electroplated Lead on Corrosion Resistant (CRES) Alloys for Sealing Applications
MA0110-001D February 10, 1966	Cleaning Hydraulic System Components
MA0110-010D March 2, 1966	General Cleaning Methods
MA0110-011K September 29, 1967	Cleaning of Aluminum and Aluminum Alloys
MA0110-012C July 26, 1966	Cleaning Ferrous Alloys
MA0110-013G November 9, 1965 Amendment MD-1 September 29, 1967	Descaling and Passivation of Corrosion and Heat Resistant Alloys

SCN 10R1

SCN 90

Number and Date	Title
MA0110-014A January 18, 1963	Cleaning and Protective Treatment of Magnesium Alloys (Approved only as applicable to MA0107-002B)
MA0110-015E May 3, 1967	Cleaning Titanium and Titanium Alloys
MA0110-018J February 18, 1969	Cleaning Components of Propellant, Pressurizing and Circulating Systems SCN 228R1
MA0110-027C August 18, 1965	Cleaning Oxidizer System Parts and Fluorescent Penetrant Cleaning
MA0110-029D June 13, 1967 Amendment MD-1A March 4, 1968	Surface Treatment of Fluorocarbon Wire Insulation for Improved Adhesion
MA0110-030 September 21, 1965	Cleaning Plastic, Glass and Elastomeric Materials (Supersedes RA0110-022 for S-II)
LA0111-001J April 26, 1967 Amendment MD-1 September 29, 1967	Heat Treatment of Aluminum
MA0111-003B February 18, 1965	Heat Treatment of 17-7PH Steel Sheet to 170,000 PSI Tensile Minimum

Number and Date	Title	
MA0111-004B November 5, 1964	Heat Treatment of MB0160-003 Bar, Extrusions, Forgings, and MB0160-001 Plate	
MA0111-005B November 5, 1964	Heat Treatment of 18 Ni Maraging Steel	
LA0111-006C April 13, 1965	Heat Treatment of Carbon and Alloy Steels	SCN 157
MA011-007A May 10, 1966	Processing of Steel Parts Heat Treated to High Tensile Strengths (Supersedes LA0111-009 for S-II)	
LA0111-008 December 4, 1961	Heat Treatment of Aluminum Alloy Bar Forgings and Extrusions	SCN 157
MA0111-008B December 17, 1964	Heat Treatment of the 400 Series Corrosion Resistant Steels (Supersedes LA0111-023 for S-II)	
MA0111-009A December 18, 1964	Heat Treatment of Heat and Corrosion Resistant, Precipitation Hardening Steels (Supersedes LA0111-022 for S-II)	
MA0111-011A December 15, 1964	Surface Hardening of Carbon and Alloy Steels	SCN 157

Number and Date	Title
MA0111-013A December 18, 1964	Heat Treatment of 440 C Stainless Steel for Low Temperature Service
LA0111-014 February 13, 1962	Processing and Heat Treatment of Ultra High Strength Steel Alloys
LA0111-016F May 5, 1965	Prevention and Elimination of Hydrogen Embrittlement in Steel
MA0115-005C February 12, 1964 Amendment MD-1 January 24, 1969	Testing Compatibility of Materials for Liquid Oxygen Systems
MA0115-031 April 27, 1967	Testing Compatibility of Materials With Titanium and Its Alloys
MA0116-015E August 8, 1966 Amendment MD-1A October 4, 1967	Clean Packaging, Requirements and Procedures
MA0116-029E September 27, 1968	Age Control Standard for Age Sensitive Rubber Items
MA0120-003C September 30, 1954	Application of Silicone-Based Heat-Dissipating Grease

SCN 238

Number and Date	Title
MA0303-021J June 18, 1968	Harness Assembly, Airborne, Systems Procedure for Assembly and Fabrication of
MA0303-023K April 17, 1969	Shielded Wire and Cable Termination - Interconnection, Electrical and Electronic Equipment, Saturn S-II Airborne Systems
MA0303-024J May 10, 1968	Solderless Terminals and Connectors, S-II Airborne Systems, Assembly of
MA0303-025F February 1, 1968	Electrical Bonding, S-II Airborne Systems, Procedure for
MA0303-027P December 3, 1968	Wiring and Cabling Devices Identification - Interconnection, Electrical and Electronic Equipment, Saturn S-II Airborne Systems
MA0303-1004H March 28, 1969	Connector, Electrical, Patchboard Type, S-II Airborne Systems, Assembly of
MA0303-1005L January 10, 1969	Connector, Electrical, Circular, MS Type, S-II Airborne Systems, Assembly of

SCN 255

Number and Date	Title
MA0303-1004E 28 October 1966	Connector, Electrical, Patchboard Type, S-II Airborne Systems, Assembly of
MA0303-1005J 23 February 1968 E.O. M517075 9 August 1967 E.O. M518329 18 August 1967 E.O. M518987 28 August 1967	Connector, Electrical, Circular, MS Type, S-II Airborne Systems, Assembly of

SCN 139

Number and Date	Title
MA0303-1006G June 12, 1967	Connector, Electrical, Miniature, Quick-Disconnect, S-II Airborne Systems, Assembly of
MA0303-1007E October 17, 1968	Connector, Electrical, Cryogenic Type, Saturn S-II Airborne Systems, Assembly of
MA0303-1008D June 6, 1968	Electrical Connectors, Interstage (Separation Plane), S-II Airborne Systems, Assembly of
MA0303-1009E May 29, 1968	Connector, Electrical Umbilical, Saturn S-II Airborne Systems, Assembly of
MA0303-1026E January 2, 1969	Connector, Electrical, Low Temperature (-300 F) MS Type S-II Airborne Systems, Assembly of
MA0303-1049A October 5, 1967	Electrical Bonding, S-II Stage Systems Procedure for
MA0313-1001J November 16, 1968	Wiring, Saturn S-II, Installation of General Specification for

SCN 232

Number and Date	Title
MA0313-1001J 16 November 1968	Wiring, Saturn S-II, Installation of General Specification for
MA0313-1002E 30 September 1966	Coaxial Cables and Connectors, S-II Airborne Systems, Assembly of
MA0313-1009B 20 June 1968	Coaxial Cables, ME411-0127 and Connectors, V7-750203 and V7-740204, Electrical, Instrumentation, Saturn S-II Flight Stage

SCN 179

Number and Date	Title	
MA0313-1010B May 2, 1969	Cable Assembly, Electrical, Extreme Environment, Fabrication of	SCN 259
MA0313-1012C May 2, 1969	Cable Assembly, Electrical, Coaxial, Fabrication of	SCN 260
MA0601-001A November 15, 1968	Installation of Conventional Rivets and Blind Fasteners for Saturn S-II (Supersedes MA0101-006 for S-II)	
MA0601-002E June 4, 1968	Installation of Threaded and Collared Fasteners for Saturn S-II (Supersedes MA0101-005 for S-II)	
MA0601-003B December 2, 1965	Installation of Thinwall Screw Thread Inserts (Supersedes MA0101-009 for S-II)	
MA0601-004 February 22, 1966 Amendment MD-1 September 16, 1966	Installation of LOX Tank Dollar Weld Reinforcing Doublers and Interference Fit Huckbolts for Saturn S-II	
MA0602-002 May 7, 1965	Forming Aluminum Alloy at High Temperature	
MA0602-003 May 12, 1965	Cold Straightening and Steel Parts for the Saturn S-II Program (Supersedes LA0102-002 for S-II)	

Number and Date	Title
MA0605-001C July 1, 1966 Amendment MD-1 March 24, 1967 Amendment MD-2 May 1, 1967	Fabricating of Multicore Sandwich Base Heat Shields for use on the Saturn S-II
MA0605-002A November 19, 1965	Fabrication of Saturn S-II Base Heat Shield Flexible Curtains
MA0605-003G November 2, 1965	Fabrication of Phenolic-Nylon Laminate-Faced Honeycomb Panels and Details for Insulating Cryogenic Fluid Tankage
MA0605-004F October 13, 1965	Fabrication of Double Seal Cryogenic Sidewall Insulation for the Saturn S-II Hydrogen Tank
MA0605-006A June 28, 1966 Amendment MD-1A November 1, 1966 Amendment MD-2 December 16, 1966	Fabrication of Glass-Phenolic Laminate-Faced Honeycomb Panels and Details for Insulating Cryogenic Fluid Tankage - Saturn S-II Program (Supersedes MA0105-022 for S-II)
MA0605-013A November 24, 1966 Amendment MD-1 April 24, 1967	Fabrication and Installation of Saturn S-II Membrane Seal

SCN 481

Number and Date	Title	
MA0606-007A 9 November 1964	Potting, Electrical Power Distributor, Saturn S-II	
MA0606-013E 2 December 1966 Amendment MD-1 17 April 1967	Adhesive Bonding the Saturn S-II Common Bulkhead (Supersedes MA0106-028 for S-II)	SCN 57B.4 to 367B
MA0606-016B 19 April 1966	Casting Electronic Module Assemblies for Saturn S-II Program (for the Saturn Program, use this specification in place of MA0106-029 and MA0606-015)	
MA0606-022B 16 March 1966	Potting of Electrical Wiring in Cryogenic Valves—Saturn S-II Program	
MA0606-027B 17 March 1966	Application of Nylon-Phenolic HRP Foam - Filled Core Sandwich Composite Cryogenic Insulation on Saturn S-II	
MA0606-028A 15 September 1965	Application of Double Seal Insulation Panels and Details to Cryogenic Fluid Tankage	

Number and Date	Title	
MA0605-014C January 18, 1968	Fabrication of Nylon Reinforced Polyurethane Laminates for Sealing Applications - Saturn S-II Program	
MA0605-015A August 10, 1967 Amendment MD-1 October 9, 1967	Spray Application of Ablative Insulation Compound to the Base Heat Affected Surfaces to the Aft Interstage Structure - Saturn S-II	
MA0605-016 February 3, 1967	Fabrication and Application of a LOX Compatible Cryogenic Insulation System Saturn S-II Program	
MA0605-017B October 11, 1967	Fabrication and Insulation of LOX Compatible Insulation for Cryogenic Surfaces - Saturn S-II	
MA0606-013E December 2, 1966 Amendment MD-2 May 6, 1968	Adhesive Bonding the Saturn S-II Common Bulkhead (Supersedes MA0106-028 for S-II)	
MA0606-027D September 29, 1967	Application of Nylon-Phenolic HRP Foam - Filled Core Sandwich Composite Cryogenic Insulation on Saturn S-II	SCN 80
MA0606-028A September 15, 1965	Application of Double Seal Insulation Panels and Details to Cryogenic Fluid Tankage	
MA0606-033E August 28, 1967	Fabrication of S-II Bolting Ring Thermal Insulation	SCN 77

Number and Date	Title	
MA0607-004D 6 July 1966 Amendment MD-1 30 January 1967	Fusion Welding of Iron, Nickle, and Cobalt Base Alloys for the Saturn S-II Vehicle	
MA0607-009 5 June 1964	Resistance Welding of Electronic Modules and Electrical Connections for Saturn S-II (Note: Supersedes MA0107-014B, for applications beyond EMM and Battleship) (Supersedes MA0107-014 for S-II)	
MA0607-010A 16 February 1965	Percussion Stud Welding for the Saturn S-II Program (Supersedes MA0107-020 for S-II)	
MA0607-013B 10 August 1965	Soldering Aluminum and Steel for Sealing Aerospace Systems (Supersedes MA0107-018 for S-II)	
MA0607-017B 6 November 1967	Manual Fusion Welding of Aluminum Alloys for Saturn S-II Vehicle	SCN 109 to 3670

Number and Date	Title
MA0606-038E November 3, 1967	Application of Composite Sealants - Saturn S-II Program
MA0606-039C June 22, 1968	Installation of Inserts in Cryogenic Insulation - S-II
MA0606-042B July 21, 1966 Amendment MD-1B September 30, 1967	Application of Flexible Closeout Seals to Foam Filled Honeycomb Cryogenic Sidewall Insulation Surfaces - Saturn S-II
MA0606-043D November 25, 1968	Foam-in-Place Insulation of Liquid Hydrogen System Components
MA0606-044B September 20, 1967	Installation of Saturn S-II Forward Skirt Insulation
MA0606-045C July 18, 1967	Spray Application of Polyurethane Foam Material, for Saturn S-II
MA0606-047C August 21, 1968 Amendment MD-1 December 18, 1968	Application of Insulation on the Saturn S-II Aft Skirt, Interstage and System Tunnel Structures — SCN 230
MA0606-049B 23 September 1968 Amendment MD-1 January 15, 1969	Emergency Repair Procedures for Sidewall Honecomb Insulation for Saturn S-II

Number and Date	Title
MA0610-002B 20 June 1966 Amendment MD-1 26 October 1966	Surface Preparation for Adhesive Bonding and Application of Chemical Films for Saturn S-II (for use at Saturn S-II Seal Beach Facility only) (Supersedes MA0109-003 for S-II)
MA0610-005D 12 November 1964	Cleanliness Requirements for Saturn S-II Hydraulic System Components
MA0610-020A 16 December 1964	Cleaning and Cleanliness Requirements for Saturn S-II Wire Mesh Filter Elements

Number and Date	Title
MA0606-050G February 7, 1969	Spray Application of Two Pound Density Polyurethane Foam Material, for Saturn S-II
MA0606-052B January 17, 1969	Application of Primer, 205F Curing for Saturn S-II
MA0606-053A September 18, 1967 Amendment MD-1A June 14, 1968	Application of Cork Insulation on Exterior Surfaces of Saturn S-II Aft Skirt and Interstage
MA0606-054A April 16, 1969	Application of Seal Lock and Retaining Compounds to Thread Fasteners SCN 237R1
MA0606-056 April 15, 1968	Application of Adhesive Primer on the LH_2 Side of Saturn S-II Common Bulkhead for Corrosion Protection
MA0606-057C February 7, 1969	Repair Procedure for Spray Foam Insulation for Saturn S-II at Field Sites
MA0606-059 January 13, 1969	Application of room temperature curing, corrosion preventive, cryogenically compatible primer, Saturn S-II program
MA0607-003F August 15, 1966 Amendment MD-1 April 27, 1967	Machine Fusion Welding of Corrosion Resistant Steel Tube Joints for the Saturn S-II Vehicle and Associated GSE
MA0607-004E September 29, 1967	Fusion Welding of Iron, Nickel, Cobalt and Titanium Base Alloys for the Saturn S-II Vehicle
MA0607-010B May 17, 1968	Percussion Stud Welding for the Saturn S-II Program (Supersedes MA0107-020 for S-II)

Number and Date	Title	
MA0615-003L 4 August 1966 Amendment MD-1 6 February 1967 Amendment MD-2 15 May 1967	Leak Detection—Saturn S-II Stages (Supersedes MA0615-009 for S-II)	SCN 245 to 367B SCN 22
MA0615-010 17 February 1966	Leak Detection—Saturn S-II Aft LO_2 Bulkhead Doubler	
MA0616-016B 23 August 1966	Clean Packaging Requirements for Saturn S-II Liquid and Gaseous Oxygen System Components	

Number and Date	Title
MA0607-017B November 6, 1967	Manual Fusion Welding of Aluminum Alloys for Saturn S-II Vehicle
MA0607-022A April 15, 1966	Manual Fusion Welding of Magnesium Alloys for Saturn S-II Vehicle
MA0608-001B November 24, 1965 Amendment MD-1A December 29, 1966	Application of Organic Finishes to Saturn S-II Stage and GSE (Supersedes MA0108-005 for S-II)
MA0608-009C March 20, 1968	Application of Organic Coats to S-II Stage Hydraulic Tank, J Section
MA0608-012 March 22, 1966	Application of Color Coat to Silicone Rubber Sealant - S-II Stage
MA0608-014A June 28, 1967	Application of Moisture Barrier Coating to the Saturn S-II Foam Thermal Insulation
MA0608-015B July 15, 1968	Application of Coatings to Saturn S-II Foam Insulation
MA0609-007C May 10, 1968 Amendment MD-1 October 24, 1968	Corrosion Control of Aluminum Alloy Components of Saturn S-II Stage

SCN 167R1

Number and Date	Title
MA0609-009 January 24, 1969 Amendment MD-1 February 25, 1969	Corrosion Control-Saturn S-II Stage
MA0609-010 May 29, 1969	Corrosion Control of Saturn S-II Stage-Oriented Used GSE SCN 234R2
MA0610-001D February 1, 1968 Amendment MD-1 November 1, 1968 Amendment MD-2 January 7, 1969	Methods of Cleaning and Cleanliness Requirements for Saturn S-II Fuel and Oxidizer Tanks
MA0610-002C September 28, 1967	Surface Preparation for Adhesive Bonding and Application of Chemical Films for Saturn S-II (for use at Saturn S-II Seal Beach Facility only) (Supersedes MA0109-003 for S-II)
MA0610-005D November 12, 1964	Cleanliness Requirements for Saturn S-II Hydraulic System Components
MA0610-020A December 16, 1964	Cleaning and Cleanliness Requirements for Saturn S-II Wire Mesh Filter Elements
MA0610-023B January 17, 1968	Surface Preparation of Metals and Non-Metals for Adhesive Bonding-Saturn S-II Program (Supersedes MA0110-024 for S-II)
MA0610-024C July 13, 1966 MD-1 September 6, 1967	Contamination Control - Saturn S-II Stage, Parts, Subassemblies and Assemblies, Including Group Support Equipment

Number and Date	Title
MB0120-026A 26 April 1965	Adhesive, Elevated and Cryogenic Temperature Resistant (-423 to 500 F) Thixotropic Paste Type

Number and Date	Title	
MA0610-026B November 6, 1967 Amendment MD-1 June 20, 1968	Contamination Control at Field Sites - Saturn S-II	
MA0610-028 July 2, 1968	Solvent Vapor Degreasing	
MA0611-002C December 20, 1966	Heat Treatment of Nickel and Cobalt Base Alloys for the Saturn S-II (Supersedes LA0111-015 for S-II)	
MA0611-004B March 21, 1966	Heat Treatment of Ferrous and Non-Ferrous Alloys-General (Saturn S-II Program) (Supersedes MA0111-001 for S-II)	
MA0611-005 April 30, 1965	Heat Treatment of Titanium Alloy Sheet and Plate for Saturn S-II	
MA0611-006 March 24, 1965	Heat Treatment of Copper and Copper Alloys	
MA0611-008B July 24, 1967 Amendment MD-1 December 5, 1967	Heat Treatment of 7075 Aluminum Alloy to the -T73 Temper for the Saturn S-II Program	
MA0613-006E August 10, 1967 Amendment MD-1B April 10, 1969	Installation of Aerospace Ground Equipment Wiring for Saturn S-II Programs	SCN 134R2
MA0615-003L August 4, 1966 Amendment MD-1 February 6, 1967 Amendment MD-2 May 15, 1967 Amendment MD-3 April 2, 1969	Leak Detection - Saturn S-II Stages (Supersedes MA0615-009 for S-II	
MA0613-011 April 10, 1969	Assembly and Installation of Parallel Connectors for Saturn S-II GSE	SCN 227R1

Number and Date	Title	
MA0615-005C May 4, 1967	Corrosion Control During Hydrostatic Testing of Saturn S-II Stage, Bulkheads and Subassemblies	
MA0615-010 February 17, 1966 Amendment MD-1 December 19, 1966	Leak Detection - Saturn S-II Aft LO_2 Bulkhead Doubler	SCN 85
MA0616-016B August 23, 1966 Amendment MD-1A October 4, 1967	Clean Packaging Requirements for Saturn S-II Liquid and Gaseous Oxygen System Components	SCN 19
MA0618-001A November 24, 1965	Shop Peening of Saturn S-II Parts (Supersedes LA0118-001 for S-II)	
MA0621-001C May 10, 1968	Finish Specification - Saturn S-II Stage	

CONTRACTOR MATERIAL SPECIFICATIONS

Number and Date	Title
MB0100-002F September 6, 1967	Material Substitutions for Steels and Heat Resistant Alloys
MB0100-003H October 14, 1966	Substitution of Temper Conditions, Form, and Size for Aluminum Alloy
MB0110-002G May 9, 1966	Nitrogen, Liquid and Gas
NB0110-003B January 15, 1968	Helium Gas
MB0110-004F October 25, 1966	Oxygen-Compatible Materials
MB0110-008B March 14, 1969	Compatibility of Materials With Titanium SCN 249
MB0120-024B October 28, 1965	Adhesive, Polyurethane, Low-Temperature Curing for Cryogenic Usage

Number and Date	Title
MB0120-042D July 18, 1967	Primer, Low Temperature Curing, for Usage from -423 to 120 F
MB0125-006D April 30, 1965	Primer, Epoxy-Polyamide, Air Drying
MB0125-019E November 30, 1966	Coating, Polyester, Light-Diffusing
MB0125-023B April 12, 1965	Enamel, Alkalyd, Lusterless
MB0125-027B August 31, 1965	Finish System, Epoxy-Amine Primer and Gloss Enamel
MB0125-044B June 28, 1967	Coating, Moisture Barrier, Foam Insulation
MB0125-045A July 15, 1968	Polyurethane Coating, for Foam Insulation
MB0125-046 December 15, 1967	Coating, Vinyl, Top Coat for Foam Insulation
MB0125-047 November 8, 1968	Primer, Epoxy Amine, Corrosion Preventive Cryogenically Compatible

Number and Date	Title
MB0130-023B July 22, 1964	Nylon Fabric, Pnenolic Resin Preimpregnated
MB0130-024D May 27, 1966	Film, Plastic, Gas Permeability Barrier
MB0130-069B May 22, 1968	Low Density Rigid Polyurethane Foam-in-Place Material for Cryogenic Insulation
MB0130-074A August 10, 1967	Spray Type Ablative Insulation Compound, High Temperature Resistant
MB0130-075D July 18, 1967	Polyurethane Foam, for Spray Application
MB0130-078A July 18, 1967	Fabric, Nylon, Polyurethane Coated
MB0140-001B April 28, 1965	Sealing and Anti-Seize Compound, Gasket and Thread, for Liquid Oxygen Service
MB0150-044A September 29, 1967	Weldable Lead and Interconnect Material for Electronic Components

SCN 180R1

Number and Date	Title	
MB0160-001C May 1, 1968	Steel 17-4PH Corrosion Resistant Sheet and Plate	
MB0160-003C December 29, 1965	Steel, 17-4PH Corrosion Resistant Bar, Extrusions, and Forgings	
MB0160-006E December 18, 1964	Maraging Steel: Bar, Extrusions, and Forgings, Precipitation Hardening (18Ni - 9Co - 5Mo - 0.5Ti-0.10AI)	
MB0160-007G December 3, 1964	Tubing, Steel Alloy, Corrosion Resistant, Type 304L	
MB0160-009A March 9, 1965	Bolts and Screws, Corrosion Resistant, A-286 Alloy	SCN 157
MB0160-018E March 1, 1968	Steel, 17-4PH Corrosion Resistant Bar, Extrusions and Forgings for Optimum Impact Properties	
MB0160-020F March 5, 1968	Heat and Corrosion Resistant Steel Bar, Extrusions, Forgings and Forging Stock, AISI Type 304L, Consumable Electrode Melted	
MB0160-021A December 18, 1964	Steel Bar, AISI Type 440C, Consumable Electrode Vacuum Melted	SCN 157
MB0160-030 February 25, 1965	Bolts, Screws, Steel, Corrosion, Heat Resistant, A-286, 145,000 PSI Minimum	SCN 157

Number and Date	Title	
MB0170-029B 9 November 1965	Aluminum Alloy Tens 50 Sand Castings	
MB0170-030A 9 November 1965	Aluminum Alloy A356 Sand and Permanent Mold Castings	
MB0170-040E March 11, 1968	Inconel 718 Alloy Sheet, Strip and Plate: Consumable Electrode, Vacuum Melted	SCN 166

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Number and Date	Title
MB0160-031C March 1, 1968	Steel, Sheet and Plate, PH15-7Mo, Corrosion Resistant, Precipitation Hardening
LB0160-107A December 11, 1962	Steel, Corrosion Resistant Bar, Extrusions, Forgings and Forging Stock, (355 Alloy)
LB0160-116 March 24, 1959	Steel; Bar, Forging, Forging Stock and Mechanical Tubing, 280-300,000 Oil Hardening
LB0160-123 June 2, 1961	Steel, Extruded Bar, Shapes, PH15-7Mo, Corrosion Resistant, Precipitation Hardening
MB0170-002K October 8, 1968	Aluminum Alloy Sheet, 2014, Bare
MB0170-003D July 14, 1965	Weldable Hand Forgings, 2014-T462, Aluminum Alloy
MB0170-012C September 23, 1966	Inconel 718 Alloy, Bar, Forgings and Forging Stock: Consumable Electrode, Vacuum Melted
MB0170-016B May 19, 1965	Aluminum Alloy 7079-T652 Hand Forgings

SCN 216

Number and Date	Title
MB0170-021F July 15, 1968	Aluminum Alloy, 2014 Bare As-Rolled Plate
MB0170-028B November 12, 1965	Aluminum Alloy Tens 50 Permanent Mold Castings
MB0170-029B November 9, 1965	Aluminum Alloy Tens 50 Sand Castings
MB0170-030A November 9, 1965	Aluminum Alloy A356 Sand and Permanent Mold Castings
MB0170-031B May 4, 1966	Inconel 718 Alloy Sheet, Strip and Plate; Consumable Electrode, Vacuum Method, Solution Annealed at 1800 F
MB0170-035A December 19, 1964	Castings, Nickel-Molybdenum Iron Alloy Corrosion, Heat Resistant
MB0170-040F June 11, 1968	Inconel 718 Alloy Sheet, Strip and Plate: Consumable Electrode, Vacuum Melted

SCN
226R1

Number and Date	Title
MQ0501-010B 19 April 1967	Inspection, Ultrasonic
MQ0501-012A 8 April 1964	Determination of Contamination Using High Pressure Filter Holder

Number and Date	Title
MB0170-042 December 14, 1964	Titanium Alloy (6Al-4V) Bar, Billet Rings, and Hand Forgings for Saturn S-II (Supersedes LB0170-110 for S-II)
MB0170-045A November 9, 1965	Magnesium Alloy - AZ91C Sand and Permanent Mold Castings
MB0170-047F September 26, 1966	Aluminum Alloy, 2020, Bar, Rod and Extruded Shapes
MB0170-048B February 15, 1968	Aluminum Alloy Forgings
MB0170-057A June 10, 1966	Aluminum Alloy 7075-T73 and -T7351, Sheet and Plate
MB0170-058B August 14, 1967	Aluminum Alloy 7075-773-T73510 and T73511 Bar, Rod, Shapes and Tube, Extruded
MB0170-063C November 16, 1967	Aluminum Alloy, 2014 Bare As-Rolled Plate, Optimum Quality
MB0170-064 March 3, 1969	Inconel 718 Alloy Bar, Forging and Forging Stock, Solution Annealed at 1875 to 1950F SCN 226R1
LB0170-138C April 8, 1965	Titanium Alloy (6Al-4V) Closed Die Forgings
MB0210-004A March 23, 1965	Cleaner, Alkaline, Non-Silicated Low-Foaming

Number and Date	Title
MB0210-005B February 8, 1965	Cleaning Agent, 1, 1, 2-Trichloro -1, 2, 2 Trifluoroethane
MB0210-006C January 30, 1968	Fluorescent Penetrant Inspection Materials, Oxidizing Agent Compatible
AB0210-009C September 1967	Trichloroethane, 1, 1, 1; Inhibited Instrument Grade
MB0295-005C January 31, 1967	Material Cleanliness Level, Precision Clean Packaging
MB0295-006C January 31, 1967	Film, Transparent, Precision Clean Package
MQ0103-001F July 1, 1968	Process Control for Adhesive Bonding of Structural and Non-Metallic Parts
LQ0201-003B August 24, 1964	Quality Control Requirements for Thermal Processing
MQ0302-001A December 8, 1966	Process Control for Fabrication of Reinforced Plastic Parts

Number and Date	Title
MQ0501-004G August 23, 1966	Inspection, Penetrant Method
MQ0501-007H November 15, 1967	Inspection, Radiographic
MQ0501-008C February 27, 1967	Nondestructive Testing Requirements for Materials and Processed Parts
MQ0501-009A March 11, 1966	Magnetic Particle Inspection
MQ0501-010C April 17, 1968	Inspection, Ultrasonic
MQ0501-034A February 3, 1967	Production Ouality Verification (POV) Testing of Organic Materials Used on Saturn S-II Vehicles and Sub-Assemblies
MQ0501-035 April 22, 1968	Inspection, Acoustic Brush
MQ0701-005F October 2, 1967	Qualification, Calibration and Verification of Tools or Tools for Crimping Solderless Electrical Connectors SCN 96
ST0110GA0002C June 28, 1967	Solvent Vapor Degreasing
ST0210GB0002 May 25, 1967	Trichlordethane 1, 1, 1 Stabalized Vapor Degreasing and Solvent Flushing Grade

V. NR SPECIFICATIONS NOT REQUIRING MSFC FORMAL CHANGE CONTROL APPROVAL

The following NR process, material, and quality control specifications do not require contract approval.

MA0101-002	MA0105-043	MA0112-002
MA0101-004	MA0105-046	MA0112-006
MA0101-007	MA0105-047	MA0112-008
MA0101-008	MA0105-048	MA0113-002
MA0101-010	MA0105-050	MA0113-012
MA0101-012	MA0106-003	MA0113-013
MA0101-013	RA0106-003	MA0113-014
MA0101-014	MA0106-008	MA0113-015
MA0102-001	MA0106-009	MA0113-016
MA0102-002	MA0106-010	MA0113-017
MA0102-004	MA0106-019	MA0113-019
MA0102-009	LA0106-021	MA0115-006
MA0102-011	MA0106-021	MA0115-011
MA0103-001	MA0106-028	MA0115-012
MA0103-003	MA0106-031	MA0115-015
MA0103-004	LA0106-033	AA0115-024
MA0103-005	MA0106-035	MA0115-025
MA0103-006	MA0106-036	MA0115-026
LA0103-006	MA0106-038	AA0115-059
MA0103-007	MA0106-047	MA0116-002
MA0103-008	MA0106-048	LA0116-003
MA0103-009	MA0106-053	MA0116-011
MA0103-010	MA0106-054	MA0116-013
LA0103-013	MA0106-055	MA0116-016
LA0104-003	MA0106-057	MA0116-017
MA0104-003	MA0106-061	MA0116-027
MA0104-006	MA0106-069	MA0116-030
MA0104-009	MA0107-003	MA0116-031
MA0104-010	MA0107-010	MA0116-032
MA0104-011	MA0107-014	MA0116-033
MA0104-013	MA0107-027	MA0116-034
MA0104-014	MA0107-028	MA0116-037
MA0104-015	MA0108-017	MA0116-038
MA0104-016	MA0108-023	
MA0104-017	MA0109-002	MA0120-002
MA0104-018	MA0109-003	MA0301-1006
MA0104-019	HA0109-006	MA0301-1008
MA0104-020	LA0109-017	MA0301-1012
MA0105-008	AA0110-002	MA0303-022
MA0105-031	MA0110-017	MA0303-026
MA0105-034	MA0110-019	MA0303-028
MA0105-035	MA0110-028	MA0303-1002
MA0105-038	MA0111-010	MA0303-1027
MA0105-040	MA0111-012	MA0303-1029

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MA0303-1036
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MA0605-018
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MB0150-016			MB0295-003	
MB0150-021			MB0295-004	
MB0150-025			MB0295-007	
MB0150-028			MB0295-008	
MB0150-036			MB0295-009	
MB0150-037			MB0295-010	
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MB0160-012			HQ0501-002	
MB0160-016			MQ0501-002	
MB0160-019			MQ0501-012	
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LB0160-124			MQ0501-015	
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MB0170-013	SCN 143		GQ0503-002	
MB0170-014			MQ0701-001	
MB0170-015			MQ0701-003	
MB0170-019			MQ0701-004	
MB0170-022			GQ0802-001	
MB0170-027			MQ0802-001	
MB0170-038			MQ0802-002	
MB0170-044			PR5-14	SCN 157
RB0170-044			ST0105GA0001	
MB0170-049			ST0109GA001	
MB0170-050	SCN 143		ST0210GB0002	SCN 157
MB0170-056			ST0225GB0001	
LB0170-124				
LB0170-131				
MB0190-001				
MB0190-003				
MB0190-004				
MB0210-001	SCN 157			
MB0210-002				
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MB0210-015				
LB0210-109				
MB0225-001				

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All information on Page 282 deleted. See Page D-1.

APPENDIXES

APPENDIX A. CROSS-REFERENCE INDEXES OF DEVIATIONS FROM S-II STAGE DOCUMENTS

Appendix A consists of the following indexes:

1. Alpha-numerical by document
2. Deviation number to CSA or SCN number
3. CSA or SCN number to deviation number

Deviations indicated by (*) were approved during the original contract negotiations, and therefore do not have a CSA number. (This appendix exists only for reference purposes and does not form a part of SID 61-367.)

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ABMA-DWG-10509313	153	310	11
ABMA-DWG-10509313 (3.6.1)	319	174	12
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ABMA-PD-C-711A	146	303	13
ABMA-PD-C-711A (3.5.2)	8	*	13
ABMA-PD-E-53	143	300	14
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	336	114	14a
ABMA-PD-E-53 (3.1.6)	70	*	14a
ABMA-PD-E-53 (3.1.9)	71	*	15
ABMA-PD-E-53 (3.1.9)	106	224	16
ABMA-PD-E-53 (3.2.3 and Fig. 1)	72	*	15
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ABMA-PD-E-53 (3.2.3.2)	74	*	16
ABMA-PD-E-53 (3.2.3.3)	75	*	16
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305	1190	89
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Appendix B consists of the following indexes:

1. Alpha-numerical by specification
2. Deviation number to CSA or SCN number
3. CSA or SCN number to deviation number

Deviations indicated by (*) were approved during the original contract negotiations, and therefore do not have a CSA number. (This appendix exists only for reference purposes and does not form a part of SID 61-367.)

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1.	QQ-P-416A	Plating, Cadmium (Electrodeposited)
	MA0109-006	Cadmium Plating - Cyanide Process)
	MA0109-008	Cadmium Plating - Fluoborate Process)
2.	MIL-B-5087A(1)	Bonding, Electrical (for Aircraft)
	MA0613-004	Bonding, Electrical, Aerospace, Ground Equipment
3.	MIL-P-5514D	Packings, Installation and Gland Design, Hydraulic, General Specification for
		(No comparable NAA specification)
4.	MIL-C-5541(1)	Chemical Films for Aluminum and Aluminum Alloys
	MA0109-003	Application of Chemical Films to Aluminum and Aluminum Alloys
	MA0610-002	Surface Preparation for Adhesive Bonding and Application of Chemical Films for Saturn S-II Details
5.	MIL-E-5556A	Enamel, Camouflage, Quick-Drying
		(No comparable NAA specification)
6.	MIL-E-5606A(1)	Hydraulic Fluid, Petroleum Base, Aircraft and Ordnance
		(No comparable NAA specification)
7.	MIL-N-6011	Nitrogen, Liquid and Gas
	MB0110-002	Nitrogen, Liquid and Gas
8.	MIL-W-6858B	Welding, Resistance: Aluminum, Magnesium, Non-hardening Steels or Alloys, Nickel Alloy Heat-Resisting Alloys, and Titanium Alloys; Spot and Seam
	MA0107-002	Resistance Welding
9.	MIL-W-6873A	Welding; Flash, Carbon and Alloy Steels
		(No comparable NAA specification)

10.	MIL-T-7081C	Tube, Aluminum Alloy, Seamless, Round, 6061 and 6062; Aircraft Hydraulic Quality
		(No comparable NAA specification)
11.	MIL-B-7883(1)	Brazing of Steels, Copper, Copper Alloys, and Nickel Alloys
	MA0107-003	Silver Alloy Brazing
	MA0107-013	Brazing, High Temperature (Above 1700 F)
12.	MIL-P-8585A	Primer Coating Zinc Chromate, Low-Moisture Sensitivity
		(No comparable NAA specification)
13.	MIL-A-8625A	Anodic Coatings for Aluminum and Aluminum Alloys
	MA0109-009	Chromic Acid and Sulphuric Acid Anodizing
14.	MIL-T-8808A	Tubing, Steel, Corrosion-Resistant (18-8 Stabilized), Aircraft Hydraulic Quality
		(No comparable NAA specification)
15.	MIL-P-25732A	Packing, Preformed, Petroleum Hydraulic Fluid Resistant, 275 F
		(No comparable NAA specification)
16.	ABMA-PD-C-4	Cleaning and Conditioning of Metallic and Non-Metallic Surfaces
	MA0110-011	Cleaning of Aluminum and Aluminum Alloys
	MA0110-012	Cleaning Ferrous Alloys
	MA0110-013	Descaling and Passivation of Corrosion and Heat Resistant Alloys
	MA0110-014	Cleaning and Protective Treatment of Magnesium Alloys
	MA0110-019	Cleaning of Copper and Copper Alloys
	MA0110-030	Cleaning Plastic, Glass and Elastomeric Materials
17.	MSFC-SPEC-164(1)	Cleanliness of Components for Use in Liquid Oxygen, Fuel, and Pneumatic Systems, Specification for
	MA0601-008	Cleanliness Requirements for Saturn S-II Liquid O_2 and Liquid H_2 Fuel and Pneumatic Systems and Components
	MA0115-005	Testing Compatibility of Materials for Liquid Oxygen Systems

	MA0117-001	Handling Hazardous Cleaning
	MA0110-018	Cleaning Components of Propellant, Pressurizing and Circulating Systems
	MA0610-001	Cleaning Saturn S-II Fuel and Oxidizer Tanks
18.	ABMA-PD-W-45A	Welding, Fusion, Shielded Arc, Missile Components, Aluminum and Magnesium Manual or Automatic
	MA0107-016	Machine Fusion Welding of Aluminum Alloys for Saturn S-II Vehicle
	MA0607-017	Manual Fusion Welding of Aluminum Alloys for the Saturn S-II Vehicle
	MA0607-015	Fusion Welding of Saturn S-II GSE
19.	ABMA-PD-E-53	Electrical Wiring Procedures
	SID 62-1254	Wiring, Saturn S-II, Installation of, General Procedure for
	MA0113-013	Termination of Shields in Aerospace GSE for NASA Programs
	MA0613-006	Installation of Aerospace GSE Wiring for Saturn S-II
20.	ABMA-PD-W-488A	Welding, Stud, Aluminum Alloy, Process for (No comparable NAA specification)
21.	ABMA-PD-C-711A	Cable and Harness Assemblies, Electrical, Missile System: General Specification for
	SID 62-1254	Wiring, Saturn S-II, Installation of General Procedure for
22.	MSFC-PROC-158A	Soldering of Electrical Connections (High Reliability) Procedure for
	MA0107-010	Tinning and Soldering of Electrical and Electronic Components for Aerospace Projects
	MA0113-002	Electronic Components and Hardware, Mounting of, General Specification for
23.	MSFC MS005.0	Fabrication of Type 17-7 PH Stainless Steel
	MA0102-002	Standard Details for Metal Sheet, Plate, and Extrusions
	MA0103-005	Tolerances on Machined Parts
	MA0107-002	Resistance Welding
	MA0110-013	Descaling and Passivation of Corrosion and Heat-Resistant Alloys
	MA0607-084	Fusion Welding of Iron, Nickel, and Cobalt Base Alloys for the Saturn S-II Vehicle and Associated Ground Support Equipment

24.	MSFC MS005.1A	Fabrication of Type 410 Stainless Steel Sheet and Plate and Strip (No comparable NAA specification)
25.	MSFC MS200.2	Internal Protection of Stainless Steel Pipe and Tubing During Fusion Welding (No comparable NAA specification)
26.	MS260.0 MA0101-002	Insert, Helical Coil Thread, Installation of Installation of Helically Coiled Wire, Screw Threads, Inserts
27.	MS260.2 MA0601-001	Installation of Jo-Bolt Blind Hocking Fasteners Installation of Conventional Rivets and Blind Fasteners for Saturn S-II
28.	FED-STD-151A	Metals; Test Methods (No comparable NAA specification)
29.	MIL-STD-130B	Identification Markings of U.S. Military Property
	MA0104-003	Markings, Etched, Application of
	MA0104-009	Markings, Stencilled, Application of
	MA0104-010	Markings, Printed, Application of
	MA0104-011	Markings, Impression Stamped, Application of
	MA0106-008	Application of Metal Foil Nameplates
	MA0104-014	Application of Decalcomanias
	MA0104-015	Markings, Engraved, Application of
	MA0104-006	Fabrication of Metal Foil Nameplates
	MA0104-016	Application of Safety and Warning Markings on Fluid Gas Systems
	MA0104-017	Processing of Photographic Etched Aluminum Nameplates
	MA0104-018	Temporary Markings, Application of
30.	MIL-STA-171A	Finishing of Metal and Wood Surfaces (No comparable NAA specification)
31.	MS33540C MA0303-1002	Safety Wiring, General Practices for Safety Wiring, Saturn S-II Airborne Systems, Electrical Connectors, Procedure for
32.	MIL-STD-1247 MA0104-016	Colors, Fluid Line Identification Application of Safety and Warning Markings of Fluid and Gas Systems

33.	ABMA-STD-3(1)	Etching of Aluminum before Spotwelding
	MA0110-011	Cleaning of Aluminum and Aluminum Alloys
34.	ABMA-STD-428B	Printed Circuit Design and Construction Standard
	MB0130-002	Printed Circuit Boards, Copper Clad, Etched
35.	MSFC-STD-105A	Synthetic Rubber, Age Control of, Standard for
	MA0116-029	Age Control for Rubber Materials, NASA Applications
36.	ABMA DWG 10419901	Cleaning and Passivation of Bellows and Ducts, Procedure for
	MA0110-013	Descaling and Passivation of Corrosion and Heat-Resistant Alloys
37.	ABMA DWG 1050930	Riveting, Fabrication and Inspection, Standard for
	MA0601-001	Installation of Conventional Rivets and Blind Fasteners for Saturn S-II
38.	ABMA DWG 10509302	Packaging and Packing of Parts, Repair Parts, and Components for Space Vehicles, General Specification for
		(No comparable NAA specifications)
39.	ABMA DWG 10509313	Lubricant, Anti-Seize and Sealing, Liquid Oxygen Systems, Specification for
	MB0140-001	Sealing and Anti-Seize Compound, Gasket and Thread, for Liquid Oxygen Service
40.	MSFC-DWG 20M85015	Procedure for Cleaning, Testing and Handling of Onboard, Hydraulic System Components and MIL-H-5606
	MA0610-005	Cleanliness Requirements for Saturn S-II Hydraulic Components
	MA0110-001	Cleaning Hydraulic System Components
41.	MIL-HDBK-5	Strength of Metal, Aircraft Elements
		(No comparable NAA specification)
42.	ARP-598	Procedure for the Determination of Particulate Contamination of Hydraulic Fluids by the Particle Count Method
		(No comparable NAA specification)

43. ARP-599 — A Dynamic Test Method for Determining the Degree of Cleanliness of the Downstream Side of Filter Elements
(No comparable NAA specification)

44. ABMA 10509307 — Brazing, Silver, Specification for
MA0107-003 — Silver Alloy Brazing

45. ABMA 10509308 — Welding, Carbon, Low Alloy and Stainless Steel (Manual or Automatic) Specification for
MA0607-003 — Machine Fusion Welding of Corrosion Resistant Steel Tube Joints for the Saturn S-II Vehicle and Associated GSE
MA0607-004 — Fusion Welding of Iron, Nickel, and Cobalt Base Alloys for the Saturn S-II Vehicle

46. FED-STD-595 — Colors
(No comparable NAA specification)

47. MIL-STD-129C — Markings for Shipment and Storage
(No comparable NAA specification)

48. MSFC-STD-110A — Electrical Hardware, Equipment, Materials and Methods Used in Saturn GSE
MA0104-003 — Markings, Etched, Application of
MA0604-003 — Identification of Aerospace Ground, Equipment Wiring for NASA Programs
MA0104-009 — Markings, Stencilled, Application of
MA0104-010 — Markings, Printed, Application of
MA0104-011 — Markings, Impression Stamped, Application of
MA0104-013 — Preparation and Use of Silk Screens
MA0104-014 — Application of Decalcomanias
MA0106-008 — Application of Metal Foil Nameplates
MA0608-001 — Application of Organic Finishes to Saturn S-II Stage and GSE
MA0104-006 — Fabrication of Metal Foil Nameplates
MA0104-017 — Processing of Photographic Etched Anodized Aluminum Nameplates
MA0109-003 — Application of Chemical Films to Aluminum and Aluminum Alloys
MA0613-005 — Terminals, Crimp Style, Aerospace Ground Equipment, Installation of, for Saturn S-II
MA0613-006 — Installation of Aerospace Ground Equipment Wiring for Saturn S-II Program
MA0113-015 — Assembly of Electrical Connectors for Aerospace Ground Equipment

APPENDIX D

SUPERSEDED NR SPECIFICATIONS

MA0101-014 (Supersedes LA0101-006 for S-II)
MA0102-001 (Supersedes LA0101-002 for S-II)
MA0106-015 (Supersedes LA0106-034 for S-II)
MA0106-065 (Supersedes MA0105-045 for S-II)
MA0110-018 (Supersedes MA0610-008 for S-II)
MA0111-007
MA0111-008 (Supersedes LA0111-023 for S-II)
MA0111-009 (Supersedes LA0111-022 for S-II)
MA0601-001 (Supersedes MA0101-006 for S-II)
MA0601-002 (Supersedes MA0101-005 for S-II)
MA0601-003 (Supersedes MA0101-009 for S-II)
MA0602-001 (Supersedes LA0102-004 for S-II)
MA0602-003 (Supersedes LA0102-002 for S-II)
MA0604-003 (Supersedes MA0104-008 for S-II)
MA0605-006 (Supersedes MA0105-022 for S-II)
MA0606-013 (Supersedes MA0106-028 for S-II)
MA0606-016 (Supersedes MA0106-029 and MA0606-015 for S-II)
MA0607-009 (Supersedes MA0107-014 for S-II beyond EMM and Battleship)
MA0607-010 (Supersedes MA0107-020 for S-II)
MA0607-013 (Supersedes MA0107-018 for S-II)
MA0607-020 (Supersedes MA0107-026 for S-II)
MA0607-021 (Supersedes MA0107-030 for S-II)
MA0608-001 (Supersedes MA0108-005 for S-II)
MA0610-002 (Supersedes MA0109-003 for S-II for Seal Beach)
MA0610-021 (Supersedes MA0110-026 for S-II)
MA0610-023 (Supersedes MA0110-024 for S-II)
MA0611-002 (Supersedes LA0111-015 for S-II)
MA0611-004 (Supersedes MA0111-001 for S-II)
MA0613-006 (Supersedes MA0113-004 and MA0113-011 for S-II)
MA0615-003 (Supersedes MA0615-009 for S-II)
MB0120-041B (Supersedes AB0120-013 for S-II)
MB0120-047 (Supersedes MB0120-020 and MB0120-022 for S-II)
MB0120-048 (Supersedes MB0120-020 and MB0120-022 for S-II)
MB0170-042 (Supersedes LB0170-110 for S-II)