GEORGE C. MARSHALL SPACE FLIGHT CENTER

SA-203

SATURN

TECHNICAL INFORMATION HANDBOOK

by

Technical Writing and Handbooks Section

VOLUME III

OF FOUR VOLUMES

April 1, 1966

U. S. Government Agencies and Contractors Only

ENGINEERING DOCUMENTATION BRANCH
VEHICLE SYSTEMS DIVISION
PROPULSION AND VEHICLE ENGINEERING LABORATORY

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SATURN TECHNICAL INFORMATION HANDBOOK
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SATURN TECHNICAL INFORMATION HANDBOOK

INTRODUCTION

This four-volume handbook provides information for personnel concerned with the launch-site operations of the SA-203 vehicle. The material contained in this handbook is divided into five sections. The sections are described in the following paragraphs.

Section I provides general information on each stage of the vehicle. The section also describes briefly the ground support equipment, the vehicle electrical network, and the handling, transportation, and preservation of the vehicle.

Section II gives a detailed breakdown of the major systems and assemblies that make up the S-IB stage. The section is divided into 12 subsections, lettered A through H and J through M. An appendix follows subsystem M of Section II and provides: standard torque values for steel and aluminum hardware; torque values for critical joint assemblies; torque values for fasteners used on the H-1 engines; an illustrated list of standard plumbing hardware; an alphanumeric drawing number list, by systems, of components together with next higher assembly numbers, zone numbers, and finding numbers; and a listing, by next higher assembly drawing number, of the engineering orders that have been reviewed for impact on Section II.

Section III gives a detailed breakdown of the major systems and assemblies that make up the S-IVB stage.

Section IV covers the systems and instrument unit group assemblies of the S-IU stage.

Section V gives a description of the vehicle payload.

The five sections are divided among the four volumes. Section I and Section II-A through II-G are contained in Volume I; the remainder of Section II is in Volume II. Section III is contained in Volume III, and Sections IV and V are in Volume IV. All four volumes have an alphabetical index.

Index sheets with yellow tabs are used to separate the sections; index sheets with blue tabs are used to divide sections into major subsections.

Introduction

Illustrations and pages within each section are assigned alphanumeric designators. The letter portion of the designator identifies the subsection in which the illustration or page is located. All pages have the section number at the top of the page to prevent confusion if the pages are removed from the binders and mixed.

A brief table of contents appears with the introductory pages of this handbook. A more detailed table of contents pertaining to each particular section is included at the beginning of each section for convenience should the handbook be divided among various groups. A sectional list of illustrations is also provided at the beginning of each section.

A component callout list and find number system is used throughout the handbook as a means of reference.

Prefix letters used with the find number system are as follows:

S-IB Stage	B
S-IVB Stage	K
S-IU Stage	D
Payload	E

Identification numbers in the lower right-hand corner of illustrations are for art identification only.

GEORGE C. MARSHALL SPACE FLIGHT CENTER

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SATURN

TECHNICAL INFORMATION HANDBOOK

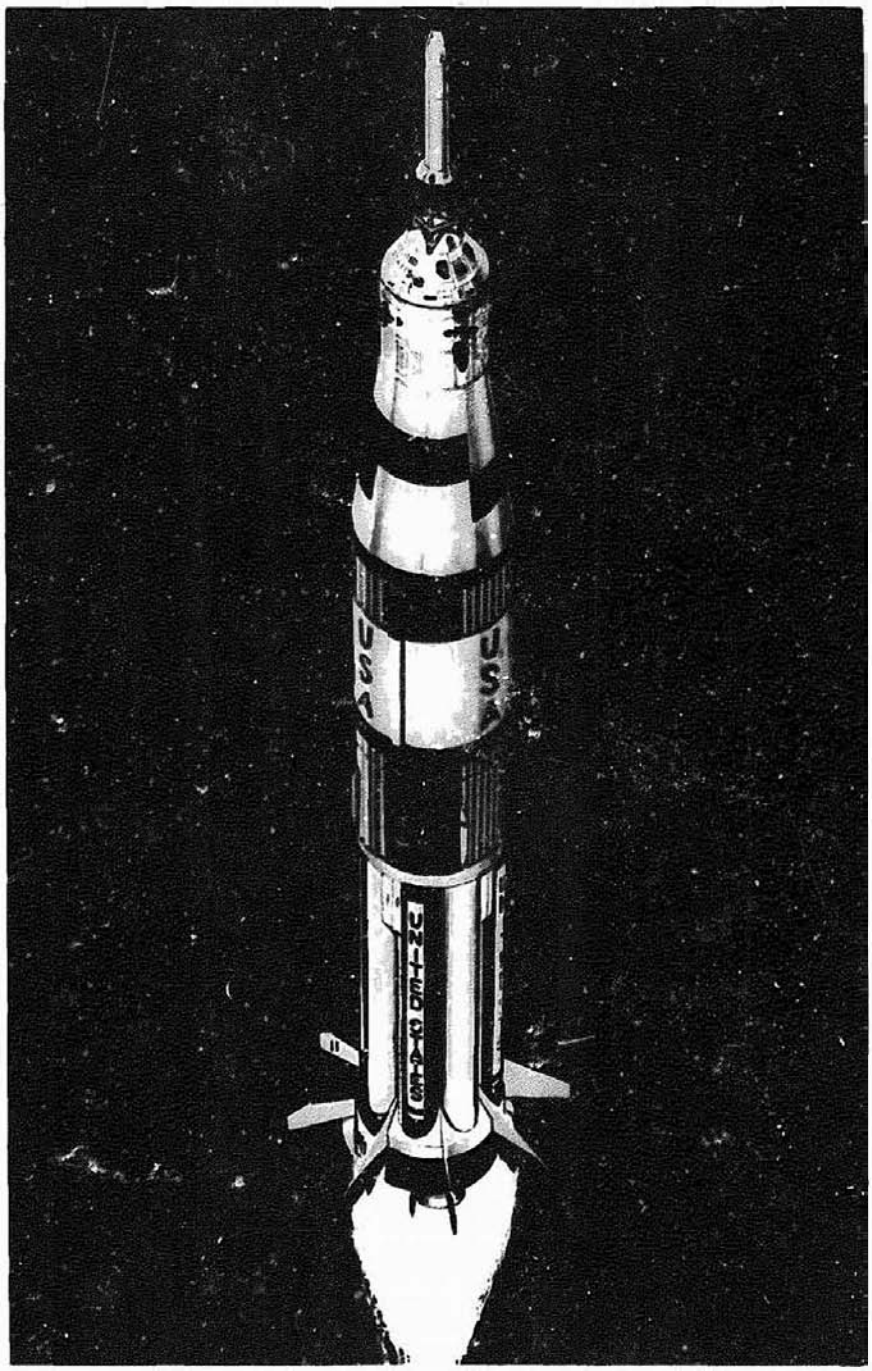
by

Technical Writing and Handbooks Section

ABSTRACT

The "Saturn Technical Information Handbook" provides up-to-date reference material to the Launch Operations Center personnel. This material shows the assembly and operation of the Saturn Vehicle components for systems analysis.

NASA



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S-IVB STAGE

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LIST OF ILLUSTRATIONS

LIST OF ILLUSTRATIONS (CONT.)

SECTION III

S-IVB STAGE

A. GENERAL

Section III contains data concerning the S-IVB stage, the aft interstage, and associated flight systems.

The propellant tank assembly, which is divided into a 291-m^3 (10,300-ft^3) LH_2 container and a 79-m^3 (2800-ft^3) LOX container by a common bulkhead, is the primary weight- and thrust-bearing structure of the S-IVB stage. The aft interstage, which attaches to the S-IB stage, and the aft skirt assemblies support the S-IVB stage during S-IB stage operation. During J-2 engine operation, the thrust structure assembly transfers the thrust to the tank assembly. The forward skirt assembly attaches to the instrument unit, supporting it and the payload.

The J-2 engine, mounted on the thrust structure, develops a thrust of 889,000 N (200,000 lb_f). A closed-loop hydraulic system gimbals the engine, controlling vehicle pitch and yaw. An auxiliary propulsion system, consisting of two modules mounted on the exterior of the aft skirt, provides vehicle roll control during powered flight and three-axis control during non-powered flight.

Pneumatic storage spheres and control panels for valve operation and propellant pressurization mount on the thrust structure. The majority of electrical system components mount in the forward and aft skirts. Tunnels on the tank exterior allow connection between components mounted in the skirt areas and connection between components located in the propellant containers and the other system components.

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B. UMBILICALS AND SERVICE POINTS

Umbilical panels and service points are presented to aid personnel during checkout and prelaunch operations. The umbilical panels are shown in figures B-1 and B-2.

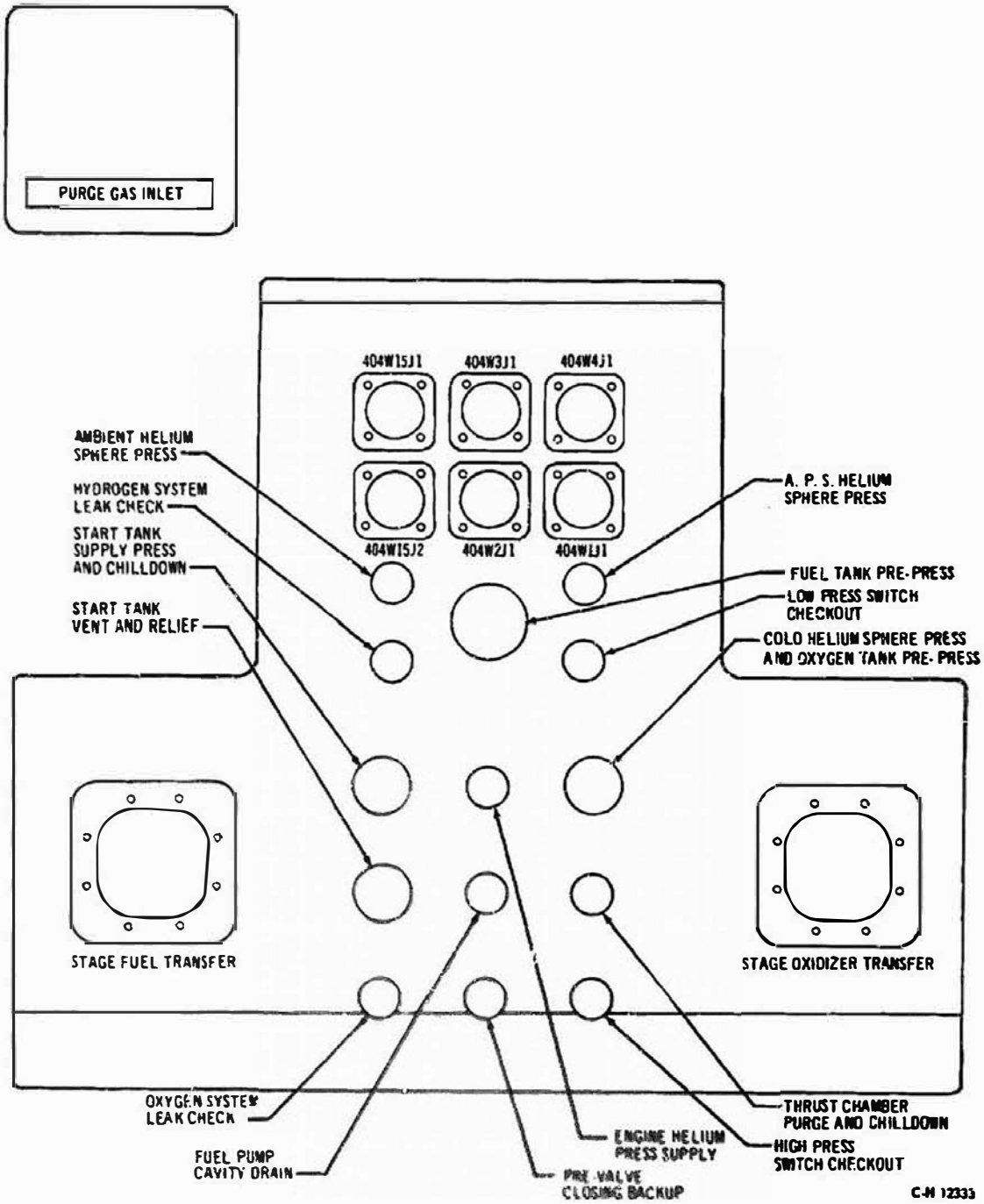

FIGURE B-1 AFT UMBILICAL

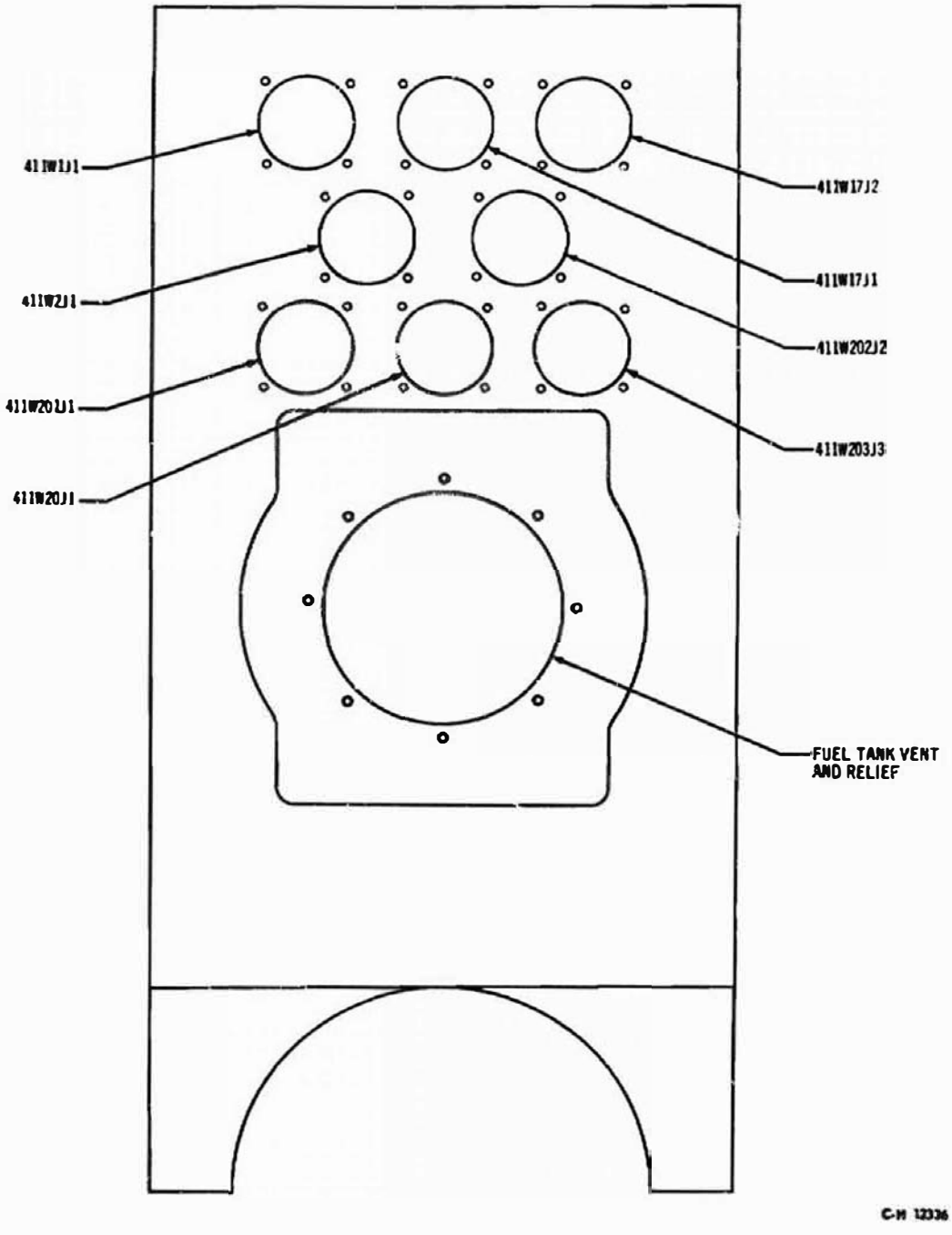

FIGURE B-2 FORWARD UMBILICAL

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C. PRIMARY PROPELLANT SYSTEM

The LOX and fuel containers, which are formed by a common bulkhead in the tank assembly, and associated ducts and valves provide for container fill and drain, venting and pressure relief, and propellant supply to the J-2 engine. Container propellant mass probes and a propellant utilization electronics assembly provide accurate level indications and regulate propellant residual at S-IVB cutoff. Container chilldown pumps circulate propellant through the feed ducts, chilling engine components prior to J-2 engine start.

Section III

PRIMARY PROPELLANT SYSTEM INFORMATION ILLUSTRATIONS

PRIMARY PROPELLANT SYSTEM CALLOUT LIST

FIND NO.	COMPONENT	PART NO.	PAGE
K1	Disconnect, LH_2 Fill and Drain	1A49978-503	C-12
K2	Valve, LH_2 Fill and Drain	1A48240-501	C-13
K3	Valve, LOX Tank Relief	1A49590-507	
K4	Valve, LOX Tank Vent and Relief	1A48312-501	C-14
K5	Valve, Relief, LOX Chilldown Pump		C-16
K6	Valve, Solenoid, LOX Chilldown Pump	1A67913-1	C-15
K7	Pump, LOX Chilldown	1A49423-503	C-16
K8	Valve, Shutoff, LOX Chilldown	1A49965-509	C-17
K9	Prevalve, LOX	1A49968-505	C-18
K10	Valve, Check	1A49964-1	C-19
K11	Disconnect, LOX Fill and Drain	1A49970-503	C-20
K12	Valve, LOX Fill and Drain	1A48240-501	C-13
K13	Prevalve, LH_2	1A49968-503	C-18
K14	Valve, Shutoff, LH_2 Chilldown	1A49965-507	C-17
K15	Pump, LH_2 Chilldown	1A49421-501	
K16	Valve, Check	1A49964-1	C-19
K17	Valve, Relief, LH_2 Tank	1A49591-513	C-21
K18	Disconnect, GH_2 Vent	1A48848-503	C-22
K19	Valve, Directional Control, LH_2 Vent	1A49988-1	C-23
K20	Valve, LH_2 Vent and Relief	1A48257-1	C-24
K21	Probe, LH_2 Mass	1A48431-501	C-25
K22	Probe, LOX Mass	1A48430-501	C-26
K23	Sensor, LOX Fast Fill	1A68710-1	C-27
K24	Sensor, LOX Point Level	1A68710-1	C-27
K25	Valve, LH_2 Propulsive Vent	1B51753-1	
K26	Sensor, LH_2 Fast Fill	1A68710-1	C-27
K27	Propellant Utilization Electronics Assembly	1A59358-511	
K28	Valve, LOX Propulsive Vent	7851806-509	
K103	Valve, Check	1B51184-1	
K307	Disconnect, Helium Control	7851823-503	F-17
K311	Module, Control	1A58347-505	F-19
K313	Module, Actuation Control	1A49982-503	F-21

*Part of 1A49423-1

PRIMARY PROPELLANT SYSTEM CALLOUT LIST (CONT.)

FIND NO.	COMPONENT	PART NO.	PAGE
K314	Module, Actuation Control	1A49982-505	F-22
K315	Module, Actuation Control	1A49982-505	F-22
K316	Module, Actuation Control	1A49982-505	F-22
K318	Module, Actuation Control	1A49982-513	F-23
K319	Module, Actuation Control	1A49982-511	F-35
K323	Restrictor, Flow	1B40622-505	F-25
K324	Restrictor, Flow	1B40622-501	F-26
K340	Module, Actuation Control	1A49982-511	F-35
K423	Valve, Propellant Utilization	251351-11	

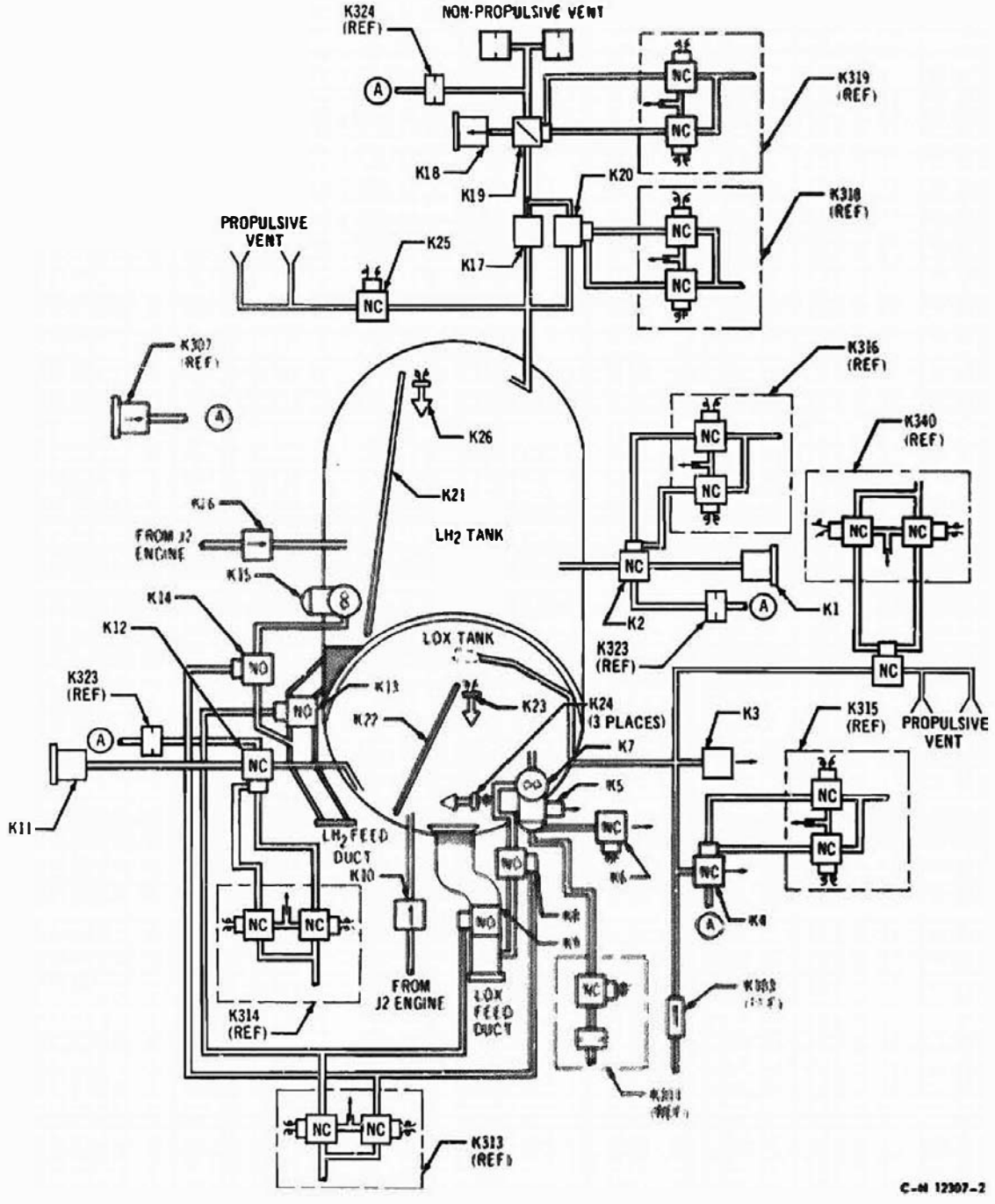

FIGURE C-1 PRIMARY PROPELLANT SYSTEM - SIMPLIFIED SCHEMATIC

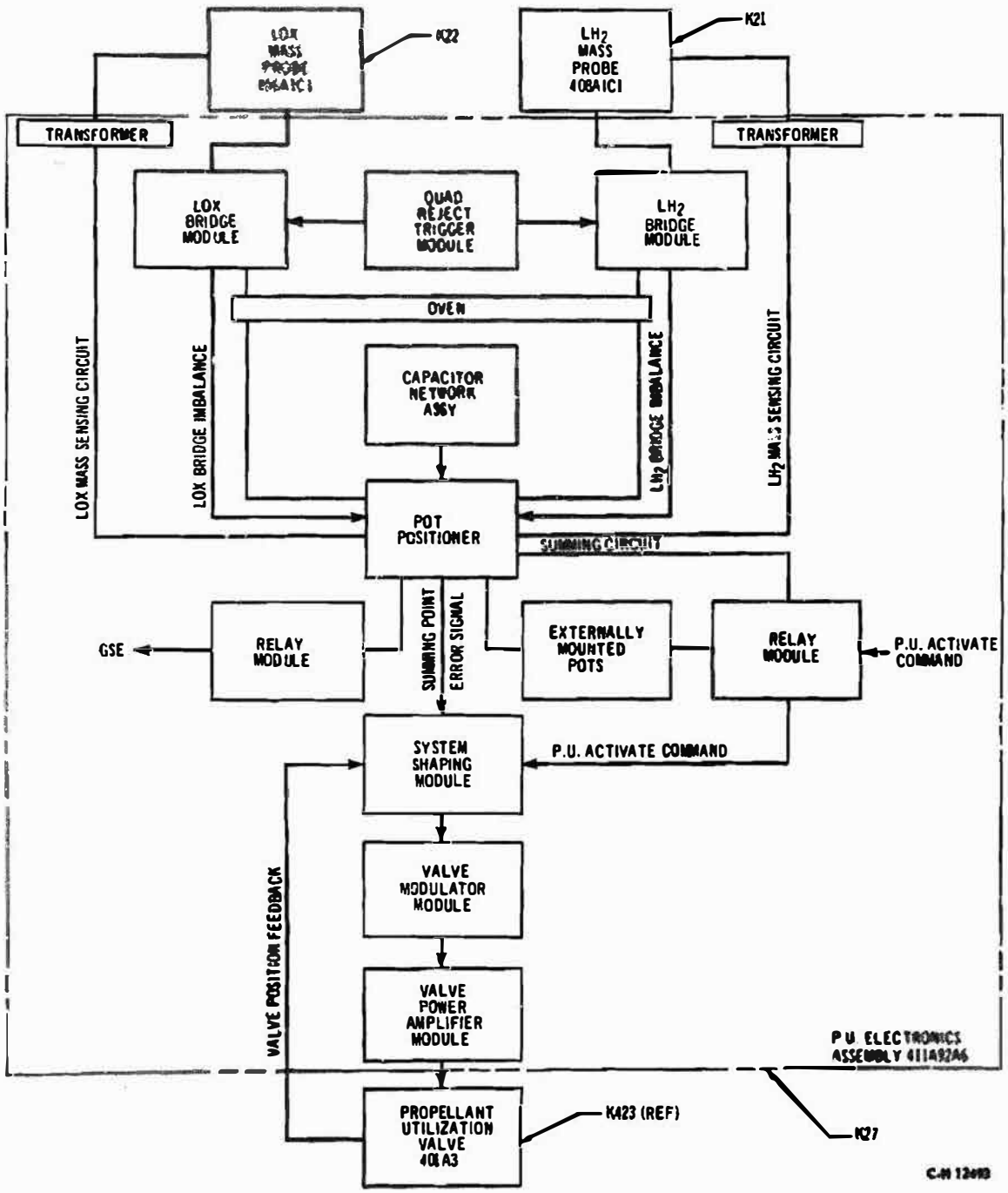

FIGURE C-2 PROPELLANT UTILIZATION ASSEMBLY - BLOCK DIAGRAM

DETAILED SCHEMATIC CALLOUT LIST, LOX TANK

FIND NO.	COMPONENT	PART NO.
1	Anti Vortex Screen	5851779-1
2	Duct Assembly	1A87736-1
3	Duct Assembly	1A49969-501
4	Duct Assembly	1A87740-1
5	Flowmeter	1A89104-501
6	Tube Assembly	1B38030-1
7	Tube Assembly	1B40899-1
8	Tube Assembly	1B52550-1
9	Tube Assembly	1B38207-1
10	Tube Assembly	1B38205-1
11	Duct Assembly	1B29979-1
12	Bellows Assembly	1A49971-501
13	Flange	1B32286-1
14	Duct Assembly	1A69044-503
15	Duct Assembly	1A69044-1
16	Tee	1B51506-1
17	Pipe Assembly	1B51553-1
18	Elbow	1A77116-1
19	Oxidizer Vent	1B51798-1
20	Duct Assembly	1A68611-501
21	Duct Assembly	1B5138-1
22	Duct Assembly	1B51538-1
23	Nozzle	1B51581-1
24	Duct Assembly	1B51539-1
25	Tube Assembly	1B51569-1
26	Tube Assembly	1B51678-1
27	Pressure Transducer	1B43324-601
28	Tee Assembly	1B51536-1
29	Tube Assembly	1B51729-1
30	Differential Pressure Transducer	P57-3432-7
31	Tube Assembly	1B51728-1
32	Tube Assembly	1B51570-1
33	Tube Assembly	1B51661-1
34	Pressure Transducer	1B43324-601
35	Duct Assembly	1B51656-1
36	Nozzle	1B51581-1
37	Duct Assembly	1B51572-1
38	Duct Assembly	1B51571-1

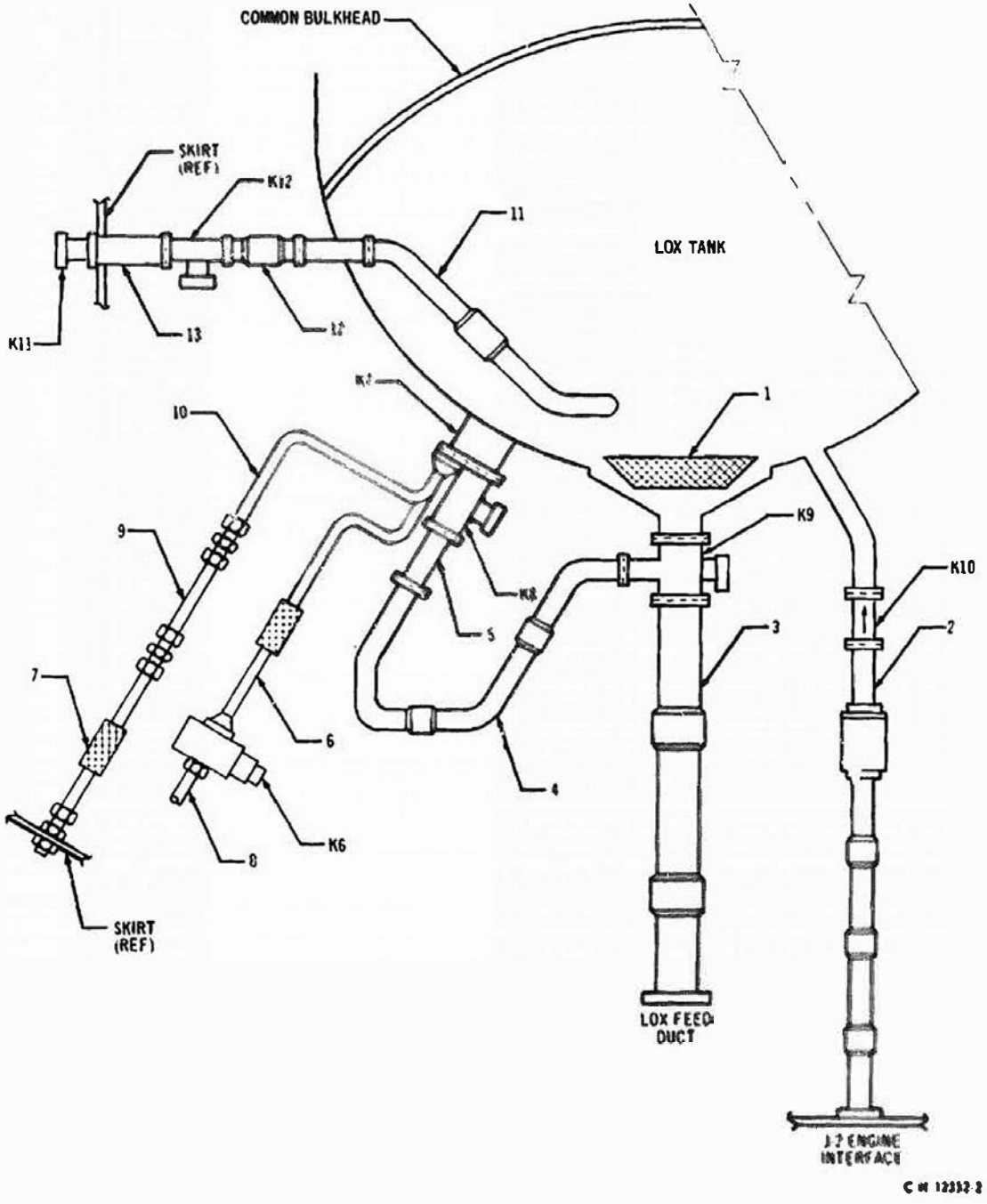

FIGURE C-3 LOX TANK - DETAILED SCHEMATIC
(sheet 1 of 2)

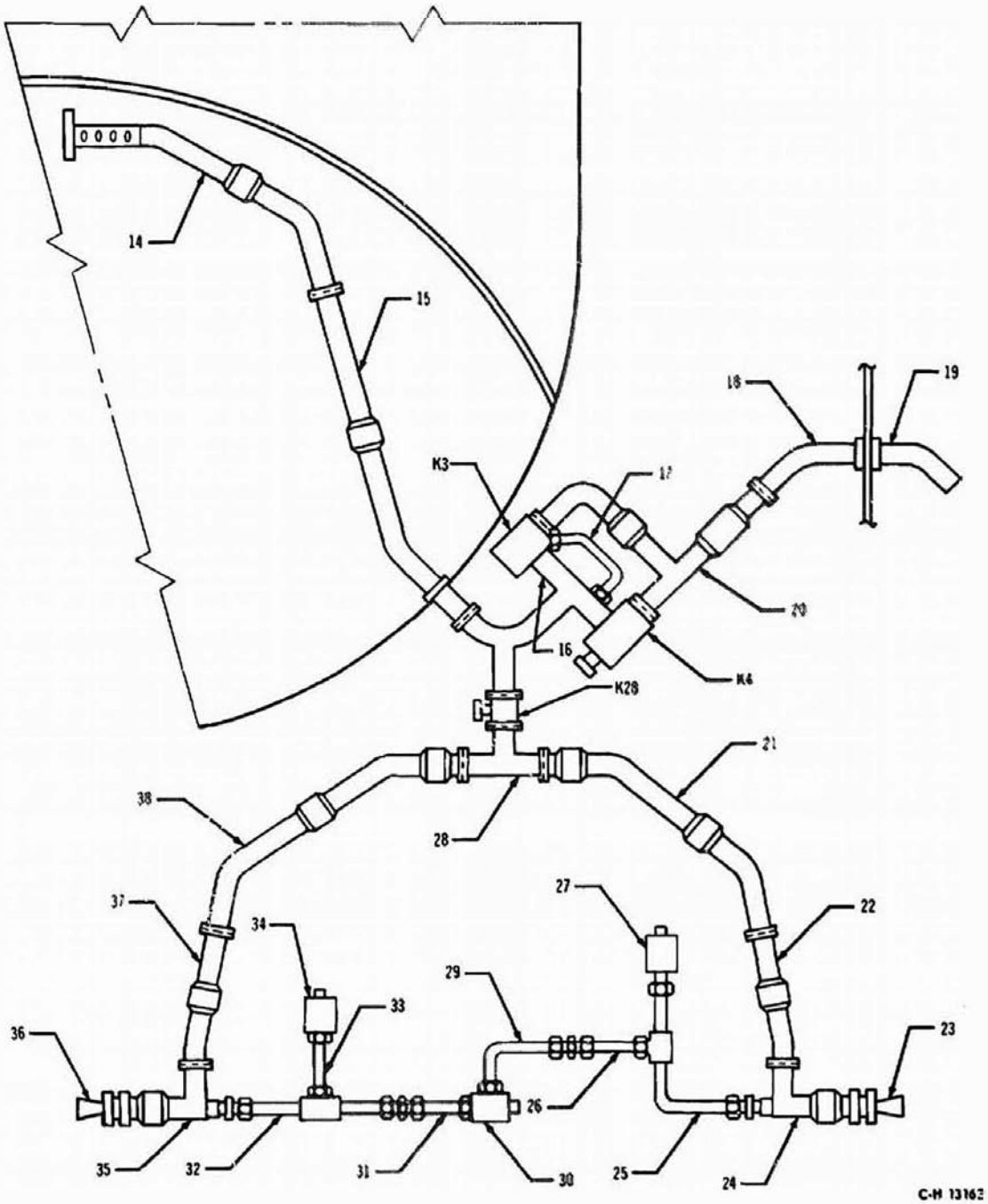

FIGURE C-3 LOX TANK - DETAILED SCHEMATIC
(sheet 2 of 2)

DETAILED SCHEMATIC CALLOUT LIST, LH_2 TANK

FIND NO.	COMPONENT	PART NO.
1	Diffuser	1A89182-1
2	Anti Vortex Screen	1B57253-1
3	Duct Assembly	1B38529
4	Bellows Assembly	1A77906-1
5	Duct Assembly	1A78053-1
6	Duct Assembly	1B51217-1
7	Flange	1B32515-1
8	Duct Assembly	1A49320-503
9	Duct Assembly	1A49320-505
10	Duct Assembly	1A49966-501
11	Flow Meter	1A89104-503
12	Tee Assembly	1A49987-1
13	Duct Assembly	1A87234-1
14	Duct Assembly	1A87436-501
15	Flange	1A87860-1
16	Orifice	1B51785-1
17	Flange	1A48848-505
18	Bellows Assembly	1A49986-1
19	Duct Assembly	1A49469-505
20	Belows Assembly	1A49985-501
21	Elbow Assembly	1B51771-1
22	Duct Assembly	1A49984-503
23	Duct Assembly	1B51694-1
24	Elbow Assembly	1B53036-1
25	Nozzle	1B51582
26	Duct Assembly	1B44575-2
27	Duct Assembly	1B44574-1
28	Duct Assembly	1B44573-1
29	Tee Assembly	1B44572-1
30	Duct Assembly	1B44573-2
31	Duct Assembly	1B44574-2
32	Nozzle	1B51582-1
33	Duct Assembly	1B44575-1
34	Duct Assembly	1B55638-1
35	Duct Assembly	1A49984-505
36	Duct Assembly	1A87755-1
37	Orifice	1B51785-1
38	Flange	1A87860-1
39	Duct Assembly	1A87436-502
40	Duct Assembly	1A87234-2

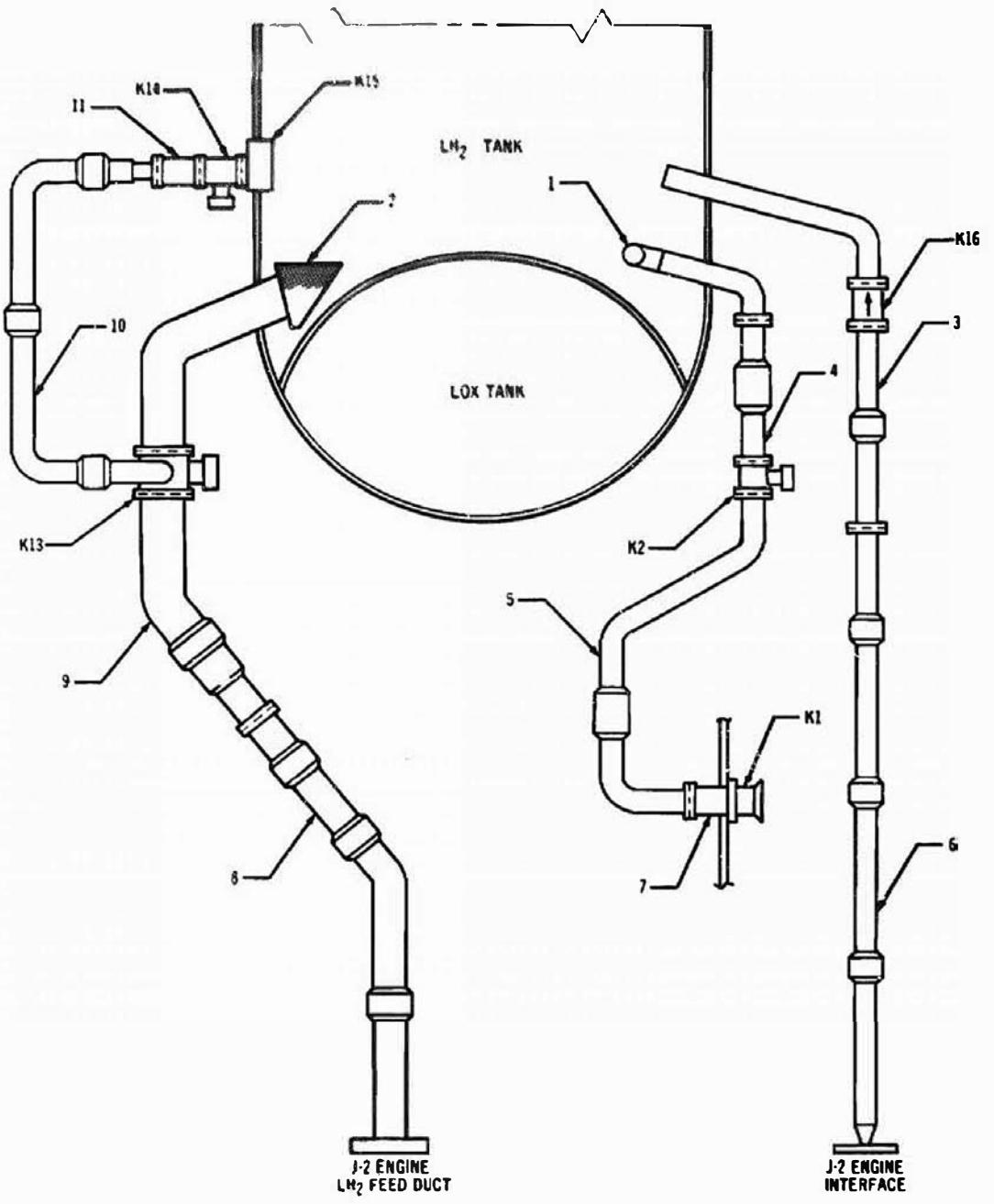

FIGURE C-4 LH_2 TANK - DETAILED SCHEMATIC
(sheet 1 of 2)

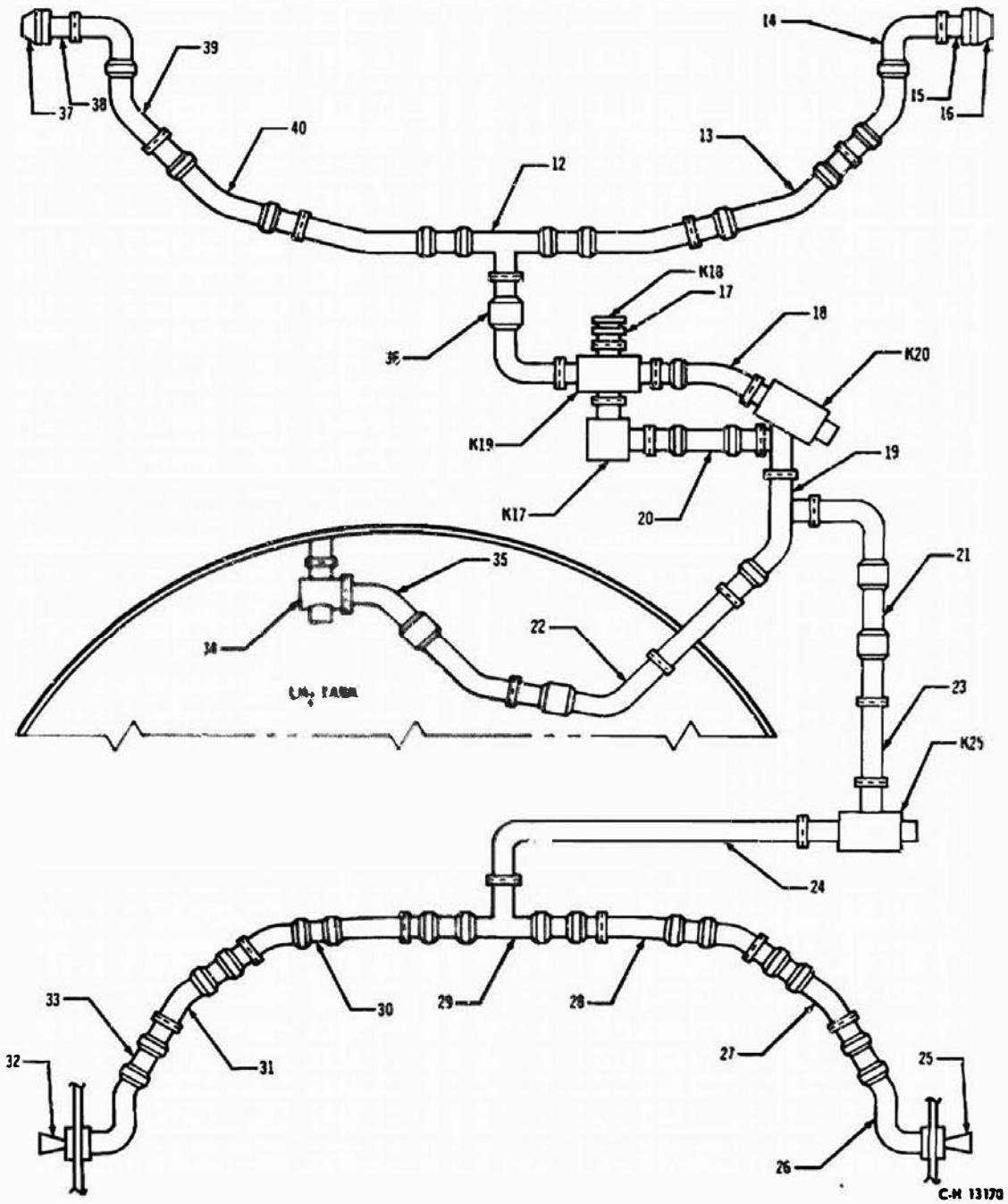

FIGURE C-4 LH_2 TANK - DETAILED SCHEMATIC
(sheet 2 of 2)

LH_2 FILL AND DRAIN DISCONNECT, PART NO. 1A49978-503

This disconnect (K1) couples with a self-aligning ground disconnect to provide LH_2 fill and drain capabilities.

1. VENDOR: Fairchild Stratos Corp. (part no. 63-541)
2. LOCATION: On the aft umblical
3. SERVICE: LH_2
4. TEMPERATURE:
   a. External: -51 to +71°C (-60 to + 160°F)
   b. Internal: -253 to +71°C (-423 to +160°F)
5. PRESSURE:
   a. Surge: 155 N/cm² (225 psia) max
   b. Proof: 227 N/cm² (330 psia)
   c. Burst: 372 N/cm² (540 psia)
6. LEAKAGE: Not more than 100 sccm (6.1 scim) of hydrogen when connected to the ground disconnect
7. REMARKS: This page reflects information on DAC drawing 1A49978, rev J and AEO's K and L.

FILL AND DRAIN VALVE, PART NO. 1A48240-501

The pneumatically operated, normally closed fill-and-drain valves--one in the LH_2 fill line (K2) and one in the LOX fill line (K12)--allow filling and draining of the propellant containers.

1. VENDOR: Fairchild Stratos Corp.
2. LOCATION: In the propellant fill lines directly behind the aft umbilical
3. SERVICE:
   a. Valve body: LOX or LH_2
   b. Actuator: Helium and electrical
4. TEMPERATURE: -253 to +71°C (-423 to +160°F)
5. PRESSURE:
   a. Valve body:
      (1) Operating: 10 to 35 N/cm² (14.7 to 51 psia) for LOX and 10 to 19 N/cm² (14.7 to 27 psia) for LH_2
      (2) Proof: 217 N/cm² (315 psig)
      (3) Burst: 372 N/cm² (540 psia)
   b. Actuator:
      (1) Operating: 327 ± 17 N/cm² (475 ± 25 psig)
      (2) Proof: 533 N/cm² (773 psig)
      (3) Burst: 888 N/cm² (1,288 psig)
6. LEAKAGE:
   a. Valve body: Not more than 100 sccm (6.1 scim) with capped outlet port and 103 N/cm² (150 psig) GH_2 at the inlet port
   b. Valve actuator: Not more than 100 sccm (6.1 scim) under normal operating conditions
7. ELECTRICAL CHARACTERISTICS:
   a. Insulation resistance: 100 MΩ with 500 Vdc applied
   b. Dielectric strength: 1000 Vrms at 60 Hz for one minute
8. REMARKS: This page reflects information on DAC drawing 1A48420, rev M and AEO N.

Section III

LOX TANK VENT AND RELIEF VALVE, PART NO. 1A48312-501

The valve (K4) pneumatically opens to vent the LOX containers and mechanically opens to relieve excessive containers pressure.

REMARKS: Additional information not available in time for publication. Latest DAC drawing available: 1B48312 rev N and AEO's through T.

LOX CHILLDOWN PUMP SOLENOID VALVE, PART NO. 1A67913-1

The normally closed solenoid valve (K6) allows venting of the LOX chilldown pump motor container.

1. VENDOR: Calmec Mfg. Corp. (part no. 586)
2. LOCATION: Interior of the thrust structure, 1.3 rad (73°) from fin line I toward IV
3. SERVICE: Electrical and helium
4. TEMPERATURE:
   a. External: -87 to +71°C (-125 to +160°F)
   b. Internal: -183 to +71°C (-297 to +160°F)
5. PRESSURE:
   a. Operating: 106 N/cm^2 (155 psia) max
   b. Proof: 162 N/cm^2 (235 psia)
   c. Burst: 270 N/cm^2 (390 psia)
6. LEAKAGE:
   a. Internal: Shall not exceed 25 sccm (1.5 scim) with inlet pressure of 55 ± 3 N/cm^2 (80 ± 5 psia)
   b. External: Shall not exceed 1.0 scch (0.061 scih) with inlet pressure of 107 N/cm^2 (155 psia)
7. ELECTRICAL CHARACTERISTICS
   a. Input voltage: 28 Vdc
   b. Insulation resistance: 100 MΩ at 500 Vdc
8. REMARKS: This page reflects information on DAC drawing 1A67913 rev J.

LOX CHILLDOWN PUMP, PART NO. 1A49423-503

The chilldown pump (K7) circulates LOX from the container through the LOX feed duct and engine components, chilling these components prior to J-2 engine start. A helium-purged relief valve (K5) protects the pump motor from overpressurization.

1. VENDOR: Pesco Products Company (part no. 144666-112)
2. LOCATION: On the aft bulkhead of the LOX container near fin line IV
3. SERVICE: Electrical and LOX
4. TEMPERATURE:
   a. Operating: -179 to -183°C (-280 to -297°F)
   b. Environmental: -40 to +74°C (-40 to +165°F)
5. PRESSURE:
   a. Operating:
      (1) Pump inlet: 0.34 to 67 N/cm^2 (0.5 to 97 psi)
      (2) Motor container: 34 to 37 N/cm^2 (49 to 53 psia)
      (3) Relief valve: Cracks between 44 and 59 N/cm^2 (65 and 85 psig), reseats between 59 and 44 N/cm^2 (85 and 65 psig)
   b. Proof:
      (1) Pump body:
         (a) 58 N/cm^2 (84 psia) internal
         (b) 100 N/cm^2 (146 psia) external
      (2) Motor container: 145 N/cm^2 (210 psia)
   c. Burst:
      (1) Pump body: 96 N/cm^2 (140 psia)
      (2) Motor container: 241 N/cm^2 (350 psia)
6. LEAKAGE:
   a. Oxygen: 490 sccm (30 scim) at 41 N/cm^2 (160 psia) pressure
   b. Helium: 1640 sccm (100 scim) at 41 N/cm^2 (60 psia) pressure
7. ELECTRICAL CHARACTERISTICS:
   a. Input voltage: 56 V at 400 Hz
   b. Current: 60 amperes max
   c. Insulation resistance: 1000 MΩ at 500 Vdc
   d. Insulation dielectric strength: 1000 Vrms at 60 Hz for 1.0 min
8. REMARKS: This page reflects information on DAC drawing 1A49423 rev K and AEO L.

CHILLDOWN SHUTOFF VALVES, PART NOS. 1A49956-507 AND -509

These normally open, pneumatically closed valves--one in the LH_2 chill system (K14) and one in the LOX chill system (K8)--shut off the flow of propellant from the chilldown pumps to the propellant feed ducts. Each valve has position switches which indicate the full open or full closed position.

1. VENDOR: Fairchild Stratos Corp. (part no. 64-400-02 for -507 and 64-401-02 for -509)
2. LOCATION: On the respective chilldown pump
3. SERVICE:
   a. -507: Helium, LH_2, and electrical
   b. -509: Helium, LOX, and electrical
4. TEMPERATURE: -253 to +71°C (-423 to +160°F)
5. PRESSURE:
   a. Actuator:
      (1) Operating: 327 ± 17 N/cm² (475 ± 25 psia)
      (2) Proof: 517 N/cm² (750 psia)
      (3) Burst: 862 N/cm² (1250 psia)
   b. Valve:
      (1) Operating: 86 N/cm² (125 psia) max
      (2) Proof: 131 N/cm² (190 psia)
      (3) Burst: 217 N/cm² (315 psia)
6. LEAKAGE:
   a. Actuator: 330 sccm (20 scim) of helium at 327 ± 17 N/cm² (475 ± 25 psig)
   b. Valve internal:
      (1) -507: 490 sccm (30 scim) max of hydrogen at 33 N/cm² (48 psig)
      (2) -509: 490 sccm (30 scim) max of oxygen at 55 N/cm² (80 psig)
   c. Valve external: 1.0 scch (0.06 scih) max of helium at pressure from 0 to 38 N/cm² (0 to 56 psig)
7. ELECTRICAL CHARACTERISTIC:
   a. Insulation resistance: 100 M
   b. Dielectric strength: 1000 Vrms at 60 Hz for 1.0 min
8. REMARKS: This page reflects information on DAC drawing 1A49965 rev P and AEO N.

PREVALVES, PART NOS. 1A49968-503 AND -505

The normally open, pneumatically closed prevalves--one in the LOX feed duct (K9) and one in the LH_2 duct (K13)--control the flow of propellant to the J-2 engine.

Each valve has position switches which indicate the open or closed position.

1. VENDOR: Clary Corp. (part nos. 527040 for -503 and 527041 for -505)
2. LOCATION: In the propellant feed ducts near the container outlet
3. SERVICE: Helium, LOX and electrical for -505 and Helium, LH_2 and electrical for -503
4. TEMPERATURE (operating): -182°C (-296°F) for -501 and -253°C (-423°F) for -503
5. PRESSURE:
   a. Valve body:
      (1) Operating: 19 N/cm^2 (28 psig) max for -501 and 14 N/cm^2 (21 psig) max for -503
      (2) Proof: 140 N/cm^2 (20 psia)
      (3) Burst: 230 N/cm^2 (330 psia)
   b. Valve actuator:
      (1) Operating: 340 $\pm$ 17 N/cm^2 (490 $\pm$ 25 psig)
      (2) Proof: 533 N/cm^2 (773 psia)
      (3) Burst: 888 N/cm^2 (1288 psia)
6. LEAKAGE:
   a. Valve body:
      (1) Internal: 8200 sccm (500 scim) of oxygen with inlet pressure of 48 $\pm$ 3 N/cm^2 (70 $\pm$ 5 psia) for -505 and 4600 sccm (1500 scim) of hydrogen inlet pressure of 29 $\pm$ 2 N/cm^2 (43 $\pm$ 3 psia) for -503
      (2) External: 1 scch (0.06 scih) of hydrogen or oxygen valve body leakage and 1640 sccm (100 scim) shaft seal leakage with 74 $\pm$ 3 N/cm^2 (108 $\pm$ 5 psia) LOX pressure (-505) of 35 $\pm$ 2 N/cm^2 (51 $\pm$ 3 psia) LH_2 pressure (503)
   b. Valve actuator: 4900 sccm (300 scim) at operating conditions
7. ELECTRICAL CHARACTERISTICS:
   a. Input voltage: 28 volts
   b. Insulation resistance: 100 at 500 $\pm$ 50 Vdc
   c. Dielectric strength: 1000 $\pm$ 25 Vrms at 60 Hz for 1.0 min
8. REMARKS: This page reflects information on DAC drawing 1A49968 rev S.

CHECK VALVE, PART NO. 1A49964-1

The swing type check valves (K10 and K16) prevent the flow of propellant from the containers through the chilldown return lines to the J-2 engine turbopumps when the chilldown system is inoperative.

1. VENDOR: Parker Aircraft Company (part no. 2630213)
2. LOCATION: In the LOX and LH_2 chilldown return lines between fin positions I and II
3. SERVICE: LOX for K10 and LH_2 for K16
4. TEMPERATURE (operating): -182°C (-296°F) for K10 and -253°C (-423°F) for K16
5. PRESSURE:
   a. Operating: Zero to 125 psia
   b. Proof: 131 N/cm² (190 psia)
   c. Burst: 217 N/cm² (315 psia)
6. LEAKAGE:
   a. External: 10^{-3} sccm ($.6 \times 10^{-3}$ scim) max of helium at all pressures from 0 to 8.6 N/cm² (0 to 125 psia)
   b. Internal: 2460 sccm (150 scim) max of oxygen at 70 N/cm² (101 psia) or hydrogen at 34 N/cm² (50 psia)
7. REMARKS: This page reflects information on DAC drawing 1A49964 rev G and AEO H.

LOX FILL AND DRAIN DISCONNECT, PART NO. 1A49970-503

This disconnect (K11) connects with a self-aligning ground half providing LOX container fill and drain capabilities.

1. VENDOR: Fairchild Stratos Corp. (part no. 64-542)
2. LOCATION: On the aft umbilical plate
3. SERVICE: LOX
4. TEMPERATURE: -182°C (-296°F)
5. PRESSURE:
   a. Surge: 155 N/cm² (225 psia)
   b. Proof: 227 N/cm² (330 psia)
   c. Burst: 370 N/cm² (540 psia)
6. LEAKAGE: 100 sccm (6.1 scim) oxygen with disconnect connected with the ground half
7. REMARKS: This page reflects information shown on DAC drawing 1A49970 rev J.

LH_2 TANK RELIEF VALVE, PART NO. 1A49591-513

The relief valve (K17) protects the LH_2 container from overpressurization.

REMARKS: Additional information not available in time for publication. Latest DAC drawing available: 1B12345 rev L.

GH_2 VENT DISCONNECT, PART NO. 1A48848-503

The disconnect (K18) connects with a self-sealing, self-aligning ground half, routing LH_2 container vent vapors away from the vehicle.

1. VENDOR: Fairchild Stratos Corp. (part no. 64-521)
2. LOCATION: On forward umbilical
3. SERVICE: GH_2
4. TEMPERATURE:
   a. Internal: -253 to +71°C (-423 to +160°F)
   b. External: -88 to +71°C (-125 to +160°F)
5. PRESSURE:
   a. Proof: 37 N/cm^2 (54 psia)
   b. Burst 62 N/cm^2 (90 psia)
6. LEAKAGE: 350 sccm (21 scim) max of GH_2 past the mating seal when coupled with the ground half and pressurized from 0 to 25 N/cm^2 (0 to 36 psia)
7. REMARKS: This page reflects information of DAC drawing 1A48848 rev L and AEO M.

DIRECTIONAL CONTROL VALVE, PART NO. 1A49988-1

The pneumatically actuated directional control (K19) routes LH_2 container vent vapors through GH_2 vent disconnect K18 during filling operations and rotates to flight position prior to liftoff, routing the vent vapors through the non-propulsive vent system. Position indicators provide GSE indication of valve position.

1. VENDOR: Calmec Mfg. Co. (part no. 511)
2. LOCATION: On interior of forward skirt, approximately $\pi/4$ rad. (45°) from position I toward position II
3. SERVICE: GH_2
4. TEMPERATURE:
   a. Internal: -253 to +71°C (-423 to +160°F)
   b. External: -88 to +71°C (-125 to +160°F)
5. PRESSURE:
   a. Actuating pressure: 338 ± 17 N/cm² (490 ± 25 psia)
   b. Operating: 0 to 25 N/cm² (0 to 36 psia)
   c. Proof:
      (1) Actuator: 527 N/cm² (765 psia)
      (2) Valve body: 37 N/cm² (54 psia)
   d. Burst:
      (1) Actuator: 872 N/cm² (1265 psia)
      (2) Valve body: 62 N/cm² (90 psia)
6. LEAKAGE:
   a. Actuator: 50 sccm (3 scim) when pressurized to 355 N/cm² (515 psia) and chilled to -240 ± 13°C (-400 ± 25°F)
   b. Valve body:
      (1) External: 25 sccm (1.5 scim) of hydrogen gas at 0 to 25 N/cm² (0 to 36 psia) inlet pressure with valve chilled to -240 ± 11°C (-400 ± 20°F)
      (2) Internal: 150 sccm (9.15 scim) of hydrogen at 0 to 25 N/cm² (0 to 36 psia) inlet pressures with the valve chilled to -240 ± 13°C (-400 ± 25°F)
7. ELECTRICAL CHARACTERISTICS:
   a. Insulation strength: 100 MΩ at 500 Vdc
   b. Dielectric strength: 1000 Vrms at 60 Hz for 1.0 min
8. REMARKS: This page reflects information on DAC drawing 1A49988 rev M.

Section III

LH_2 VENT AND RELIEF VALVE, PART NO. 1A48257-1

The vent and relief valve (K20) pneumatically opens to vent the LH_2 container and mechanically opens to relieve excessive container pressure.

Position indicators provide full open or full closed indicators.

1. VENDOR: Calmec Mfg. Co. (part no. 519-503)
2. LOCATION: Interior of forward skirt approximately $\pi/4$ rad. (45°) from fin position I toward position II
3. SERVICE: GH_2 and helium
4. TEMPERATURE (operating):
   a. External: -87.2 to +71.1°C (-125 to +160°F)
   b. Internal: -253 to +71.1°C (-423 to +160°F)
5. PRESSURE:
   a. Valve actuator:
      (1) Operating: 340 ± 17 N/cm² (490 ± 25 psia)
      (2) Proof: 53.2 N/cm² (773 psia)
      (3) Burst: 846.7 N/cm² (1228 psia)
   b. Valve body:
      (1) Operating: 30 N/cm² (43 psia) max
      (2) Proof: 45 N/cm² (65 psia)
      (3) Burst: 74.4 N/cm² (108 psia)
   c. Relief operation:
      (1) Cracking: 30 N/cm² (42 psia)
      (2) Reseat: 27 N/cm² (39 psia)
6. LEAKAGE:
   a. Valve body:
      (1) External: 10 sccm (0.6 scim) of hydrogen with 30 N/cm² (43 psia) applied at the inlet port
      (2) Internal: 1600 sccm (1000 scim) past the primary outlet seal with 27 N/cm² (39 psia) at the inlet port and vibrated according to simulated flight conditions
   b. Valve actuator:
      (1) External: 500.0 sccs (1.0 scfm) past the position seal with 396 N/cm² (575 psig) helium applied at the 'close' port, or 10 sccm (.60 sccm) past the piston seal with the pressure applied at the 'open' port
      (2) Internal: 200.0 sccs (4.0 scfm) past the piston seal with 100 N/cm² (150 psig) helium applied at the 'open' port
7. ELECTRICAL CHARACTERISTICS:
   a. Insulation resistance: 100 MΩ at 500 Vdc
   b. Dielectric strength: 1000 Vrms at 60 Hz for 1.0 min

LH_2 MASS PROBE, PART NO. 1A48431-501

The capacitance type probe (K21) in conjunction with the propellant utilization electronics assembly (K27) provides finite mass level indication for GSE, telemetry and the propellant utilization system.

1. VENDOR: Minneapolis-Honeywell Regulator Company (part no. FG-360C2)
2. LOCATION: LH_2 container
3. SERVICE: LH_2, GH_2 and electrical
4. TEMPERATURE: -253 to +71°C (-423 to +160°F)
5. ELECTRICAL CHARACTERISTICS:
   a. Capacitance: Varies non-linearly from 200 pF min with the height of LH_2 contained between the probe elements.
   b. Electrical resistance: 1000 MΩ at 500 Vdc between the two probe elements

LOX MASS PROBE, PART NO. 1A48430-501

The capacitance-type probe (K22) in conjunction with the propellant utilization electronics assembly (K27) provides finite mass level indication for GSE, telemetry, and the propellant utilization system.

1. VENDOR: Minneapolis-Honeywell Regulator Company (part no. FG359C2)
2. LOCATION: LOX container
3. SERVICE: LOX, GOX, and electrical
4. TEMPERATURE: -183 to +71°C (-297 to +160°F)
5. ELECTRICAL CHARACTERISTICS:
   a. Capacitance: Varies non-linearly from 800 pF min with the height of LOX contained between the probe elements.
   b. Electrical resistance: 1000 MΩ at 500 Vdc between the two probe elements

LIQUID LEVEL SENSOR, PART NOS. 1A68710-1, -503 AND -505

The capacitance type sensor (-1) senses the absence or presence of LH_2 or LOX, providing input to a control unit (-503 for LH_2 and -505 for LOX) having a relay output.

LOX fast-fill sensor K23, indicates 93 pct of the LOX mass loaded.

Should any two of the three LOX point level sensors K24 sense an absence of LOX, the J-2 engine cutoff sequence would start.

LH_2 fast-fill sensor K26, indicates 98 pct of the LH_2 mass loaded.

1. VENDOR: Minneapolis-Honeywell Regulator Company (part no. FG350E1 for -1, RG86H2 for -503, and RG86H3 for -503)
2. LOCATION:
   a. K23: Near the top of the LOX container, on mass sensing probe K22
   b. K24: Spaced around the LOX container sump
   c. K25: Spaced around the bottom of the LH_2 container
   d. K26: Near the top of the LH_2 container, on the mass sensing probe K23.
3. SERVICE:
   a. Sensor: LH_2 or LOX and electrical
   b. Control unit: Electrical
4. TEMPERATURE:
   a. Sensor: -253 to +68°C (-423 to +150°F)
   b. Control unit: -54 to +68°C (-5 to +150°F)
5. ELECTRICAL CHARACTERISTICS:
   a. Sensor:
      (1) Dry capacitance: 7.7 ± 0.4 pF
      (2) Wet capacitance: 9.2 pF min in LH_2 and 10.9 pF for LOX
      (3) Insulation resistance: 100 MΩ at 500 Vdc between any combination of electrodes and mounting stud
   b. Control unit:
      (1) Sensitivity: 0.5 pF in sensor capacitance
      (2) Contact switching current: 250 mA min
      (3) Switching transient: 50 mV max peak to peak transient into a one ohm 28 Vdc source
      (4) Insulation resistance: 100 MΩ at 500 Vdc
      (5) Input voltage: 28 Vdc
      (6) Operating current: 75 mA max
6. REMARKS: This page reflects information on DAC drawing 1A68710 rev 'N.'

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D. OXIDIZER CONTAINER PRESSURIZATION SYSTEM

Cold helium from a ground source prepressurizes the LOX container and fills eight storage spheres in the LH_2 container. A pressurization control module, in conjunction with pressure switches, regulates preflight and in-flight pressurization. During prepressurization and S-IB stage operation, cold helium directly from the spheres maintains tank pressure; however, after J-2 engine ignition, the cold helium is routed through the J-2 engine heat exchanger. A relief valve protects the container from overpressurization.

OXIDIZER CONTAINER PRESSURIZATION SYSTEM INFORMATION ILLUSTRATIONS

OXIDIZER CONTAINER PRESSURIZATION SYSTEM CALLOUT LIST

FIND NO.	COMPONENT	PART NO.	PAGE
K3	Valve, LOX Tank Relief	1A49590-507	
K4	Valve, LOX Tank Vent and Relief	1A48312-501	
K100	Sphere, Storage, Helium	1A48858-1	
K101	Valve, Calibration	10414087	
K102	Switch, Pressure, Low	7851847-523	
K103	Valve, Check	1B40284-1	
K104	Manifold and Pressure Switch Assembly	1B53756-1	
K105	Switch, Pressure, Medium	7851830-509	
K106	Tank, Compressed Gas	1A49991-1	
K107	Module, Control	1B42290-501	
K107-1	Filter		
K107-2	Regulator		
K107-3	Valve, Solenoid, N.C.		
K107-4	Valve, Solenoid, N.C.		
K107-5	Valve, Solenoid, N.O.		
K108	Module, Cold Helium Fill	1B57781-1	
K109	Valve, Check	1B40284-1	
K110	Disconnect, Cold Helium	7851844-501	
K111	Manifold and Pressure Switch Assembly	1A95232-505	
K111-1	Switch, Pressure, Helium Safe	1A66998-501	
K111-2	Switch, Pressure, Helium Minimum Liftoff	1A66996-501	

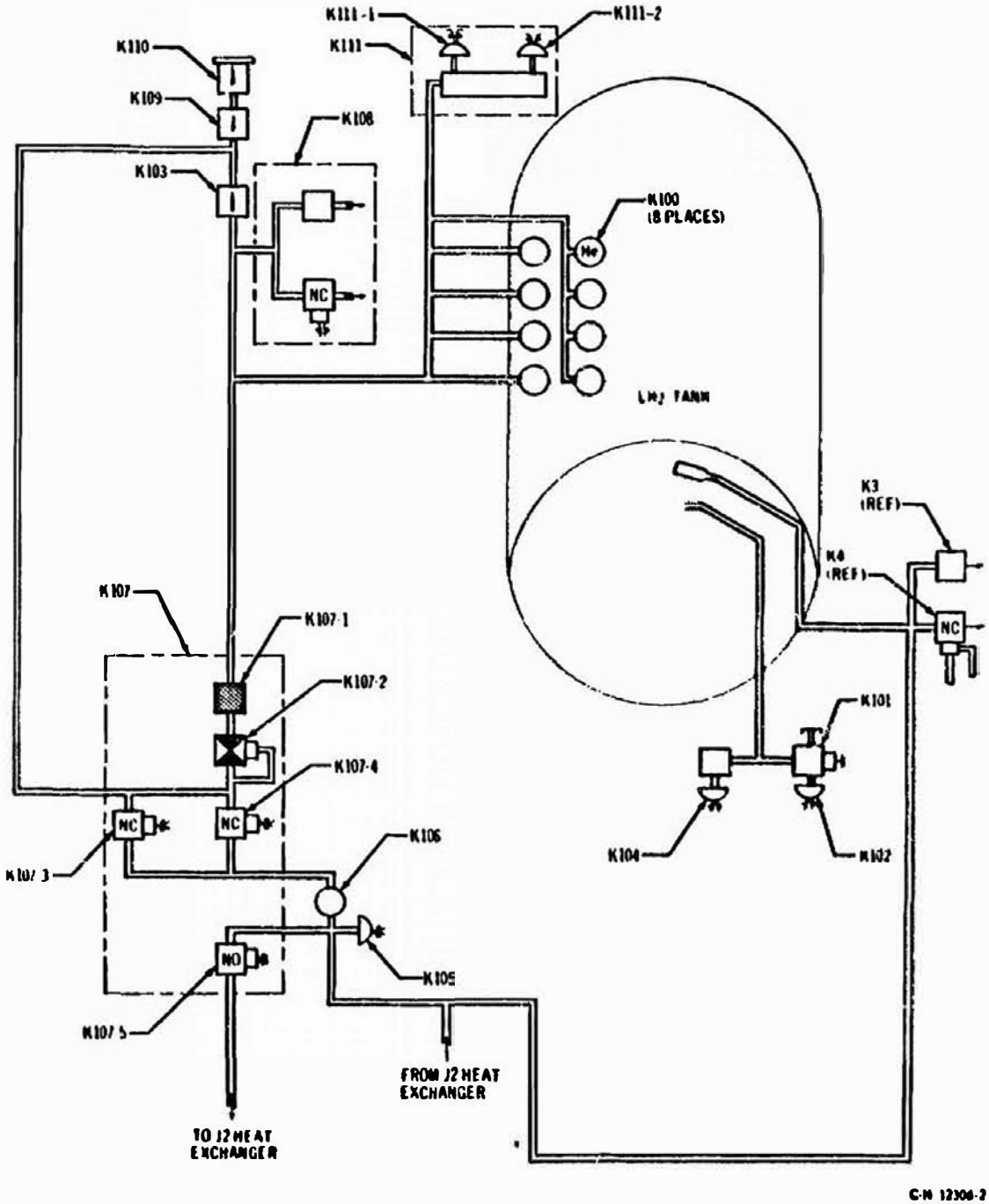

FIGURE D-1 OXIDIZER CONTAINER PRESSURIZATION SYSTEM - SIMPLIFIED SCHEMATIC

Section III

DETAILED SCHEMATIC CALLOUT LIST

FIND NO.	COMPONENT	PART NO.
1	Manifold Assembly	1A68668-1
2	Pipe Assembly	1A97085-1
3	Pipe Assembly	1B44237-1
4	Pipe Assembly	1A97083-1
5	Manifold Assembly	1A68668-501
6	Pipe Assembly	1A81844-1
7	Transducer, Pressure	1A72913-575
8	Duct Assembly	1A69044-501
9	Duct Assembly	1A69044-1
10	Pipe Assembly	1A96390-1
11	Pipe Assembly	1A96991-1
12	Pipe Assembly	1B42285-1
13	Pipe Assembly	1B51554-1
14	Pipe Assembly	1B54155-1
15	Pipe Assembly	1B54156-1
16	Pipe Assembly	1B52873-1
17	Pipe Assembly	1B51562-1
18	Transducer, Pressure	1A68551-545
19	Transducer, Pressure	1A68551-545
20	Transducer, Pressure	1A72913-539
21	Pipe Assembly	1B52832-1
22	Pipe Assembly	1B56439-1
23	Pipe Assembly	1A52430-1
24	Pipe Assembly	1A56435-1
25	Pipe Assembly	1B56441-1
26	Pipe Assembly	1B52405-1
27	Pipe Assembly	1B56444-1
28	Adapter	1B52432-1
29	Pipe Assembly	1A97088-1
30	Pipe Assembly	1B44236-1
31	Pipe Assembly	1A95480-1
32	Pipe Assembly	1B58573-1
33	Pipe Assembly	1A97087-1
34	Pipe Assembly	1B58575-1
35	Pipe Assembly	1B58569-1
36	Pipe Assembly	1B58570-1
37	Pipe Assembly	1B58580-1
38	Pipe Assembly	1B58578-1
39	Pipe Assembly	1B58578-1
40	Pipe Assembly	1B32913-1

DETAILED SCHEMATIC CALLOUT LIST (CONT.)

FIND NO.	COMPONENT	PART NO.
41	Pipe Assembly	1B39770-1
42	Fitting	MC23628
43	Pipe Assembly	1A52408-1
44	Pipe Assembly	1B56432-1
45	Pipe Assembly	1B56437-1

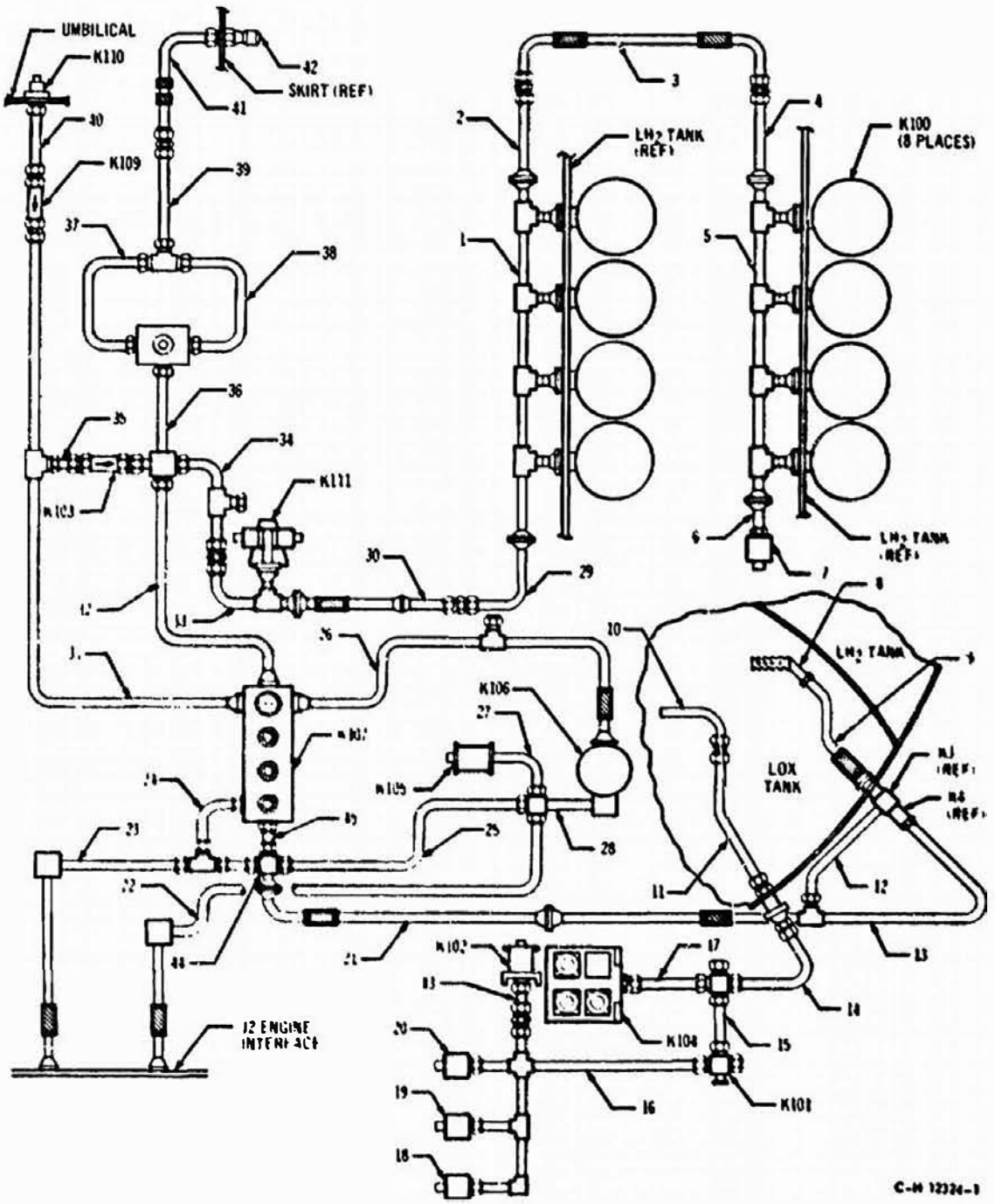

FIGURE D-2 OXIDIZER CONTAINER PRESSURIZATION SYSTEM - DETAILED SCHEMATIC

E. FUEL CONTAINER PRESSURIZATION SYSTEM

Helium from a ground source prepressurizes the LH_2 container, and gaseous hydrogen from the J-2 engine maintains container pressure during S-IVB operation. A pressurization control module, in conjunction with pressure switches, regulates container pressure.

Section III

FUEL CONTAINER PRESSURIZATION SYSTEM INFORMATION ILLUSTRATIONS

FUEL CONTAINER PRESSURIZATION SYSTEM CALLOUT LIST

FIND NO.	COMPONENT	PART NO.	PAGE
K200	Module, Control	1B55200-1	
K200-1	Valve, Solenoid, Control		
K200-2	Valve, Solenoid, Step		
K201	Valve, Check	1A66984-1	
K202	Disconnect, LH_2 Tank Pressurization	7851861-1	
K203	Manifold and Pressure Switch Assembly	1B55000-503	
K203-1	Switch, Pressure, Pad Safety	1A67010-501	
K203-2	Switch, Pressure, LH_2 Ground Fill	1A67003-501	
K203-3	Switch, Pressure	1A67005-505	
K204	Switch, Pressure, Flight Control	7851860-539	
K205	Valve, Calibration	10414087	
K206	Module, Repressurization	1A49989-505	
K206-1	Valve, Check		
K206-2	Valve, Pump, Solenoid		
K206-3	Valve, Relief		
K206-4	Filter		
K206-5	Valve, Control		
K207	Tank, Repressurization	1A49990-1	
K208	Pressure Switch Assembly	1B53615-1	

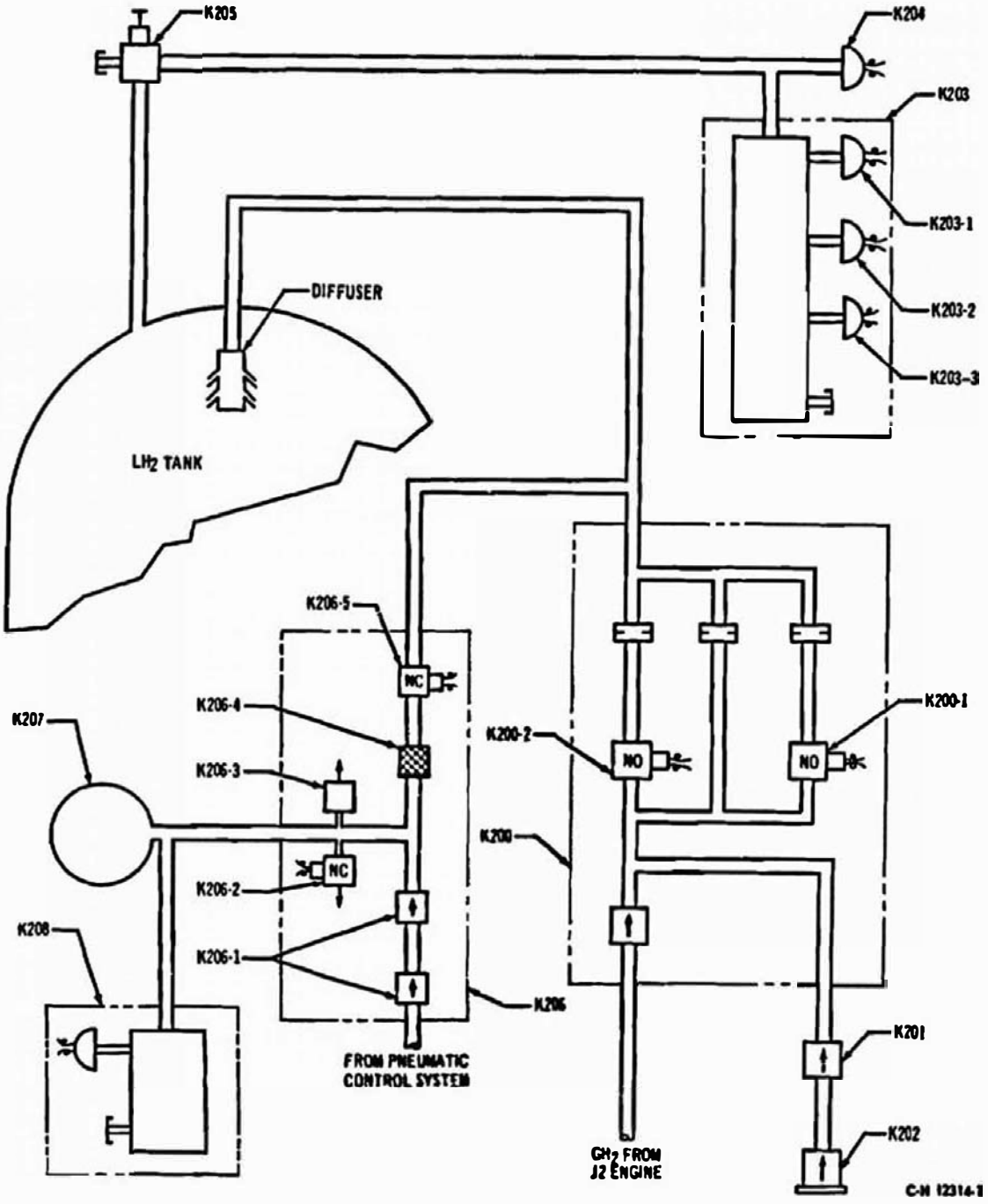

FIGURE E-1 FUEL CONTAINER PRESSURIZATION SYSTEM - SIMPLIFIED SCHEMATIC

Section III

DETAILED SCHEMATIC CALLOUT LIST

FIND NO.	COMPONENT	PART NO.
1	Pipe Assembly	1A43817-1
2	Pipe Assembly	1A43824-1
3	Pipe Assembly	1B52369-1
4	Pipe Assembly	1A98357-1
5	Pipe Assembly	1A98355-1
6	Pipe Assembly	1A98356-1
7	Pipe Assembly	1A97404-1
8	Pipe Assembly	1B43400-1
9	Pipe Assembly	1B51605-1
10	Pipe Assembly	1B55283-1
11	Pipe Assembly	1B55284-1
12	Pipe Assembly	1A92853-1
13	Transducer, Pressure	1A72913-573
14	Pipe Assembly	1B55280-1
15	Pipe Assembly	1B43815-1
16	Transducer, Pressure	1A72913-539
17	Pipe Assembly	1A43818-1
18	Pipe Assembly	1B51560-1
19	Pipe Assembly	1B51558-1
20	Pipe Assembly	1B51520-1
21	Pipe Assembly	1B51521-1
22	Switch, Pressure, Dummy	8288-1
23	Pipe Assembly	1B54498-1
24	Pipe Assembly	1B54368-1
25	Pipe Assembly	1B54369-1
26	Pipe Assembly	1B58307-1
27	Pipe Assembly	1B58308-1
28	Pipe Assembly	1B54515-1
29	Transducer, Pressure	1A68551-545

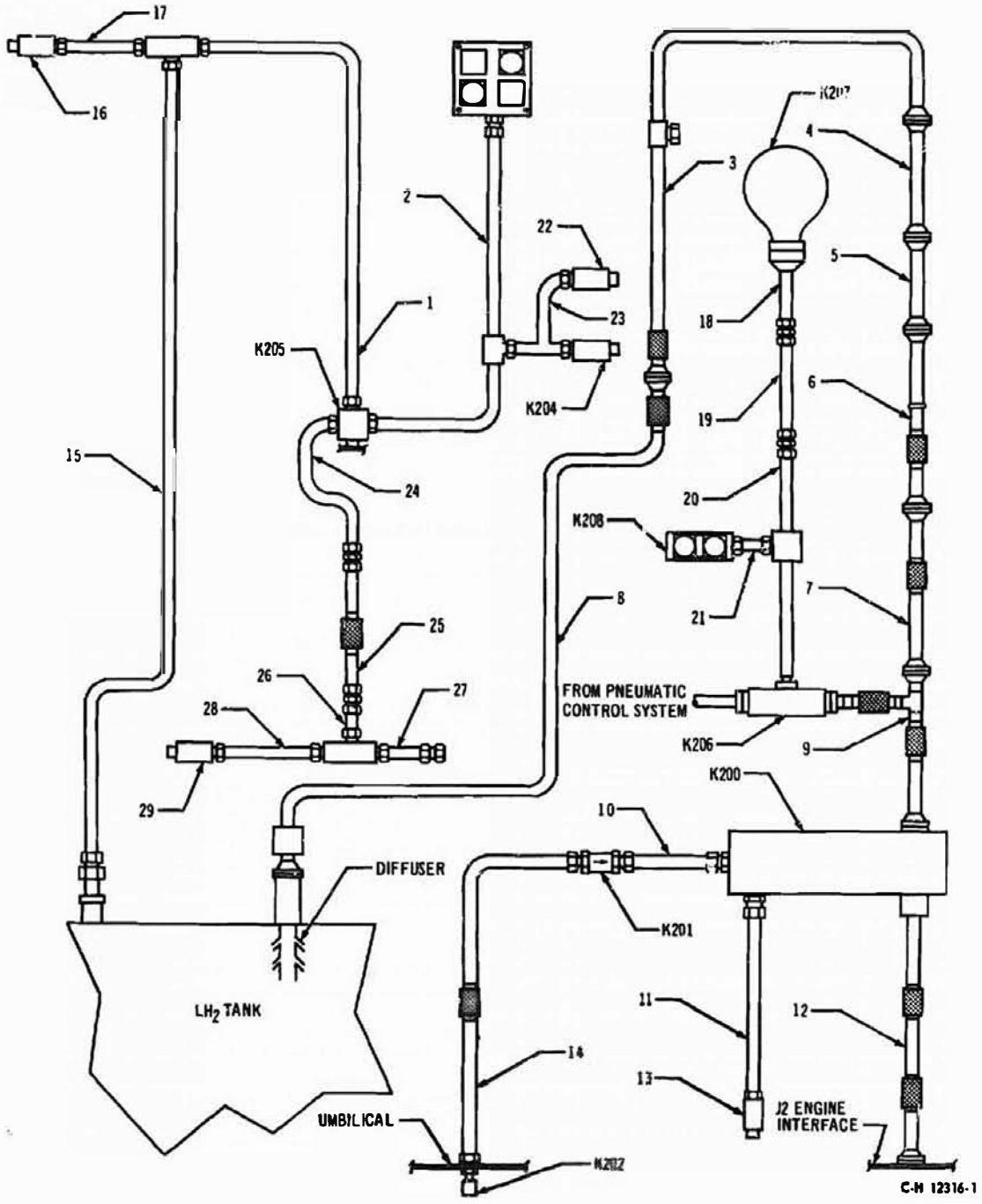

FIGURE E-2 FUEL CONTAINER PRESSURIZATION SYSTEM - DETAILED SCHEMATIC

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F. PNEUMATIC CONTROL SYSTEM

The pneumatic control system is controlled by a pneumatic power-control module assembly using helium supplied from a ground source. This module provides pneumatic power to the control modules. The control modules provide pneumatic power for the operation of the LOX and LH_2 vent and relief valves, the directional control valve, the LOX and LH_2 fill and drain valves, the LOX and LH_2 turbopump purge, the LOX chilldown pump purge, the LOX and LH_2 chilldown shutoff valves, the LOX propulsive vent valve, and the LOX and LH_2 prevalves.

Helium is used for purging the LH_2 fill and drain valve, LOX tank vent and relief valve, LOX fill and drain valve, LH_2 propulsive vent system, LOX propulsive vent system, camera lights, T. V. cameras, and the directional control valve. The purge system consists of check valves and restrictors.

Section III

PNEUMATIC CONTROL SYSTEM INFORMATION ILLUSTRATIONS

PNEUMATIC CONTROL SYSTEM CALLOUT LIST

FIND NO.	COMPONENT	PART NO.	PAGE
K1	Disconnect, LH_2 Fill and Drain	1A49978-503	C-12
K2	Valve, LH_2 Fill and Drain	1A48240-501	C-13
K3	Valve, LOX Tank Relief	1A49590-507	
K4	Valve, LOX Tank Vent and Relief	1A48312-501	C-14
K5	Valve, LOX Chilldown Relief	P/O 1A49423-1	C-16
K6	Valve, Solenoid, LOX Chilldown Pump	1A67913	C-15
K7	Pump, LOX Chilldown	1A49423-1	C-16
K8	Valve, Shutoff, LOX Chilldown	1A49965-509	C-17
K9	Prevalve, LOX	1A49968-501	C-18
K11	Disconnect, LOX Fill and Drain	1A49970-503	C-20
K12	Valve, LOX Fill and Drain	1A48240-501	C-13
K13	Prevalve, LH_2	1A49968-503	C-18
K14	Valve, Shutoff, LH_2 Chilldown	1A49965-507	C-17
K15	Pump, LH_2 Chilldown	1A49421-501	
K17	Valve, Relief, LH_2 Tank	1A49591-513	C-21
K18	LH_2 Vent Disconnect Assembly	1A48848-503	C-22
K19	Valve, Directional Control, LH_2 Vent	1A49988-1	C-23
K20	Valve, LH_2 Vent and Relief	1A48257-1	C-24
K28	Valve, Vent, LOX Propulsive	7851806-509	
K206	Module, Repressurization	1A49989-505	
K300	Module, Pneumatic Power Control	1A58345-505	F-11
K301	Sphere, Storage, Helium	1A49963-1	F-12
K302	Valve, Check, Helium	1B51361-1	F-13
K303	Switch, Pressure, Helium Safe	1A66998-503	F-14
K304	Switch, Pressure, Helium Minimum Liftoff	1A66996-511	F-15
K305	Manifold and Pressure Switch Assembly	1B53615-1	
K306	Module, Helium Fill	1A57350-503	F-16
K307	Disconnect, Helium Control	7851823-503	F-17
K308	Valve, Check, Helium	1B51361-1	F-13
K309	Valve, Check, Helium	1B51361-1	F-13
K310	Module, Engine Pump Purge	1A58347-507	F-18
K311	Module, Control	1A58347-505	F-19
K312	Switch, Pressure	7851847-525	F-20
K313	Module, Actuation Control	1A49982-503	F-21

PNEUMATIC CONTROL SYSTEM CALLOUT LIST (CONT.)

FIND NO.	COMPONENT	PART NO.	PAGE
K314	Module, Actuation Control	1A49982-505	F-22
K315	Module, Actuation Control	1A49982-505	F-22
K316	Module, Actuation Control	1A49982-505	F-22
K317	Valve, Check, Helium	1B51361-1	F-13
K318	Module, Actuation Control	1A49982-513	F-23
K319	Module, Actuation Control	1A49982-511	F-35
K320	Tank, Compressed Gas, Control Helium	1A48857-1	F-24
K321	Valve, Check, Helium	1B51361-1	F-13
K322	Restrictor, Flow	1B40622-505	F-25
K323	Restrictor, Flow	1B40622-505	F-25
K324	Restrictor, Flow	1B40622-501	F-26
K325	Restrictor, Flow	1A48854-1	F-27
K326	Transducer, Pressure, Absolute	1A72913-547	F-28
K327	Transducer, Pressure, Absolute	1A72913-557	F-29
K328	Transducer, Pressure, Absolute	1B39293-1	F-30
K329	Transducer, Pressure, Absolute	1A72913-547	F-28
K330	Valve, Needle, Three-way	10414087	F-31
K331	Valve, Needle, Three-way	10414087	F-31
K332	Switch, Pressure, Pump Purge Regulator Back-up	1A67002-501	F-32
K333	Switch, Pressure, Medium, Helium Control	7851830-511	F-33
K334	Valve, Check, Helium	1B51361-1	F-13
K335	Valve, Check, Helium	1B51361-1	F-13
K336	Orifice	1B63206-1	
K337	Restrictor, Flow	1B40622-501	F-26
K338	Restrictor, Flow	1B40622-501	F-26
K339	Restrictor, Flow	1B40622-503	F-34
K340	Module, Actuation Control	1A49982-511	F-35
K341	Restrictor, Flow	R4-8*	

*Del Mfg. Co.

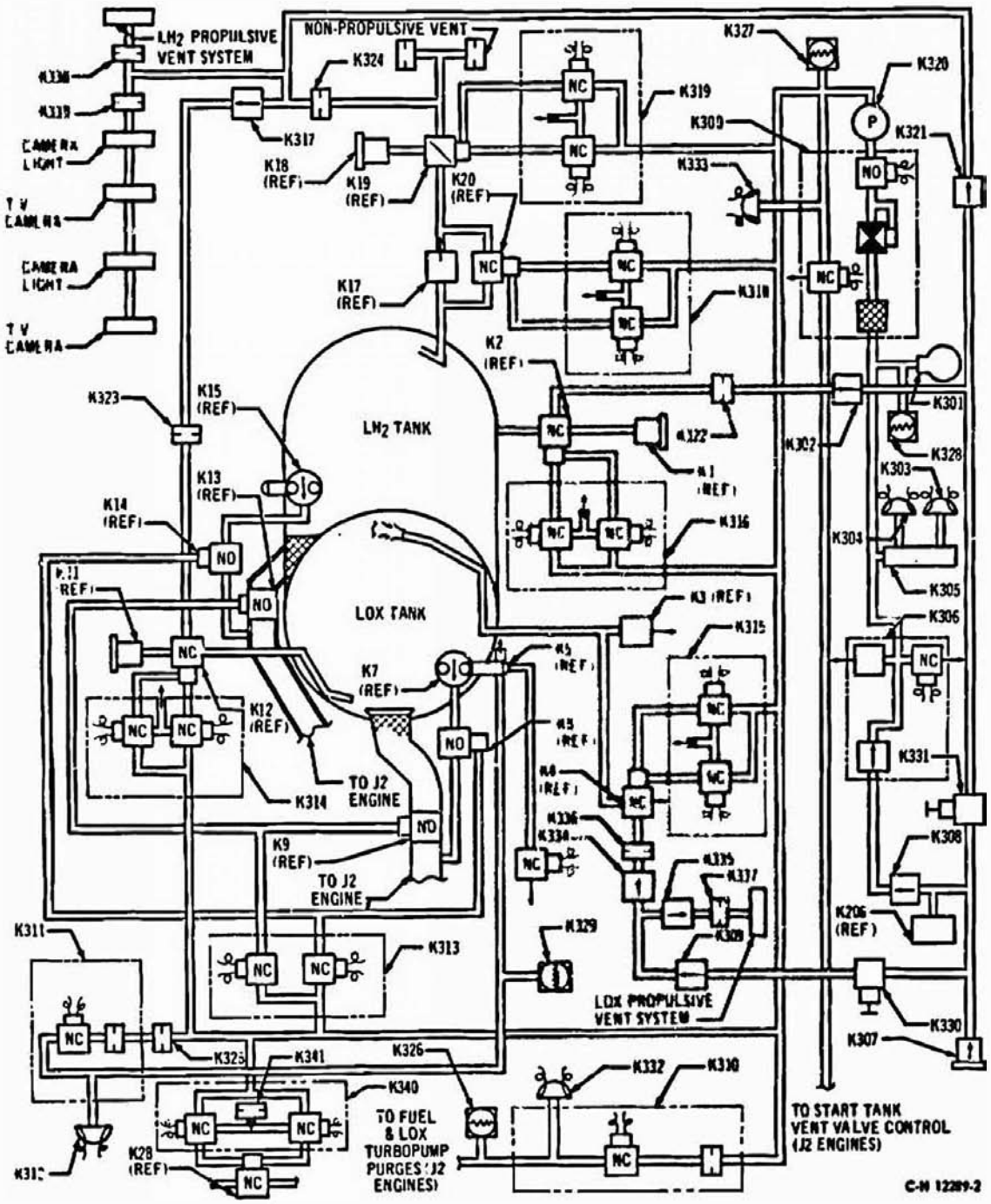

FIGURE F-1 PNEUMATIC CONTROL SYSTEM - SIMPLIFIED SCHEMATIC

DETAILED SCHEMATIC CALLOUT LIST

FIND NO.	COMPONENT	PART NO.
1	Pipe Assembly	1B53674-1
2	Pipe Assembly	1A96386-1
3	Pipe Assembly	1B33564-1
4	Pipe Assembly	1B32912-1
5	Pipe Assembly	1B38030-1
6	Pipe Assembly	1B38205-1
7	Pipe Assembly	1A96657-1
8	Pipe Assembly	1B54931-1
9	Pipe Assembly	1B34773-1
10	Pipe Assembly	1A96658-1
11	Pipe Assembly	1A95050-1
12	Pipe Assembly	1A95051-1
13	Pipe Assembly	1B28528-1
14	Pipe Assembly	1B62917-1
15	Pipe Assembly	1A92852-1
16	Pipe Assembly	1A96405-1
17	Pipe Assembly	1B32909-1
18	Pipe Assembly	1B34923-1
19	Pipe Assembly	1B52509-1
20	Pipe Assembly	1B57900-1
21	Pipe Assembly	1B59189-1
22	Pipe Assembly	1B62920-1
23	Pipe Assembly	1B62919-1
24	Pipe Assembly	1B62923-1
25	Pipe Assembly	1B52550-1
26	Pipe Assembly	1B59187-1
27	Pipe Assembly	1B62913-1
28	Pipe Assembly	1B58809-1
29	Pipe Assembly	1B62918-1
30	Pipe Assembly	1B62915-1
31	Pipe Assembly	1B62916-1
32	Pipe Assembly	1B62912-1
33	Pipe Assembly	1B59181-1
34	Pipe Assembly	1B56808-1
35	Pipe Assembly	1B58817-1
36	Pipe Assembly	1B51252-1
37	Pipe Assembly	1B51219-1
38	Pipe Assembly	1B51220-1
39	Pipe Assembly	1B51255-1
40	Pipe Assembly	1A92844-1
41	Pipe Assembly	1B29207-1
42	Pipe Assembly	1B62914-1

DETAILED SCHEMATIC CALLOUT LIST (CONT.)

FIND NO.	COMPONENT	PART NO.
43	Pipe Assembly	1A96396-1
44	Pipe Assembly	1B54932-1
45	Pipe Assembly	1B51567-1
46	Pipe Assembly	1B51566-1
47	Pipe Assembly	1B51224-1
48	Pipe Assembly	1A96659-1
49	Pipe Assembly	1B34766-1
50	Pipe Assembly	1A95048-1
51	Pipe Assembly	1A95049-1
52	Pipe Assembly	1A74417-1
53	Pipe Assembly	1A74418-1
54	Pipe Assembly	1B54166-1
55	Pipe Assembly	1A45047-1
56	Pipe Assembly	1A95046-1
57	Pipe Assembly	1A96662-1
58	Pipe Assembly	1A95042-1
59	Pipe Assembly	1B37302-1
60	Pipe Assembly	1B37315-1
61	Pipe Assembly	1B40931-1
62	Pipe Assembly	1B43396-1
63	Pipe Assembly	1B32914-1
64	Pipe Assembly	1B51775-1
65	Pipe Assembly	1B43398-1
66	Pipe Assembly	1B32910-1
67	Pipe Assembly	1B51227-1
68	Pipe Assembly	1A97227-1
69	Pipe Assembly	1A95044-1
70	Pipe Assembly	1A95045-1
71	Pipe Assembly	1B34770-1
72	Pipe Assembly	1A92864-1
73	Pipe Assembly	1A96663-1
74	Pipe Assembly	1B38321-1
75	Pipe Assembly	1B38322-1
76	Pipe Assembly	1A96661-1
77	Pipe Assembly	1B44116-1
78	Pipe Assembly	1B54932-1
79	Pipe Assembly	1B43554-1
80	Pipe Assembly	1B44220-1
81	Pipe Assembly	1B51522-1
82	Pipe Assembly	1B51254-1
83	Pipe Assembly	1B51253-1
84	Pipe Assembly	1B56604-1

DETAILED SCHEMATIC CALLOUT LIST (CONT.)

FIND NO.	COMPONENT	PART NO.
85	Pipe Assembly	1B56603-1
86	Pipe Assembly	1B51618-1
87	Pipe Assembly	1B51788-1
88	Pipe Assembly	1B51792-1
89	Pipe Assembly	1B51790-1
90	Pipe Assembly	1B51791-1
91	Pipe Assembly	1B51789-1
92	Pipe Assembly	1B51788-1
93	Pipe Assembly	1B51792-1
94	Pipe Assembly	1B51790-1
95	Pipe Assembly	1B51575-1
96	Pipe Assembly	1B51576-1
97	Pipe Assembly	1B51580-1
98	Pipe Assembly	1B51577-1
99	Pipe Assembly	1B51578-1
100	Pipe Assembly	1B51579-1
101	Camera Light	50M10224-1
102	Tube Assembly	10M12047-1
103	T. V. Camera	50M12584-1
104	Tube Assembly	10M12048-1
105	Camera Light	50M10224-1
106	Tube Assembly	10M12049-1
107	T. V. Camera	50M12583-1
108	Pipe Assembly	1B51561-1
109	Pipe Assembly	1B51551-1
110	Pipe Assembly	1B51552-1
111	Pipe Assembly	1B51529-1

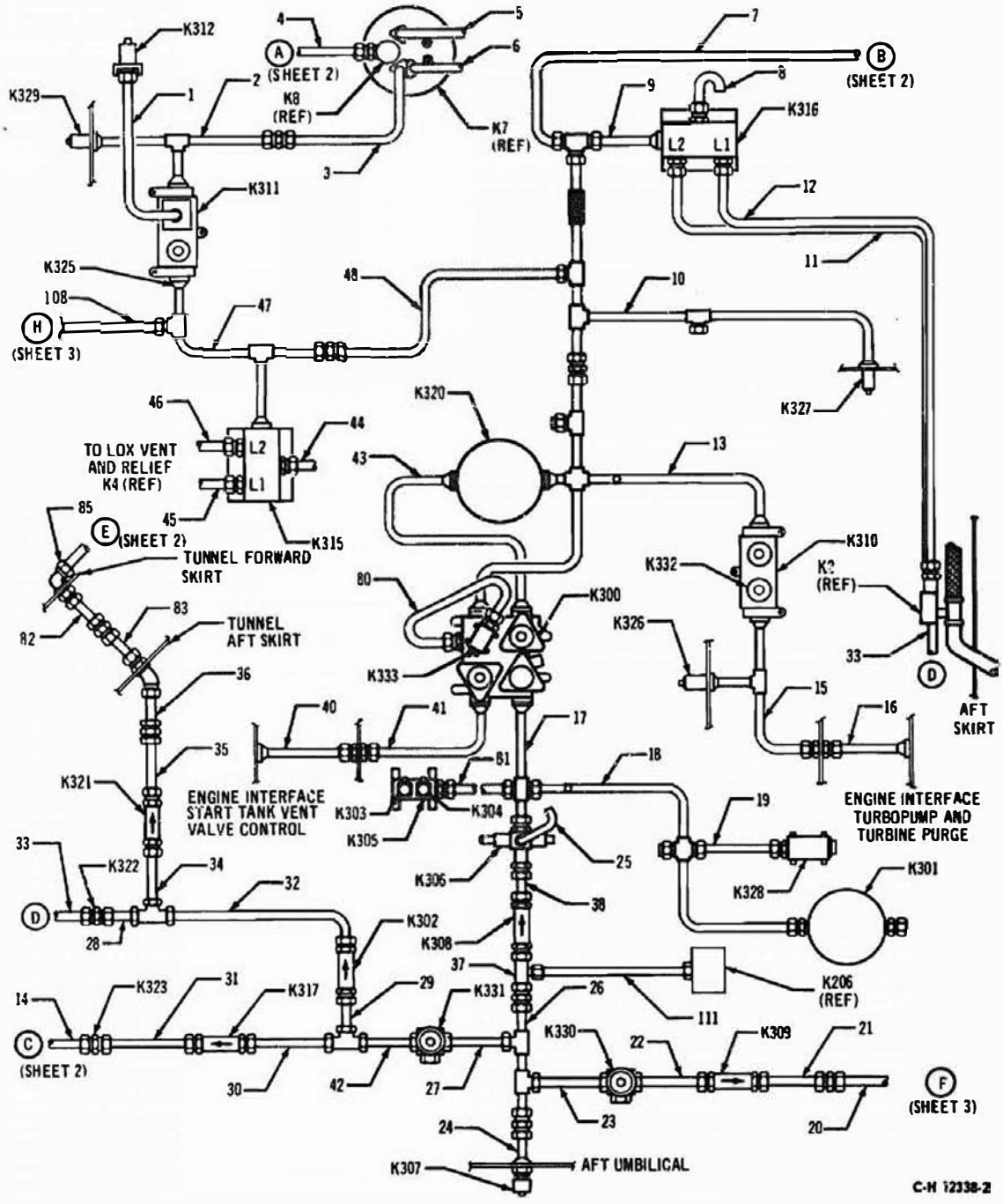

FIGURE F-2 PNEUMATIC CONTROL SYSTEM - DETAILED SCHEMATIC (Sheet 1 of 3)

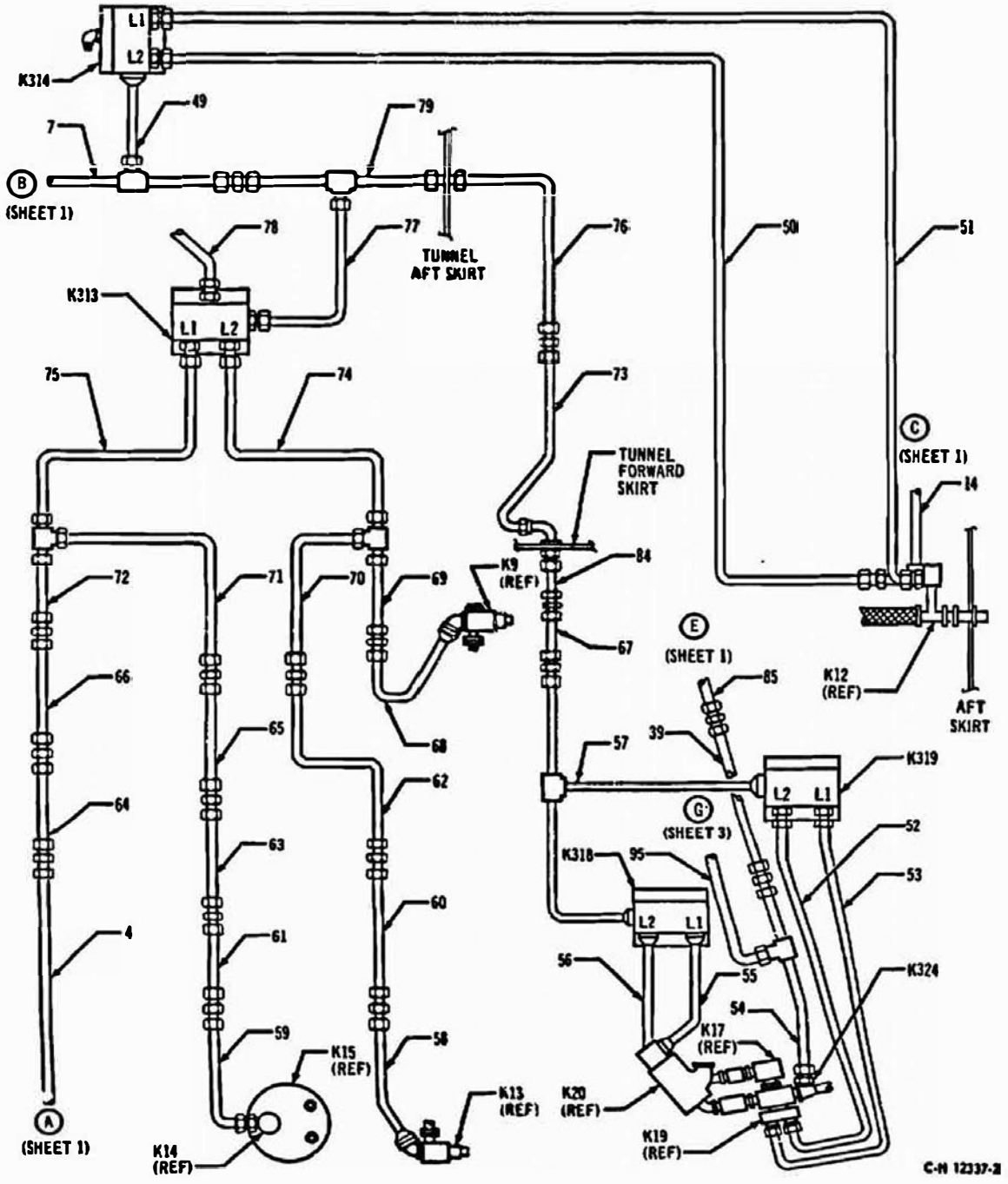

FIGURE F-2 PNEUMATIC CONTROL SYSTEM - DETAILED SCHEMATIC
(Sheet 2 of 3)

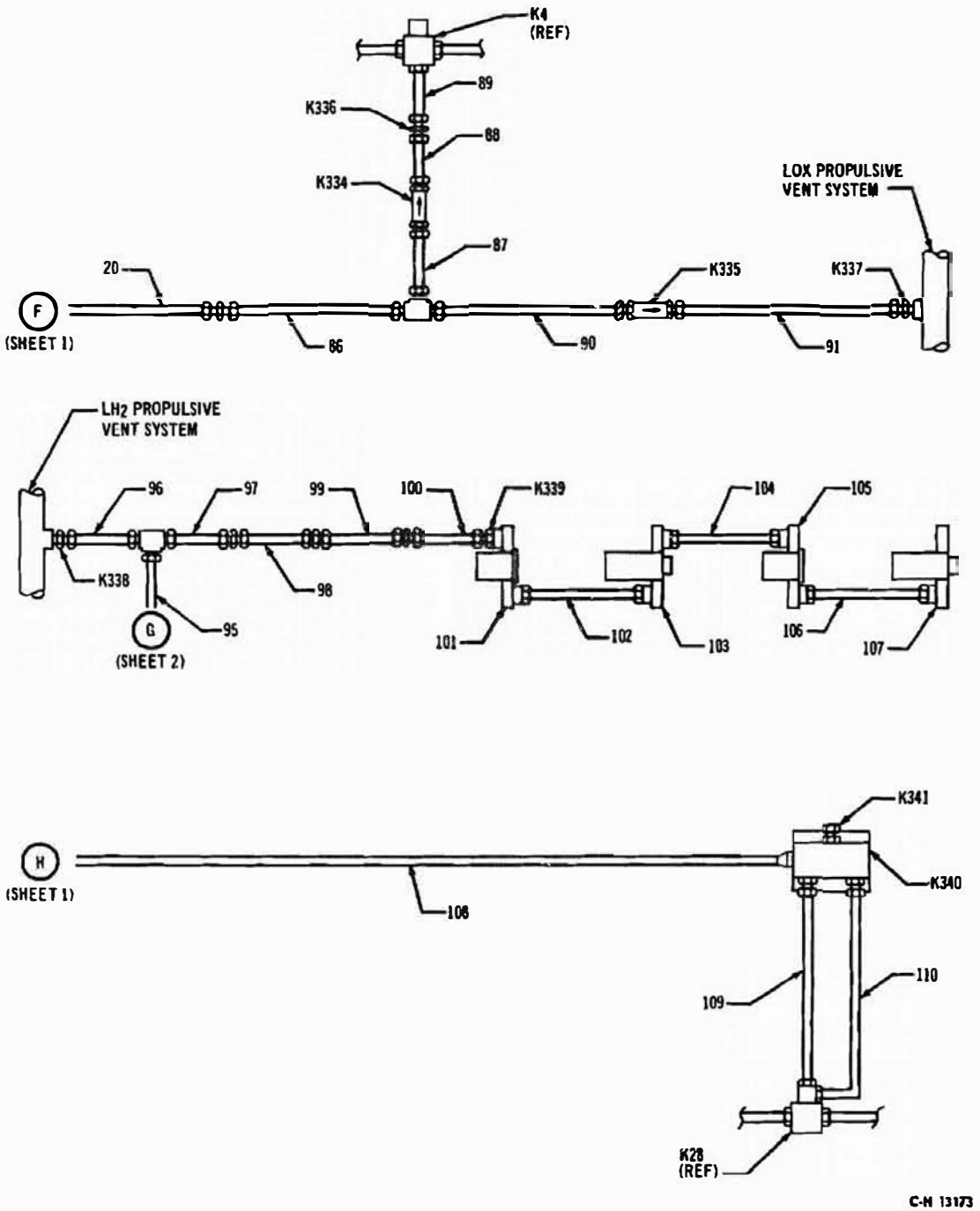

FIGURE F-2 PNEUMATIC CONTROL SYSTEM - DETAILED SCHEMATIC (Sheet 3 of 3)

PNEUMATIC POWER CONTROL MODULE, PART NO. 1A58345-505

The pneumatic power control module (K300) regulates helium from the ground source and supplies pneumatic power for the control of the control modules in this system. The module consists of a filter, regulator, shutoff valve, and vent valve.

1. VENDOR: Vinson Mfg. Co. (part no. A-62390-501)
2. LOCATION: On thrust structure between stringer 7 and 8
3. SERVICE: Helium and electrical
4. TEMPERATURE (operating): -87.2 to +74°C (-125 to +165°F)
5. PRESSURE:
   a. Operating:
      (1) Port no. 2: 2100 ± 70 N/cm² (3100 ± 100 psig)
      (2) Ports no. 3 and 4: 327 ± 17.2 N/cm² (475 ± 25 psig)
   b. Proof:
      (1) Ports no. 1 and 4: 1700 N/cm² (2400 psig) applied simultaneously
      (2) Ports no. 2 and 3: 3300 N/cm² (4800 psig) applied simultaneously
   c. Burst:
      (1) Ports no. 1 and 4: 2800 N/cm² (4000 psig) applied simultaneously
      (2) Ports no. 2 and 3: 5500 N/cm² (8000 psig) applied simultaneously
6. LEAKAGE:
   a. External: 1 scch (0.06 scih) max at operating pressure and temperature
   b. Internal: 160 sccm (10 scim) max with inlet pressure at 2100 ± 70 N/cm² (3100 ± 100 psig) with temperature -87°C (-125°F)
7. ELECTRICAL CHARACTERISTICS:
   a. Operating voltage: 24 to 30 Vdc
   b. Operating current: 1.5 A at 28 Vdc
   c. Drop-out voltage: 8 Vdc max, 2 Vdc min
8. FILTER ELEMENT:
   a. Remove particles of 10^{-2} cm (10 microns) or larger.
   b. Element must be at least 98 percent efficient.
   c. 2240 N/cm² (3250 psig) min collapse differential pressure
9. REMARKS: This page reflects information on DAC drawing 1A58345 rev M and AEO's through R.

HELIUM STORAGE SPHERE, PART NO. 1A49963-1

The helium storage sphere (K301) stores and provides regulated helium for the operation of the pneumatic power control module (K300) after liftoff.

1. VENDOR: Airtek Dynamics, Inc. (part no. 4425009-901)
2. LOCATION: On thrust structure between stringer 7 and 8
3. SERVICE: Helium
4. TEMPERATURE (operating): -40 to +99°C (-40 to +210°F)
5. PRESSURE:
   a. Operating: 0 to 2200 N/cm² (0 to 3200 psig)
   b. Proof: 3300 N/cm² (4800 psig)
   c. Burst: 6000 N/cm² (8000 psig)
6. LEAKAGE: External: 1×10^{-3} sccm (0.06×10^{-3} in³/s) max with 2200 N/cm² (3200 psig) applied
7. REMARKS: This page reflects information on DAC drawing 1A49963 rev J.

HELIUM CHECK VALVE, PART NO. 1B51361-1

The helium check valves (K302, K308, K309, K317, K321, K334, and K335) are used in the pneumatic control system to prevent reverse flow of regulated helium.

1. VENDOR: The Lanagan Co. Inc. (part no. 90237)
2. LOCATION:
   a. K302: Inside aft skirt between stringer 21A and 22A in purge line to LH_2 fill and drain valve
   b. K308: On thrust structure, between stringer 6A and 8A in fill line to helium fill module
   c. K309: On thrust structure, between stringer 9A and 10 in purge line to LOX tank vent and relief valve
   d. K317: Inside aft skirt, between stringer 22A and 23A in purge line to LOX fill and drain valve
   e. K321: Inside aft skirt, between stringer 21A and 22A in purge line to directional control valve
   f. K334: On thrust structure, between stringer 17 and 18 in purge line to LOX tank vent and relief valve
   g. K335: On thrust structure, between stringer, 17 and 18 in purge line to LOX propulsive vent system
3. SERVICE: Helium
4. TEMPERATURE (operating): -184 to +71°C (-300 to +160°F)
5. PRESSURE:
   a. Proof: 3300 N/cm² (4800 psig)
   b. Burst: 6000 N/cm² (8000 psig)
6. LEAKAGE:
   a. External: 1 scch (0.06 scih) max at operating pressure and temperature
   b. Internal: 80 sccm (5 scim) max at operating pressure and temperature
7. REMARKS: This page reflects information on DAC drawing 1B51361 rev C.

HELIUM SAFE PRESSURE SWITCH, PART NO. 1A66998-503

The helium safe pressure switch (K303) is part of the manifold and pressure switch assembly (K305). The switch indicates helium safe pressure in the storage sphere (K301).

1. VENDOR: Frebank Co. (part no. 8221-4)
2. LOCATION: On thrust structure between stringer 11 and 11A
3. SERVICE: Helium and electrical
4. TEMPERATURE (operating): -73 to +74°C (-100 to +165°F)
5. PRESSURE:
   a. Operating: 2200 N/cm² (3200 psia)
   b. Proof: 3300 N/cm² (4800 psia)
   c. Burst: 6000 N/cm² (8000 psia)
   d. Actuation: 1140 ± 70 N/cm² (1650 ± 100 psia)
   e. Deactuation: 1000 ± 70 N/cm² (1450 ± 100 psia)
6. LEAKAGE: External: 1 x 10^{-7} cm³/s (0.06 x 10^{-7} in³/s) max with 2200 N/cm² (3200 psia) applied
7. ELECTRICAL CHARACTERISTICS:
   a. Type: Double-pole double-throw
   b. Insulation resistance: 100 MΩ min at 500 Vdc
   c. Contact voltage drop: 50 mV max at 1A, 30 Vdc for each set of contacts
8. REMARKS: This page reflects information on DAC drawing 1A66998 rev M.

MINIMUM LIFTOFF PRESSURE SWITCH, PART NO. 1A66996-511

The minimum liftoff pressure switch (K304) is part of the manifold and pressure switch assembly (K305). The switch indicates helium minimum liftoff pressure in the storage sphere (K301).

1. VENDOR: Frebank Co. (part no. 8221-7)
2. LOCATION: On thrust structure between stringer 11 and 11A
3. SERVICE: Helium and electrical
4. TEMPERATURE (operating): -20.5 to +49°C (-5 to +120°F)
5. PRESSURE:
   a. Operating: 2200 N/cm² (3200 psia)
   b. Proof: 3300 N/cm² (4800 psia)
   c. Burst: 6000 N/cm² (8000 psia)
   d. Actuation: 2000 N/cm² (3000 psia)
   e. Deactuation: 1920 N/cm² (2790 psia)
6. LEAKAGE (external): 1×10^{-7} cm³/s (0.06×10^{-7} in³/sec) max with 3000 N/cm² (4000 psia) applied
7. ELECTRICAL CHARACTERISTICS:
   a. Type: Double-pole double-throw
   b. Insulation resistance: 100 MΩ min at 500 Vdc
   c. Contact voltage drop: 50 mV max at 1A, 30 Vdc for each set of contacts
8. REMARKS: This page reflects information on DAC drawing 1A66996 rev T.

Section III

HELIUM FILL MODULE, PART NO. 1A57350-503

The helium fill module (K306) relieves excess pressure and vents storage sphere (K301). The module consists of a check valve, solenoid valve, and a pressure relief valve.

1. VENDOR: Fairchild Hiller Corp. (part no. 64-820-02)
2. LOCATION: On thrust structure between stringer 9 and 10
3. SERVICE: Helium and electrical
4. TEMPERATURE (operating): -87.2 to +74°C (-125 to +165°F)
5. PRESSURE:
   a. Operating: 300 to 2200 N/cm² (500 to 3200 psig)
   b. Proof: 3300 N/cm² (4800 psig)
   c. Burst: 6000 N/cm² (8000 psig)
6. LEAKAGE:
   a. External: 1 scch (0.06 scih) max throughout the operating pressure and temperature range.
   b. Internal: 80 sccm (5 scim) max throughout the operating pressure and temperature range.
7. ELECTRICAL CHARACTERISTICS:
   a. Operating voltage: 24 to 30 Vdc
   b. Insulation resistance: 100 MΩ min at 500 Vdc
   c. Current draw: 1.5 A max
   d. Pull-in voltage: 18 Vdc max
   e. Drop-out voltage: 8 Vdc max, 2 Vdc min
8. REMARKS: This page reflects information on DAC drawing 1A57350 rev D and AEO's through H.

HELIUM CONTROL DISCONNECT, PART NO. 7851823-503

The helium control disconnect (K307) is a male-type coupling nipple with an internal sealing poppet to prevent reverse flow after disconnect. This coupling allows ground helium connection for filling of the pneumatic control system.

1. VENDOR: On Mark Coupling Corp. (part no. 1198004-02)
2. LOCATION: Aft umbilical plate on aft skirt
3. SERVICE: Helium
4. TEMPERATURE (operating): -40 to +71°C (-40 to +160°F)
5. PRESSURE:
   a. Operating: 2100 N/cm² (3100 psig)
   b. Proof: 3200 ± 30 N/cm² (4650 ± 50 psig)
   c. Burst: 5340 N/cm² (7750 psig)
6. LEAKAGE:
   a. External: 160 sccm (10 scim) max at 2000 ± 70 N/cm² (3000 ± 100 psig)
   b. Internal: 16 sccm (1 scim) max
7. REMARKS: This page reflects information on DAC drawing 7851823 rev M.

ENGINE PUMP PURGE CONTROL MODULE, PART NO. 1A58347-507

The engine pump purge control module (K310) supplies controlled pneumatic power for purging of the fuel and LOX turbopump. The module consists of a restrictor and a solenoid valve.

1. VENDOR:
2. LOCATION: On thrust structure between stringer 6A and 8A
3. SERVICE: Helium and electrical
4. TEMPERATURE (operating): -87 to +71°C (-125 to +160°F)
5. PRESSURE:
   a. Operating: 327 ± 17 N/cm² (475 ± 25 psig)
   b. Proof: 520 N/cm² (750 psig)
   c. Burst: 862 N/cm² (1250 psig)
6. LEAKAGE:
   a. External: 1 sccm (0.06 scim) max at operating pressure and temperature.
   b. Internal: 10 sccm (0.61 scim) max with inlet pressure at 327 + 17 N/cm² 475 ± 25 psig with temperature -53.8°C (-65°F).
7. ELECTRICAL CHARACTERISTICS:
   a. Insulation resistance: 100 MΩ min at 500 Vdc
   b. Current draw: 1.5A max at operating pressure
   c. Pull-in voltage: 18 Vdc max
   d. Drop-out voltage: 8 Vdc max, 2 Vdc min
8. REMARKS: This page reflects information on DAC drawing 1A58347 rev P.

LOX CHILLDOWN PUMP PURGE CONTROL MODULE, PART NO. 1A58347-505

The LOX chilldown pump purge control module (K311) supplies controlled pneumatic power for the purging of the LOX chilldown pump. The module consists of a restrictor and a solenoid valve.

1. VENDOR:
2. LOCATION: On thrust structure between stringer 15 and 16
3. SERVICE: Helium and electrical
4. TEMPERATURE (operating): -87 to +71°C (-125 to +160°F)
5. PRESSURE:
   a. Operating: 327 ± 17 N/cm² (475 ± 25 psig)
   b. Proof: 520 N/cm² (750 psig)
   c. Burst: 860 N/cm² (1250 psig)
6. LEAKAGE:
   a. External: 1 sccm (0.06 scim) max at operating pressure and temperature
   b. Internal: 10 sccm (0.61 scim) max with inlet pressure at 327 ± 17 N/cm² (475 ± 25 psig) with temperature -540°C (-65°F)
7. ELECTRICAL CHARACTERISTICS:
   a. Insulation resistance: 100 MΩ min at 500 ± 50 Vdc
   b. Current draw: 1.5A max at operating pressure and temperature, with 28 Vdc applied to terminals
   c. Pull-in voltage: 18 Vdc max
   d. Drop-out voltage: 8 Vdc max, 2 Vdc min
8. REMARKS: This page reflects information on DAC drawing 1A58347 rev P.

Section III

LOW PRESSURE SWITCH, PART NO. 7851847-525

The low pressure switch (K312) serves as a regulating function for the solenoid valve located in the LOX Chilldown Pump Purge Control Module (K311).

1. VENDOR: Freband Co. (part no. 8261-8)
2. LOCATION: On thrust structure between stringer 15 and 16
3. SERVICE: Helium and electrical
4. TEMPERATURE (operating): -74 to +52°C (-100 to +125°F)
5. PRESSURE:
   a. Operating: 60 N/cm² (80 psia)
   b. Proof: 83 N/cm² (120 psia)
   c. Burst: 100 N/cm² (200 psia)
   d. Actuation: 36 N/cm² (53 psia)
   e. Deactuation: 34 N/cm² (49 psia)
6. LEAKAGE (external): 1×10^{-7} cm³/s (0.06×10^{-7} in³/sec) max with 83 N/cm² (120 psia) applied
7. ELECTRICAL CHARACTERISTICS:
   a. Insulation resistance: 100 MΩ min at 500 Vdc
   b. Contact voltage drop: 50 mV max at 1A, 30 Vdc for each set of contacts
8. REMARKS: This page reflects information on DAC drawing 7851847 rev AC and AEO AD.

ACTUATION CONTROL MODULE, PART NO. 1A49982-503

The actuation control module (K313) provides pressure-regulated helium for the pneumatic control of the LOX prevalve (K9), LH_2 prevalve (K13), LOX chilldown shutoff valve (K8), and the LH_2 chilldown shutoff valve (K14). The module consists of two solenoid valves.

1. VENDOR: Clary Dynamics Corp. (part no. 525094)
2. LOCATION: Inside aft skirt at stringer 32
3. SERVICE: Helium and electrical
4. TEMPERATURE (operating): -34 to +74°C (-30 to +165°F)
5. PRESSURE:
   a. Operating: 327 $\pm$ 17 N/cm² (475 $\pm$ 25 psig
   b. Proof: 520 N/cm² (750 psig)
   c. Burst: 862 N/cm² (1250 psig)
6. LEAKAGE:
   a. External: 1 scch (0.06 scih) max at operating pressure and temperature
   b. Internal: 20 sccm (1.22 scim) max at operating temperature with 327 $\pm$17 N/cm² (475 $\pm$25 psig) applied at port no. 1 and no. 4
7. ELECTRICAL CHARACTERISTICS:
   a. Operating voltage: 24 to 30 Vdc
   b. Insulation resistance: 100MΩ min at 500 Vdc
   c. Current draw: 1.5 A max
   d. Pull-in voltage: 18 Vdc max, 5 Vdc min
   e. Drop-out voltage: 8 Vdc max, 1.5 Vdc min
8. REMARKS: This page reflects information on DAC drawing 1A49982 rev V and AEO's through Z.

ACTUATION CONTROL MODULE, PART NO. 1A49982-505

The actuation control module (K314) provides pressure-regulated helium for the pneumatic control of the LOX fill and drain valve (K12).

The actuation control module (K315) provides pressure-regulated helium for the pneumatic control of the LOX tank vent and relief valve (K4).

The actuation control module (K316) provides pressure-regulated helium for the pneumatic control of the LH_2 fill and drain valve (K2). Each module consists of two solenoid valves.

1. VENDOR: Clary Dynamics Corp. (part no. 520941)
2. LOCATION:
   a. K314: Inside aft skirt, between stringer 26A and 27A.
   b. K315: On thrust structure, between stringer 15 and 16.
   c. K316: Inside aft skirt, at stringer 21A.
3. SERVICE: Helium and electrical
4. TEMPERATURE (operating): -34 to +74°C (-30 to +165°F)
5. PRESSURE:
   a. Operating: 327 ± 17 N/cm² (475 ± 25 psig)
   b. Proof: 520 N/cm² (750 psig)
   c. Burst: 862 N/cm² (1250 psig)
6. LEAKAGE:
   a. External: 1 scch (0.06 scih) max at operating pressure and temperature.
   b. Internal: 20 sccm (1.22 scim) max at operating temperature with 327 ± 17 N/cm² (475 ± 25 psig) applied at port no. 1.
7. ELECTRICAL CHARACTERISTICS:
   a. Operating voltage: 24 to 38 Vdc
   b. Insulation resistance: 100MΩ min at 500 Vdc
   c. Current draw: 1.5 A max
   d. Pull-in voltage: 18 Vdc max, 5 Vdc min
   e. Drop-out voltage: 8 Vdc max, 1.5 Vdc min
8. REMARKS: This page reflects information on DAC drawing 1A49982 rev V and AEO's through Z.

ACTUATION CONTROL MODULE, PART NO. 1A49982-513

The actuation control module (K318) provides pressure-regulated helium for the pneumatic control of the LH_2 vent and relief valve (K20). The module consists of two solenoid valves.

1. VENDOR: Clary Dynamics Corp. (part no. 527081)
2. LOCATION: Inside forward skirt, between stringer 13 and 17
3. SERVICE: Helium and electrical
4. TEMPERATURE (operating): -34.5 to +74°C (-30 to +165°F)
5. PRESSURE:
   a. Operating: 327 ± 17 N/cm² (475 ± 25 psig)
   b. Proof: 520 N/cm² (750 psig)
   c. Burst: 862 N/cm² (1250 psig)
6. LEAKAGE:
   a. External: 1 scch (0.06 scih) max at operating pressure and temperature
   b. Internal: 20 sccm (1.22 scim) max at operating temperature with 327 ± N/cm² (475 ± 25 psig) applied at port no. 1.
7. ELECTRICAL CHARACTERISTICS:
   a. Operating voltage: 24 to 30 Vdc
   b. Insulation resistance: 100 MΩ min at 500 Vdc
   c. Current draw: 1.5 A max
   d. Pull-in voltage: 18 Vdc max, 5 Vdc min
   e. Drop-out voltage: 8 Vdc max, 1.5 Vdc min
8. REMARKS: This page reflects information on DAC drawing 1A49982 rev V and AEO's through Z.

Section III

CONTROL HELIUM COMPRESSED GAS TANK, PART NO. 1A48857-1

The control helium compressed gas tank (K320) maintains relative constant pneumatic pressure in the pneumatic control system.

1. VENDOR: Airtek Dynamics (part no. 4425002-901)
2. LOCATION: On thrust structure, between stringer 6A and 8A
3. SERVICE: Helium
4. TEMPERATURE (operating): -87 to +71°C (-125 to +160°F)
5. PRESSURE:
   a. Operating: 0 to 1100 N/cm² (0 to 1600 psig)
   b. Proof: 1700 N/cm² (2400 psig)
   c. Burst: 3000 N/cm² (4000 psig)
6. LEAKAGE: None
7. REMARKS: This page reflects information on DAC drawing 1A48857 rev C and AEO's through H.

FLOW RESTRICTOR, PART NO. 1B40622-505

The flow restrictors (K322 and K323) are used to regulate flow in the pneumatic control system.

1. VENDOR: Del Mfg. Co. (part no. 10183-30)
2. LOCATION:
   a. K322: Inside aft skirt, at stringer 19A in purge line to LH_2 fill and drain valve.
   b. K323: Inside aft skirt, between stringer 22A and 23A in purge line to LOX fill and drain valve.
3. SERVICE: Helium
4. TEMPERATURE (operating):
   a. Internal: -183 to +71°C (-297 to +160°F)
   b. External: -87 to +71°C (-125 to +160°F)
5. PRESSURE:
   a. Operating: 2200 N/cm² (3200 psia)
   b. Proof: 4400 N/cm² (6400 psia)
   c. Burst: 8830 N/cm² (12800 psia)
6. FLOW RATE: 245 ± 3 sccm (15 ± 2 scim) at a temperature of 21 ± 11°C (70 ± 20°F) with a pressure differential of 2200 N/cm² (3200 psia)
7. REMARKS: This page reflects information on DAC drawing 1B40622 rev E and AEO F.

FLOW RESTRICTOR, PART NO. 1B40622-501

The flow restrictor (K324, K337, and K338) are used to regulate flow in the pneumatic control system.

1. VENDOR: Del Mfg. Co. (part no. 10183-10)
2. LOCATION:
   a. K324: Inside forward skirt, at stringer 19 in purge line to LH_2 vent directional valve.
   b. K337: On thrust structure, at stringer 18 in purge line to LOX propulsive vent system.
   c. K338: Inside forward skirt, at stringer 14 and 15 in purge line to LH_2 propulsive vent system.
3. SERVICE: Helium
4. TEMPERATURE (operating):
   a. Internal: -183 to +71°C (-297 to +160°F)
   b. External: 87 to +71°C (-125 to +160°F)
5. PRESSURE:
   a. Operating: 2200 N/cm² (3200 psia)
   b. Proof: 4400 N/cm² (6400 psia)
   c. Burst: 8830 N/cm² (12800 psia)
6. FLOW RATE: 28330 ± 4000 sccm (1728 ± 243 scim) at a temperature of 21 ± 7°C (70 ± 20°F) with a pressure differential of 2200 N/cm² (3200 psia)
7. REMARKS: This page reflects information on DAC drawing 1B40622 rev E and AEO's F.

FLOW RESTRICTOR, PART NO. 1A48854-1

The flow restrictor (K325) is used to regulated flow in the pneumatic control system.

1. VENDOR: Del Mfg. Co. (part no. 10178-10)
2. LOCATION: On thrust structure between stringer 15 and 16 in purge line to LOX chilldown pump
3. SERVICE: Helium
4. TEMPERATURE (operating):
   a. Internal: -183 to +71°C (-297 to +160°F)
   b. External: 87 to +71°C (-125 to +160°F)
5. PRESSURE:
   a. Operating: 360 N/cm² (530 psia)
   b. Proof: 731 N/cm² (1060 psia)
   c. Burst: 1460 N/cm² (2120 psia)
6. FLOW RATE: 16000 ± 1600 sccm (950 ± 95 scim) at a temperature of 21 ± 11°C (70 ± 20°F) with a pressure differential of 327 N/cm² (475 psia).
7. REMARKS: This page reflects information on DAC drawing 1A48854 rev D.

ABSOLUTE PRESSURE TRANSDUCER, PART NO. 1A72913-547

The absolute pressure transducers (K326 and K329) sense the helium pressure in the purge lines.

1. VENDOR: Giannini Controls Corp. (part no. 451319AH-547) and Bourns Inc. (part no. 2004209503)
2. LOCATION:
   a. K326: On thrust structure, between stringer 5 and 6
   b. K329: On thrust structure, between stringer 15 and 16
3. SERVICE: Helium and electrical
4. TEMPERATURE (operating): -74 to +85°C (-101 to +185°F)
5. PRESSURE:
   a. Operating: 0 to 103 N/cm^2 (0 to 150 psia)
   b. Proof: 155 N/cm^2 (225 psia)
   c. Burst: 258 N/cm^2 (375 psia)
6. LEAKAGE: 1×10^{-6} cm^3/s (0.06×10^{-6} in^3/s) max with 100 N/cm^2 (145 psia) applied
7. ELECTRICAL CHARACTERISTICS: Insulation resistance: 50 MΩ min at 200 Vdc between all insulated conductors and case
8. REMARKS: This page reflects information on DAC drawing 1A72913 rev V.

ABSOLUTE PRESSURE TRANSDUCER, PART NO. 1A72913-557

The absolute pressure transducer (K327) senses the helium pressure in the pneumatic power control module (K300).

1. VENDOR: Giannini Controls Corp. (part no. 461319AL-557)
2. LOCATION: On thrust structure, between stringer 5 and 6.
3. SERVICE: Helium and electrical
4. TEMPERATURE (operating): -74 to +85°C (-101 to +185°F)
5. PRESSURE:
   a. Operating: 0 to 450 N/cm² (0 to 650 psia)
   b. Proof: 672 N/cm² (975 psia)
   c. Burst 1120 N/cm² (1625 psia)
6. LEAKAGE: 1×10^{-6} cm³/s (0.06×10^{-6} in³/s) max with 403 N/cm² (585 psia) applied
7. ELECTRICAL CHARACTERISTICS (insulation resistance): 50 MΩ min at 200 Vdc between all insulated conductors and case
8. REMARKS: This page reflects information on DAC drawing 1A72913 rev V.

ABSOLUTE PRESSURE TRANSDUCER, PART NO. 1B39293-1

The absolute pressure transducer (K328) senses the helium pressure in storage sphere (K301).

1. VENDOR: Statham Instrument, Inc. (part no. 16466-3.5M)
2. LOCATION: On thrust structure, between stringer 6A and 8A
3. SERVICE: Helium and electrical
4. TEMPERATURE (operating): -196 to +74°C (-320 to +165°F)
5. PRESSURE:
   a. Operating: 2400 N/cm² (3500 psia)
   b. Proof: 362 N/cm² (5250 psia)
   c. Burst: 6030 N/cm² (8750 psia)
6. ELECTRICAL CHARACTERISTICS:
   a. Operating voltage: 28 ± 4 Vdc
   b. Insulation resistance: 100 MΩ min at 100 Vdc
   c. Current draw: 60 mA max at 28 Vdc
7. REMARKS: This page reflects information on DAC drawing 1B39293 rev J and AEO K.

THREE-WAY NEEDLE VALVE, PART NO. 10414087

The three-way needle valves (K330 and K331) are manually operated and located in the purge line.

1. VENDOR: Benton Corp. (part no. B-15600)
2. LOCATION:
   a. K330: On thrust structure, between stringer 5A and 6
   b. K331: Inside aft skirt, between stringer 25A and 26A
3. SERVICE: Helium
4. TEMPERATURE (operating): -74 to +290°C (-100 to +550°F)
5. PRESSURE:
   a. Operating: 2000 N/cm² (3000 psig)
   b. Proof: 3100 N/cm² (4500 psig)
   c. Burst: 5200 N/cm² (7500 psig)
6. REMARKS: This page reflects information on drawing 10414087.

PUMP PURGE REGULATOR BACK-UP PRESSURE SWITCH, PART NO. 1A67002-501

The pump purge regulator back-up pressure switch (K332) serves a regulating function for the solenoid valve in module (K310).

1. VENDOR: Frebank Co. (part no. 8220-1)
2. LOCATION: On thrust structure, between stringer 6A and 8A
3. SERVICE: Helium and electrical
4. TEMPERATURE (operating): -129 to +71°C (-200 to +160°F)
5. PRESSURE:
   a. Operating: 400 N/cm² (600 psia)
   b. Proof: 620 N/cm² (900 psia)
   c. Burst: 1000 N/cm² (1500 psia)
   d. Actuation: 90 N/cm² (130 psia)
   e. Deactuation: 72 N/cm² (105 psia)
6. LEAKAGE:
   a. External: 1×10^{-7} cm³/s (0.06×10^{-7} in³/s) max with 520 N/cm² (750 psia) applied
   b. Internal: 1×10^{-7} cm³/s (0.06×10^{-7} in³/s) max with 520 N/cm² (750 psia) applied
7. ELECTRICAL CHARACTERISTICS:
   a. Insulation resistance: 100 MΩ min at 500 Vdc between all insulated points and between all insulated conductors and the case
   b. Contact voltage drop: 100 mV max at 1A, 30 Vdc in both the actuated and deactuated position for each set of contacts
8. REMARKS: This page reflects information on DAC drawing 1A67002 rev N and AEO P.

HELIUM CONTROL, MEDIUM PRESSURE SWITCH, PART NO. 7851830-511

The helium control pressure switch (K333) controls the shutoff valve in the pneumatic power control module (K300).

1. VENDOR: Frebank Co. (part no. 8259-2)
2. LOCATION: On thrust structure, between stringer 7 and 8
3. SERVICE: Helium and electrical
4. TEMPERATURE (operating): -54 to +71°C (-65 to +160°F)
5. PRESSURE:
   a. Operating:
      (1) Actuation: 321 + 7 -10 N/cm² (465 +10 -15 psia)
      (2) Deactuation: 310 + 10 -7 N/cm² (450 +15 -10 psia)
   b. Proof: 1600 N/cm² (2400 psia)
   c. Burst: 3000 N/cm² (4000 psia)
6. LEAKAGE (external): 1×10^{-7} cm³/s (0.06×10^{-7} in³/s) max with 1700 N/cm² (2400 psig) applied
7. ELECTRICAL CHARACTERISTICS:
   a. Insulation resistance: 100 MΩ min at 500 Vdc between all insulated conductors and case
   b. Contact voltage drop: 100 mV max at 1A, 30 Vdc for each set of contacts
8. REMARKS: This page reflects information on DAC drawing 7851830 rev AA.

Section III

FLOW RESTRICTOR, PART NO. 1B40622-503

The flow restrictor (K339) is used to regulate flow in the pneumatic control system.

1. VENDOR: Del Mfg. Co. (part no. 10183-20)
2. LOCATION: On forward tank cover, in purge line to camera lights and T. V. cameras.
3. SERVICE: Helium
4. TEMPERATURE (operating):
   a. Internal: -183 to +71°C (-297 to +160°F)
   b. External: -87 to +71°C (-125 to +160°F)
5. PRESSURE:
   a. Operating: 2200 N/cm² (3200 psia)
   b. Proof: 4400 N/cm² (6400 psia)
   c. Burst: 8830 N/cm² (12800 psia)
6. FLOW RATE: 141600 ± 20500 sccm (8640 ± 1250 scim) at a temperature of 21 ± 7°C (70 ± 20°F) with a pressure differential of 2200 N/cm² (3200 psia)
7. REMARKS: This page reflects information on DAC drawing 1B40622 rev E and AEO F.

ACTUATION CONTROL MODULE, PART NO. 1A49982-511

The actuation control module (K319) provides pressure-regulated helium for the pneumatic control of the directional control valve (K19).

The actuation control module (K340) provides pressure-regulated helium for the pneumatic control of the LOX propulsive vent valve (K28). Each module consists of two solenoid valves.

1. VENDOR: Clary Dynamics Corp. (part no. 527080)
2. LOCATION:
   a. K319: Inside forward skirt, between stringer 13 and 17
   b. K340: On thrust structure, between stringer 18 and 19
3. SERVICE: Helium and electrical
4. TEMPERATURE (operating): -34 to +74°C (-30 to +165°F)
5. PRESSURE:
   a. Operating: 327 ± 17 N/cm² (475 ± 25 psig)
   b. Proof: 520 N/cm² (750 psig)
   c. Burst: 860 N/cm² (1250 psig)
6. LEAKAGE:
   a. External: 1 scch (0.06 scih) max at operating pressure and temperature
   b. Internal: 20 sccm (1.22 scim) max at operating temperature with 327 ± 17 N/cm² (425 ± 25 psig) applied at port no. 1.
7. ELECTRICAL CHARACTERISTICS:
   a. Operating voltage: 24 to 38 Vdc
   b. Insulation resistance: 100 MΩ min at 500 Vdc
   c. Current draw: 1.5 A max
   d. Pull-in voltage: 18 Vdc max, 5 Vdc min
   e. Drop-out voltage: 8 Vdc max, 1.5 Vdc min
8. REMARKS: This page reflects information on DAC drawing 1A49982 rev V and AEO's through Z.

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G. J-2 ENGINE SYSTEM

The 889,000 N (200,000 lbf) thrust, high-performance, LOX and LH_2 J-2 engine powers the S-IVB stage during the S-IVB portion of Saturn IB powered flight. The engine features a single tubular-wall, bell-shaped thrust chamber and two independently driven turbopumps. A single gas generator drives both the LOX and LH_2 turbopumps independently. A GHe engine-mounted tank supplies GHe pressure for engine valve actuation. The J-2 engine systems are: propellant feed, pneumatic-electrical control, gas generator and exhaust, thrust chamber and gimbal, start, and flight instrumentation.

Section III

J-2 ENGINE SYSTEM INFORMATION ILLUSTRATION

J-2 ENGINE SYSTEM CALLOUT LIST

FIND NO.	COMPONENT	PART NO.	PAGE
K400	Valve Fast Shutdown	*556970	
K401	Regulator Assembly	*556948	
K402	Accumulator, GHe	*703000-21	
K403	Valve, Purge Control	*557823	
K404	Spark Plug, Gas Generator (2)	*651385	
K405	Gas Generator Assembly	*302676-21	
K406	Fuel Turbopump Assembly	*459000-31	
K407	Valve, Fuel Bleed	*309036	
K408	Valve, Control, Start Tank Discharge	*555767	
K409	Valve, Discharge, Start Tank	*308726	
K410	Start Tank Assembly	*303439	
K411	Valve, Vent and Relief, Start Tank	*557180	
K412	Package, Tank Support and Fill Valve	*557756	
K413	Valve, Main Fuel	*408474	
K414	Valve, Turbine Bypass	*408022	
K415	Thrust Chamber Assembly	*204445-91	
K416	Spark Plug, Augmented Spark Igniter (2)	*206280	
K417	Switch, Pressure, LOX Injector	*NA5-27302-11	
K418	Valve, Main LOX	*409969	
K419	Heat Exchanger	*307725-41	
K420	Valve, LOX, Augmented Spark Igniter	*308880	
K421	LOX Bleed Valve Assembly	*309031	
K422	LOX Turbopump Assembly	*458175-11	
K423	Propellant Utilization Valve Assembly	*251351-11	
K424	Eng GHe Press. Supply Disconnect Assembly	1A49958-515	
K425	Start Tank Supply Pressure and Chilldown Disconnect Assembly	1A49958-523	
K426	Thrust Chamber Purge and Chilldown Disconnect Assembly	1A49958-519	
K427	Start Tank Vent and Relief Disconnect Assembly	1A49958-521	

*Rocketdyne Part Numbers. For detailed information, refer to Rocketdyne Manual R-3825-1 thru -4(c).

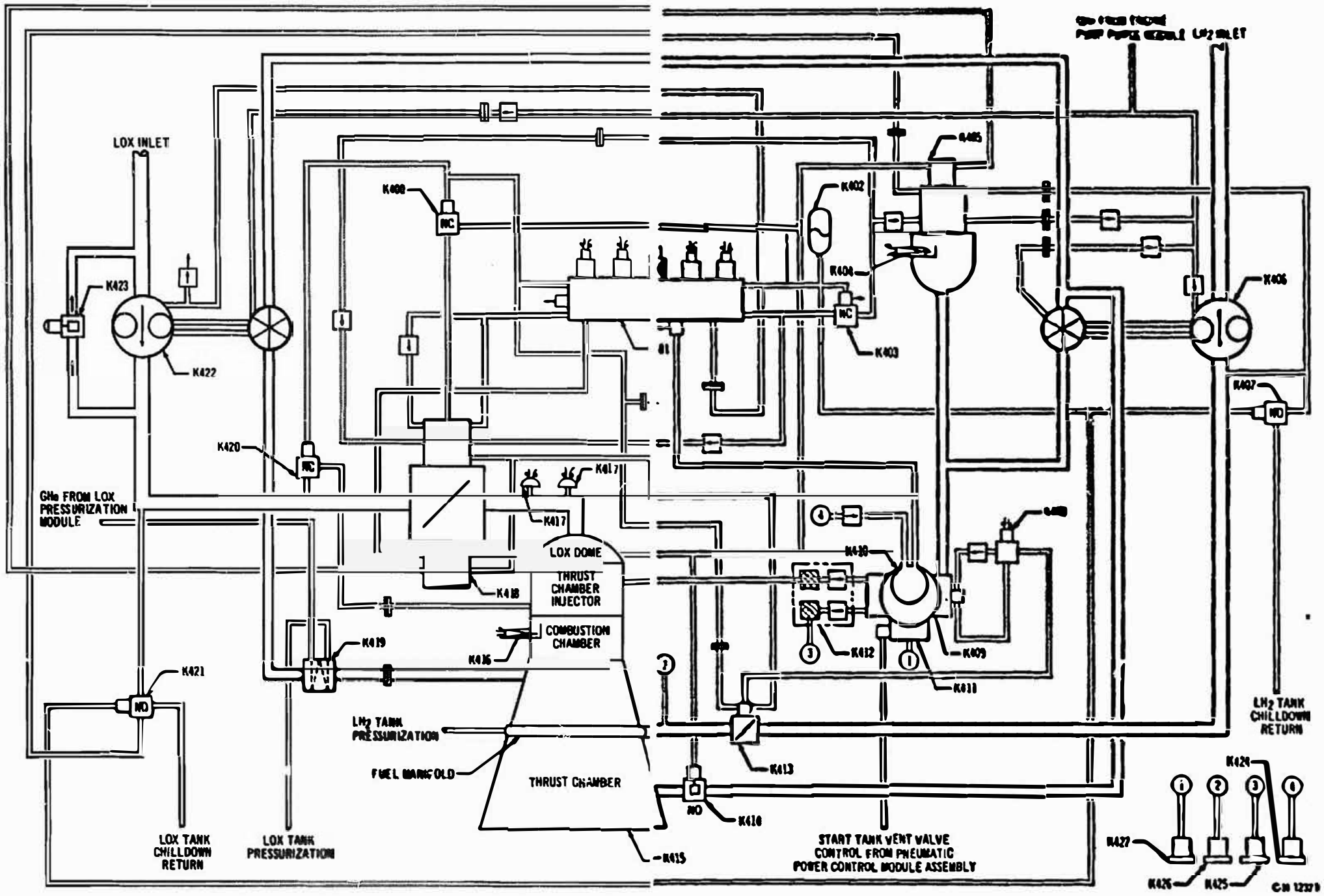

FIGURE G-1 J-2 ENGINE SYSTEM - SCHEMATIC

H. HYDRAULIC SYSTEM

The independent, closed-loop S-IVB Hydraulic System gimbals the J-2 Engine during engine non-firing and firing operations. A main hydraulic pump, an auxiliary motor-driven hydraulic pump, an accumulator-reservoir, two servoactuators, and interconnecting tube and hose assemblies comprise the S-IVB hydraulic system.

Each of two identical servoactuator assemblies provides the mechanical force to gimbal the J-2 engine. The servovalve within each actuator diverts fluid to one side or the other of the actuator pistons in accordance with signals received by the servovalve torque motor from the flight control computer in the instrument unit.

Section III

HYDRAULIC SYSTEM INFORMATION ILLUSTRATION

HYDRAULIC SYSTEM CALLOUT LIST

FIND NO.	COMPONENT	PART NO.	PAGE
K500	Valve, Check, High Pressure	1A66245-501	H-13
K501	Switch, Thermal, Auxiliary Pump	1A74765-501	H-20
K502	Transducer, Temperature, Main Pump Inlet	1B34472-503	H-29
K503	Switch, Thermal, Main Pump Inlet	1A74764-501	H-19
K504	Pump, Hydraulic, Engine Driven	1A66240-501	H-7
K505	Yaw Hydraulic Actuator Assembly	1A66248-503	H-14
K506	Pitch Hydraulic Actuator Assembly	1A66248-503	H-14
K507	Transducer, Pressure, Differential	1A72914-1	H-18
K508	Transducer, Pressure, GN_2 Accumulator	1B31356-501	H-27
K509	Transducer, Temperature, GN_2 Accumulator	1B34472-1	H-28
K510	Valve, Relief, Vent, Low Pressure	1A86746-1	H-22
K511	Gage, Pressure, Dial Indicator (2)	1B31296-1	H-25
K512	Valve, Air, High Pressure, Charging (2)	1B31295-1	H-24
K513	Accumulator - Reservoir	1B29319-513	
K514	Valve, Relief, Vent, Low Pressure	1A86746-1	H-22
K515	Filter Element, Main System	1A66244-1	H-11
K516	Coupling Half, Quick-Disconnect	1A68498-521	H-17
K517	Valve, Relief, High Pressure	1A66242-503	H-9
K518	Valve, Relief, Low Pressure, Balanced	1A66243-501	H-10
K519	Coupling Half, Quick-Disconnect	1A68498-519	H-16
K520	Valve, Hydraulic Bleeder (7)	1A92754-501	H-23
K521	Coupling Half, Quick Disconnect	1A68498-517	H-15
K522	Valve, Check, High Pressure	1A66245-1	H-12
K523	Pump, Hydraulic, Motor-Driven, Auxiliary	1A66241-503	H-8
K524	Transducer, Pressure, Hydraulic System	1B31356-501	H-27
K525	Potentiometer, Piston Position	1A78153-501	H-21
K526	Transducer, Pressure, Reservoir Oil	1B31356-507	H-26
K527	Valve, Relief, Low Pressure, Balanced	1A66243-501	H-10
K528	Transducer, Temperature, Reservoir Oil	1B34472-1	H-28

HYDRAULIC SYSTEM CALLOUT LIST (CONT)

FIND NO.	COMPONENT	PART NO.	PAGE
K529	Tank, Compressed Gas	1B55406-1	
1	Isolator, Thermal	1A86457-1	
2	Hydraulic Pump Pipe Plug Assembly	1B27980-1	
10	Fitting, Hose Adapter	1B33562-1	
20	Valve, Prefiltration	*1A66248-503	
21	Filter, Servovalve	*1A66248-503	
22	Valve, Cylinder Bypass	*1A66248-503	
24	Indicator, Differential Pressure	**1A66241-503	
25	Filter	**1A66241-503	
26	Valve, Relief	**1A66241-503	
27	Hydraulic Pump Pipe Plug Assembly	1B27980-1	
28	Detector, Chip	**1A66241-503	
29	Valve, Relief	**1A66241-503	
30	Valve, Check	**1A66241-503	
31	Valve, Check	**1A66241-503	
32	Valve, Relief	**1A66241-503	
33	Valve, Check	**1A66241-503	
35	Hydraulic Pump Pipe Plug Assembly	1B27980-1	
36	Regulator, Helium Pressure	**1A66241-503	
37	Valve, Check	**1A66241-503	
44	Manifold, Compressed Gas	1B55407-1	

*Part of 1A66248-503
**Part of 1A66241-503

HOSE AND TUBE ASSEMBLIES CALLOUT LIST

FIND NO.	COMPONENT	PART NO.
3	Main Pump Suction Hose Assembly	1B63072-1
4	Main Pump Discharge Hose Assembly	1B63007-1
5	Main Pump Discharge Tube Assembly	1B39772-1
6	Main Pump Suction Tube Assembly	1B56325-1
7	Main Pump Suction Hose Assembly	1B63073-1
8	Main Pump Suction Tube Assembly	1B39771-1
9	Auxiliary Pump Discharge Tube Assembly	1B55349-1
11	Yaw Actuator Return Tube Assembly	1B57825-1
12	Yaw Actuator Return Hose Assembly	1B63071-1
13	Yaw Actuator Pressure Hose Assembly	1B63006-1
14	Pitch and Yaw Actuator Return Tube Assembly	1B57829-1
15	Pitch Actuator Return Tube Assembly	1B57831-1
16	Yaw Actuator Pressure Tube Assembly	1B39783-1
17	Pitch Actuator Pressure Tube Assembly	1B56397-1
18	Pitch Actuator Pressure Hose Assembly	1B63006-1
19	Pitch Actuator Return Hose Assembly	1B63071-1
23	Auxiliary Pump Suction Tube Assembly	1B55348-1
34	Main Pump Discharge Tube Assembly	1B56395-1
38	Main Pump Discharge Hose Assembly	1B63008-1
39	Thermal Conditioning Tube Assembly	1B57827-1
40	Thermal Conditioning Hose Assembly	1B63010-1
41	Thermal Conditioning Tube Assembly	1B57822-1
42	Thermal Conditioning Hose Assembly	1B63009-1
43	Pump Purge Tube Assembly	1B55894-1

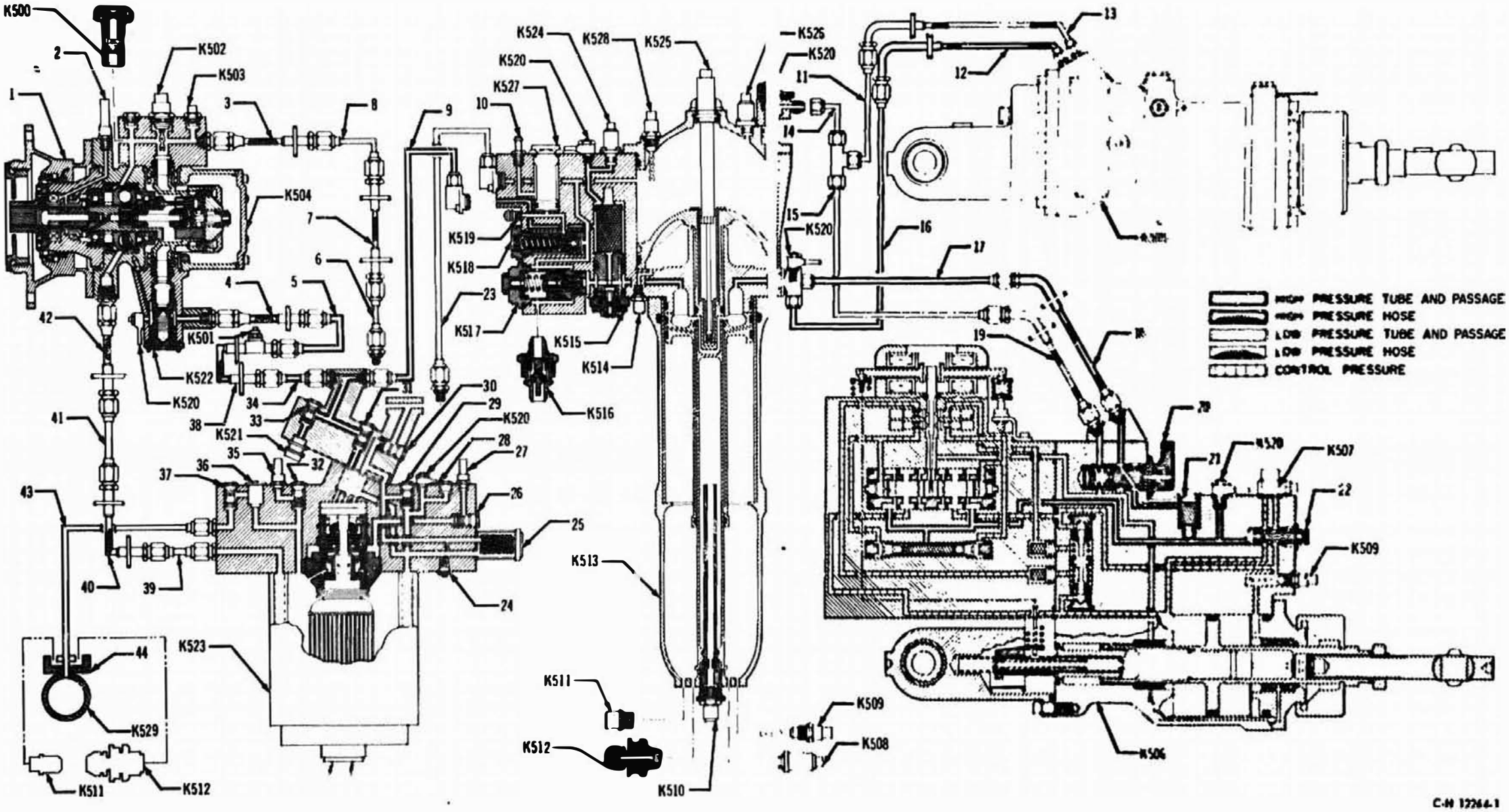

FIGURE H-1 HYDRAULIC SYSTEM - SCHEMATIC

ENGINE-DRIVEN HYDRAULIC PUMP, PART NO. 1A66240-501

The engine-driven single stage, yoke type, variable displacement, variable delivery, axial piston, pressure compensated hydraulic pump (K504) supplies operating pressure fluid to the hydraulic system during hot gimbaling.

1. VENDOR: Vickers, Inc. (part no. AA-65365-L-S619)
2. LOCATION: Mounted on J-2 engine oxidizer exhaust manifold dome
3. SERVICE: MIL-H-5606A hydraulic fluid
4. TEMPERATURE:
   a. Ambient: -34 to +135°C (-30 to +275°F)
   b. Fluid: -34 to +135°C (-30 to +275°F)
5. PRESSURE:
   a. Ambient: Zero N/cm^2 to sea level (zero psi to sea level)
   b. Inlet: 130 N/cm^2 (190 psig) max
   c. Outlet: 2520 N/cm^2 (3650 psig) max
   d. Proof: Outlet, 3775 N/cm^2 (5475 psig) min; inlet, 330 N/cm^2 (480 psig) min; case, 330 N/cm^2 (480 psig)
   e. Burst: Outlet, 6292 N/cm^2 (9125 psig) min; inlet, 550 N/cm^2 (800 psig) min; case, 550 N/cm^2 (800 psig) min
6. SHAFT SPEED: $7/3\pi \times 10^2$ rad./s (7,000 rpm)
7. RATED FLOW: 0.4 dm^3/s (7 gpm) min
8. RESPONSE TIME: 0.5 sec from rest to $3\pi \times 10^2$ rad./s (9,000 rpm), when ambient and fluid temperatures are -17.80°C (0°F) max and inlet pressure is 118 N/cm^2 (172 psig)
9. STARTING TORQUE: The max allowable torque required to accelerate the pump from a static condition to $3\pi \times 10^2$ rad./s (9,000 rpm) linearly in 1.5 sec with a steadily applied 2450 N/cm^2 (3550 psig) outlet pressure and 103 N/cm^2 (150 psig) inlet pressure shall not exceed 125 N-cm (220 in-lb) after an 8-hour soak period at -17.8°C (0°F)
10. LEAKAGE:
    a. External: None allowed
    b. Shaft seals: Gas seal -0.0028 scmm (0.1 scfm) oil seal -0.5 scch (1.768×10^{-5} scfh)
    c. Case drain: .054 dm^3/s (0.85 gpm) at 93°C (200°F) pump inlet temperature, and 0.069 dm^3/s (1.1 gpm) above 93°C (200°F) pump inlet temperature when pump operates.
11. REMARKS: This page reflects information on DAC drawing 1A66240 rev M.

AUXILIARY MOTOR-DRIVEN HYDRAULIC PUMP, PART NO. 1A66241-503

The electrically driven, variable delivery, fixed angle, constant-displacement pump (K523) supplies operating pressure hydraulic fluid for preflight engine gimbaling checkouts, null positioning during boost phase, and emergency backup during S-IVB powered flight.

1. VENDOR: Vickers, Inc. (part no. EA1565-530-3)
2. LOCATION: Stringer No. 14 on thrust structure lower end
3. SERVICE: Electrical and Mil-H-5606A hydraulic fluid
4. TEMPERATURE:
   a. Ambient: -34 to +135°C (-30 to +275°F)
   b. Fluid: 0 to 135°C (0 to 275°F)
5. PRESSURE:
   a. Ambient: Zero N/cm² to sea level (zero psi to seal level)
   b. Inlet: 31 N/cm² (45 psig) min
   c. Outlet: 2520 N/cm² (3650 psig) max
   d. Proof: 3775 N/cm² (5475 psig) applied to pump outlet
   e. Burst: 6292 N/cm² (9125 psig) applied to pump outlet
6. RATED FLOW: 0.0945 dm³/s (1.5 gpm) min at 2440 N/cm² (3550 psig) min
7. RESPONSE TIME: 100 ms under normal operating conditions (paragraphs 4 and 5)
8. LEAKAGE:
   a. Pump shaft seal: 0.5 sc h (0.03 sc/h)
   b. Motor shaft seal: Check valve, helium service: (16.00 sccm) (1 scim)
9. ELECTRICAL CHARACTERISTICS (motor):
   a. Type: continuous duty, shunt field
   b. Voltage: 57 Vdc
   c. Starting current: 250 A
   d. Running current: 75 A
10. REMARKS: This page reflects information on DAC drawing 1A66241 rev. K.

HIGH PRESSURE RELIEF VALVE, PART NO. 1A66242-503

The adjustable, spring loaded, cartridge mounted, operating pressure relief valve (K517) prevents system overpressurization by venting excessively pressurized fluid to the reservoir.

1. VENDOR: Pneudraulics, Inc. (part no. 1619)
2. SERVICE: MIL-H-5606A hydraulic fluid
3. TEMPERATURE: -34 to +135°C (-30 to +275°F)
4. PRESSURE:
   a. Reseat: 2496 N/cm² (3620 psig) min. 25.0 sccm (1.52 scim) over entire temperature range
   b. Cracking: 2590 N/cm² (3760 psig) max at 37.8 ± 6°C (100 ± 10°F)
   c. Relief: 2930 N/cm² (4250 psi)
   d. Proof: 3860 N/cm² (5600 psi)
5. INTERNAL LEAKAGE: 25.0 sccm (1.52 scim)
6. FLOW: 630 cm³/s (10 gpm) in full open position
7. RESPONSE: 30 ms full closed to full open
8. REMARKS: This page reflects information on DAC drawing 1A66242 rev K and AEO N.

BALANCED LOW PRESSURE RELIEF VALVE. PART NO. 1A66243-501

Two identical, cartridge mounted, normally closed, spring loaded, sliding poppet, pressure balanced relief valves (K518, K527) protect the reservoir and the return pressure side of the system. The valves connect hydraulically in series--the discharge of the first valve flows to the inlet of the second.

1. VENDOR: Pneudraulics, Inc. (part no. 1605)
2. SERVICE: MIL-H-5606A hydraulic fluid
3. TEMPERATURE (operating): -34 to +135°C (-30 to +275°F)
4. PRESSURE:
   a. Reseat: 172 N/cm² (250 psig) min up to 49°C (120°F), 162 N/cm² (235 psig) at 135°C (275°F)
   b. Cracking: 190 N/cm² (275 psig) max at temp of 21 to 43.5°C (70 to 110°F)
   c. Relief: 210 N/cm² (310 psig) max at 0.662 dm³/s (10.5 gpm)
   d. Proof: 340 N/cm² (500 psig)
   e. Burst: 568 N/cm² (825 psig)
5. LEAKAGE: One drop per 10-min interval
6. RATED FLOW: 662 cm³/s (10.5 gpm)
7. RESPONSE: Full closed to full open 30 ms
8. REMARKS: This page reflects information on DAC drawing 1A66243 rev F and AEO's through 11.

MAIN SYSTEM FILTER ELEMENT, PART NO. 1A66244-1

The high pressure, full flow, cartridge-type filter element (K515) filters the hydraulic fluid prior to its entry into the accumulator-reservoir high pressure side.

1. VENDOR: Aircraft Porous Media (part no. AC-6543E-5)
2. SERVICE: MIL-H-5606A hydraulic fluid
3. TEMPERATURE: -54 to +135°C (-65 to +275°F)
4. PRESSURE:
   a. Burst: 5000 N/cm² (7300 psig)
   b. Differential: 10 N/cm² (15 psig) max @ .76 dm³/s (12.0 gpm) and 38 ± 2°C (100 ± 3°F)
5. ELEMENT RATING: 15 x 10^{-4} cm 15 microns per MIL-F-8815, 18 March 1960
6. ELEMENT WEIGHT: 0.68 kg (1.5 lb) max
7. REMARKS: This page reflects information on DAC drawing 1A66244 rev H.

HIGH PRESSURE CHECK VALVE, PART NO. 1A66245-1

The spring-loaded poppet, metal-to-metal sealing, cartridge-mounted check valve (K522) prevents reverse motoring of the inoperative main pump during servicing and during auxiliary pump operation.

1. VENDOR: Parker Aircraft Co. (part no. 4630063)
2. LOCATION: Mounted on the main pump exhaust manifold
3. SERVICE: MIL-H-5606A hydraulic fluid
4. TEMPERATURE (operating): -34 to +135°C (-30 to +275°F)
5. PRESSURE:
   a. Operating: 2520 N/cm² (3650 psig)
   b. Proof: 3800 + 34 -0 N/cm² (5500 + 50 -0 psig)
   c. Burst: 6300 N/cm² (9200 psig)
   d. Cracking: 1.4 to 5.5 N/cm² (2 to 8 psig)
6. LEAKAGE:
   a. External: None with 4481 N/cm² (6500 psig) applied
   b. Internal: None with 3792 N/cm² (5500 psig) applied in the reverse direction
7. RATED FLOW: 757 cm³/s (12.0 gpm)
8. REMARKS: This page reflects information on DAC drawing 1A66245 rev D and AEO's through G.

HIGH PRESSURE CHECK VALVE, PART NO. 1A66245-501

The spring-loaded poppet, metal-to-metal sealing, cartridge-mounted valve (K500) prevents main pump case drain flow from entering the main pump inlet when the auxiliary pump output is zero. The valve ensures entry of the main pump case drain flow into the auxiliary pump thermal conditioning line.

1. VENDOR: Parker Aircraft Co (part no. 2630328)
2. LOCATION: Mounted on the main pump intake manifold
3. SERVICE: MIL-H-5606A hydraulic fluid
4. TEMPERATURE (operating): -34 to +135°C (-30 to +275°F)
5. PRESSURE:
   a. Operation: 2520 N/cm² (3650 psig)
   b. Proof: 3800 N/cm² (5500 psig)
   c. Cracking: 1 to 6 N/cm² (2 to 8 psig)
6. LEAKAGE:
   a. External: None allowed with 4500 N/cm² (6500 psig) applied
   b. Internal: None allowed with 3800 N/cm² (5500 psig) applied in the reverse direction
7. RATED FLOW: 220 cm³/s (3.5 gpm)
8. REMARKS: This page reflects information on DAC drawings 1A66245 rev D and AEO's through G.

HYDRAULIC ACTUATOR ASSEMBLY, PART NO. 1A66248-503

The manifold-type hydraulic actuator assembly (K506 or K505) in conjunction with another identical unit provides the necessary force required to gimbal the J-2 engine.

1. VENDOR: Moog Servocontrols, Inc. (part no. 17-189A)
2. LOCATION: Between the thrust structure and engine thrust chamber
3. SERVICE: Electrical and hydraulic fluid
4. TEMPERATURE: -37 to +135°C (-35 to +275°F)
5. PRESSURE:
   a. Operating: 2520 N/cm² (3650 psig)
   b. Burst (oil pressure sections): 6300 N/cm² (9130 psig) to pressure ports
   c. Proof (oil pressure sections): 3775 N/cm² (5475 psig) all high pressure ports
   d. Burst (oil return sections): 3775 N/cm² (5475 psig) to return ports
   e. Proof (oil return sections): 2520 N/cm² (3650 psig) all low pressure ports
6. LEAKAGE: No external leakage allowed
7. ELECTRICAL CHARACTERISTICS:
   a. Servo valve:
      (1) Torque motor rated current: 50 mA
      (2) Coil resistance: 100 ± 5Ω. The difference between the two coil resistances is 0 to 5Ω.
      (3) Dielectric breakdown: 1000 Vdc for 60 sec
   b. Feedback potentiometer:
      (1) Voltage rating: 60 Vdc
      (2) Insulation resistance: 50 MΩ at 500 Vdc min
      (3) Pot resistance: 2000Ω ± 10 pct
8. REMARKS: This page reflects information on DAC drawing 1A66248 rev U.

QUICK DISCONNECT COUPLING HALF, PART NO. 1A68498-517

The operating-pressure fill coupling half (K521) with integral check valve, when engaged with its mating half on the hydraulic servicer high pressure hose, allows high pressure hydraulic fluid flow from the servicer to the auxiliary pump assembly.

1. VENDOR: E. B. Wiggins Oil Tool Co. (part no. 60004D83WS37-6)
2. LOCATION: Accumulator-reservoir assembly
3. SERVICE: MIL-H-5606A hydraulic fluid
4. RATED PRESSURE: 2520 N/cm^2 (3650 psig)
5. TEMPERATURE (operating): -34 to +135°C (-30 to +275°F)
6. RATED FLOW: 440 cm^3/s (7.0 gpm) at 5.5 N/cm^2 (8 psig) pressure drop and fluid temperature of 38 $\pm$ 6°C (100 $\pm$ 10°F)
7. LEAKAGE: None
8. REMARKS: This page reflects information on DAC drawing 1A68498 rev E and AEO G.

Section III

QUICK DISCONNECT COUPLING HALF, PART NO. 1A68498-519

The low pressure return coupling half (K519), when engaged with its mating half on the hydraulic return servicer hose, allows low pressure hydraulic fluid flow from the accumulator-reservoir to the hydraulic servicer.

1. VENDOR: E. B. Wiggins Oil Tool Co. (part no. 60008D94SD12)
2. LOCATION: Accumulator-reservoir assembly
3. SERVICE: MIL-H-5606A hydraulic fluid
4. TEMPERATURE (operating): -34 to +135°C (-30 to +275°F)
5. RATED PRESSURE: 2520 N/cm^2 (3650 psig)
6. LEAKAGE: None
7. RATED FLOW: 660 cm^3/s (10.5 gpm) at 5 N/cm^2 (8 psig) pressure drop and fluid temperature of 38 $\pm$ 6°C (100 $\pm$ 10°F)
8. REMARKS: This page reflects information on DAC drawing 1A68498 rev E and AEO G.

QUICK DISCONNECT COUPLING HALF, PART NO. 1A68498-521

The air content coupling half (K516) functions during the air content test, which determines how much air remains in the hydraulic system during the bleed procedure.

1. VENDOR: E. B. Wiggins Oil Tool Co. (part no. 60004D94SD6)
2. LOCATION: Accumulator-reservoir assembly
3. SERVICE: MIL-H-5606A hydraulic fluid
4. TEMPERATURE (operating): -34 to +135°C (-30 to +275°F)
5. RATED PRESSURE: 2520 N/cm² (3650 psig)
6. LEAKAGE: None
7. RATED FLOW: 180 cm³/s (3.0 gpm) at 5 N/cm² (8 psig) pressure drop and fluid temperature of 38 ± 6°C (100 ± 10°F)
8. REMARKS: This page reflects information on DAC drawing 1A68498 rev E and AEO G.

DIFFERENTIAL PRESSURE TRANSDUCER, PART NO. 1A72914-1

The hermetically sealed, variable voltage, differential pressure transducer (K507) measures the differential pressure between the extend and retract sides of the actuator piston for transmittal to GSE through the S-IVB Telemetry System.

1. VENDOR: Servonic Instruments, Inc. (part no. 2131-0501)
2. LOCATION: Hydraulic actuator differential pressure ports
3. SERVICE: Electrical and MIL-H-5606A hydraulic fluid
4. TEMPERATURE: -25 to +135°C (-13 to +275°F)
5. PRESSURE:
   a. Operating: 4100 N/cm² (6000 psid)
   b. Proof: 6200 N/cm² (9000 psid)
   c. Burst: 10,000 N/cm² (15,000 psia)
6. LEAKAGE: 2×10^{-8} (0.122×10^{-8} in³) cm³ max
7. ELECTRICAL CHARACTERISTICS:
   a. Insulation resistance: 50 MΩ at 100 Vdc
   b. Response time: 35 ms max
   c. Linearity: ± 1 pct of full scale
8. REMARKS: This page reflects information on DAC drawing 1A72914 rev F and AEO G.

MAIN PUMP INLET THERMAL SWITCH, PART NO. 1A74764-501

The hermetically sealed, single pole, single throw, normally open, countdown thermal switch (K503) senses the temperature of low pressure hydraulic fluid in the main pump intake manifold. During prelaunch countdown, the thermal switch actuates at low fluid temperatures, closing the contacts and stopping the countdown.

1. VENDOR: United Control Corp. (part no. 2627-1-4)
2. LOCATION: Mounted on main pump intake manifold
3. SERVICE: Electrical and MIL-H-5606A hydraulic fluid
4. TEMPERATURE:
   a. Operating: -54 to +168.5°C (-65 to +335°F)
   b. Opens: -17.8 ± 2°C (0 ± 3°F) on increasing temperature
   c. Closes: -26 ± 2°C (-15 ± 3°F) on decreasing temperature
5. PRESSURE:
   a. Operating: 117 N/cm² (170 psia)
   b. Proof: 413 N/cm² (600 psia)
6. LEAKAGE: 1×10^{-7} sccs (0.06×10^{-7} scis) max at pressure of 10^{-6} mm Hg over operating temperature range
7. ELECTRICAL CHARACTERISTICS:
   a. Insulation resistance: 100 MΩ min at 500 Vdc
   b. Dielectric strength: 1000 V rms, 60 Hz, applied between all current-carrying parts and ground with a max leakage of 50 μA
   c. Voltage rating: 28 +2 -4 Vdc
8. REMARKS: This page reflects information on DAC drawing 1A74764 rev D and AEO's through J.

AUXILIARY PUMP THERMAL SWITCH, PART NO. 1A74765-501

The hermetically sealed, single pole, single throw, normally closed auxiliary pump thermal switch (K501) starts and stops the auxiliary pump motor, which adds heat to the system fluid during the coast mode period of prelaunch operations.

1. VENDOR: United Control Corporation (part no. 2627-1-5)
2. LOCATION: Mounted on the main pump intake manifold
3. SERVICE: Electrical and MIL-H-5606A hydraulic fluid
4. TEMPERATURE:
   a. Operating: -54 to +168.5°C (-65 to +335°F)
   b. Opens: -12 ± 2°C (10 ± 4°F) on decreasing temperature
   c. Closes: 4 ± 2°C (40 ± 4°F) on increasing temperature
5. PRESSURE:
   a. Operating: 2520 N/cm² (3650 psia)
   b. Proof: 5000 N/cm² (7300 psia)
   c. Burst: 10,000 N/cm² (14,600 psia)
6. LEAKAGE: 1×10^{-7} sccs (0.061×10^{-7} scis) max at pressure of 10^{-6} torr at room temperature
7. ELECTRICAL CHARACTERISTICS:
   a. Insulation resistance: 100 MΩ min at 500 Vdc
   b. Dielectric strength: 1000 V rms at 60 Hz
   c. Voltage rating: 28 +2 -4 Vdc
   d. Current rating: 1 A, inductive
8. REMARKS: This page reflects information on DAC drawing 1A74765 rev L and AEO M.

PISTON POSITION POTENTIOMETER, PART NO. 1A78153-501

The internally mounted, single element, rectilinear potentiometer (K525) continuously monitors the reservoir piston position. The potentiometer output voltage varies directly with shaft extension, so that piston position can be converted to reservoir fluid volume indication. The unit contains a position switch that indicates unacceptably high fluid volume.

1. VENDOR: Markite Corp. (part no. 9781)
2. SERVICE: Electrical, 30 Vdc
3. TEMPERATURE (operating): -26 to +135°C (-15 to +275°F)
4. INSULATION RESISTANCE: 100 MΩ at 500 Vdc
5. POTENTIOMETER RESISTANCE: 5,000 ohms ± 10 pct
6. LINEARITY: Calibration points within 0.5 pct of full scale of this line
7. POSITION SWITCH:
   a. Resistance: 150Ω ± 10 pct
   b. Voltage: 50 Vdc
   c. Current: 250 mA
   d. Dielectric strength: 1000 Vrms, 60 Hz for 1 min
8. REMARKS: This page reflects information on DAC drawing 1A78153 rev F and AEO's F, H, K, and L.

LOW PRESSURE VENT RELIEF VALVE, PART NO. 1A86746-1

Two identical, spring loaded, poppet, adjustable vent relief valves (K510, K514) cartridge-mount in the accumulator-reservoir assembly. One vents the area below the reservoir piston and the other vents the area inside the pneumatic pressurization piston. The valves also provide passage for leakage past seals and air trapped during piston movement.

1. VENDOR: James Pond & Clark, Inc. (part no. P34-352)
2. SERVICE: MIL-H-5606A hydraulic fluid and GN_2
3. TEMPERATURE (operating): -29 to +135°C (-20 to +275°F)
4. PRESSURE:
   a. Cracking: 14 + 1.4 -0.7 N/cm² (20 +2 -1 psig)
   b. Reseat: 12 N/cm² (18 psig) min
   c. Full flow: 24 N/cm² (35 psig) max
5. REMARKS: This page reflects information on DAC drawing 1A86746 rev C.

HYDRAULIC BLEEDER VALVE, PART NO. 1A92754-501

Three of these valves (K520) are used on the accumulator-reservoir assembly (one on the main pump exhaust manifold, one on the auxiliary pump manifold, and one on each actuator) for bleeding air from the system and for taking fluid samples for contamination analysis.

1. VENDOR: Fluid Regulators (part no. 7579S1 with MS28778-4 packing added)
2. SERVICE: Air and MIL-H-5606A hydraulic fluid
3. PROOF PRESSURE: 5000 N/cm^2 (7300 psig)
4. END FITTING: MC178
5. REMARKS: This page reflects information on DAC drawing 1A92754 rev C.

CHARGING HIGH PRESSURE AIR VALVE, PART NO. 1B31295-1

This valve (K512), when connected to the nitrogen fill truck charging hose, allows the nitrogen portion of the accumulator-reservoir module to be charged. This valve also allows the auxiliary pump helium air tank assembly to be charged.

1. VENDOR: Tavco, Inc. (part no. 238128-1)
2. LOCATION: Accumulator-reservoir and auxiliary pump air tank assembly
3. SERVICE: GN_2 per MIL-N-6011
4. TEMPERATURE (operating): -54 to +135°C (-65 to +275°F)
5. PRESSURE:
   a. Operating: 2520 N/cm^2 (3650 psig)
   b. Proof: 5030 N/cm^2 (7300 psig)
   c. Burst: 10,000 N/cm^2 (14,600 psig)
6. LEAKAGE: None
7. REMARKS: This page reflects information on DAC drawing 1B31295 rev A.

DIAL INDICATOR PRESSURE GAGE, PART NO. 1B31296-1

This gage (K511) mounted in the bottom of the accumulator-reservoir module gives a visual indication of the GN_2 pressure in the accumulator-reservoir assembly.

1. VENDOR: American Standard (part no. 6914-753)
2. SERVICE: GN_2 per MIL-N-6011 and/or MIL-H-5606A hydraulic fluid
3. TEMPERATURE (operating): -73 to +135°C (-100 to +275°F)
4. PRESSURE:
   a. Operating: 2520 N/cm² (3650 psig)
   b. Proof: 5000 N/cm² (7300 psig)
5. LEAKAGE: 1×10^{-9} sccs (0.06×10^{-9} scis)
6. GAGE RANGE: 0 to 3440 N/cm² (0 to 5000 psig)
7. REMARKS: This page reflects information on DAC drawing 1B31296 rev C.

RESERVOIR OIL PRESSURE TRANSDUCER, PART NO. 1B31356-507

The potentiometer type, hermetically sealed transducer (K526) measures the hydraulic return pressure in the accumulator-reservoir and transmits this signal through telemetry to GSE.

1. VENDOR: Giannini Controls Corp. (part no. 461319AK-507)
2. LOCATION: Reservoir low pressure port
3. SERVICE: Electrical and MIL-H-5606A hydraulic fluid
4. TEMPERATURE: -24 to +135°C (-31 to +275°F)
5. PRESSURE:
   a. Operating: 0 to 275 N/cm² (0 to 400 psia)
   b. Proof: 413 N/cm² (600 psia)
   c. Burst: 689 N/cm² (1000 psia) (sensing element)
6. LEAKAGE: 2×10^{-8} sccs (0.122×10^{-8} scis) at 90 pct of full scale
7. ELECTRICAL CHARACTERISTICS:
   a. Potentiometer resistance: 5000Ω ± 5 pct
   b. Contact resistance: 150Ω with brush current of 10 μA
   c. Insulation resistance: 50 MΩ at 100 Vdc
8. REMARKS: This page reflects information on DAC drawing 1B31356 rev J and AEO K.

GN_2 ACCUMULATOR PRESSURE TRANSDUCER, PART NO. 1B31356-501

The potentiometer type, hermetically sealed transducer (K508) measures the GN_2 precharge within the GN_2 accumulator portion of the accumulator-reservoir and transmits the signal through telemetry to GSE. Transducer (K524) measures, for telemetry purposes, the operating pressure in the high pressure side of the hydraulic system.

1. VENDOR: Giannini Controls Corp. (part no. 461319AK-501)
2. LOCATION: Accumulator-reservoir
3. SERVICE: Electrical and MIL-H-5606A hydraulic fluid
4. TEMPERATURE: -24 to +135°C (-31 to +275°F)
5. PRESSURE:
   a. Operating: 1000 to 2760 N/cm² (1500 to 4000 psia)
   b. Proof: 4130 N/cm² (6000 psia)
   c. Burst: 6900 N/cm² (10,000 psia) (sensing element)
6. LEAKAGE: 2×10^{-8} sccs (0.122×10^{-8} scis) at 90 pct of full scale
7. ELECTRICAL CHARACTERISTICS:
   a. Potentiometer resistance: 5000Ω ± 5 pct
   b. Contact resistance: 150Ω with brush current of 10 μA
   c. Insulation resistance: 50 MΩ at 100 Vdc
8. REMARKS: This page reflects information on DAC drawing 1B31356 rev J and AEO K.

Section III

TEMPERATURE TRANSDUCER, PART NO. 1B34472-1

The resistance wire temperature transducer (K509) measures the temperature in the GN_2 accumulator portion of the accumulator-reservoir for transmittal through telemetry to GSE. The transducer (K528) measures reservoir oil temperature within the reservoir portion of the accumulator-reservoir for telemetry purposes.

1. VENDOR: Trans-Sonics, Inc. (part no. T4525-1)
2. LOCATION:
   a. K509: Accumulator end of accumulator-reservoir
   b. K528: Reservoir end of accumulator-reservoir
3. SERVICE: Electrical and MIL-H-5606A hydraulic fluid
4. TEMPERATURE: -73 to +176°C (-100 to +350°F)
5. PRESSURE: 2510 N/cm^2 (3650 psia) (working)
6. LEKAGE: 2×10^{-8} sccs (0.1×10^{-8} scis) at standard conditions
7. ELECTRICAL CHARACTERISTICS:
   a. Insulation resistance: 50 MΩ at 100 Vdc
   b. Current: 20 mA max
8. REMARKS: This page reflects information on DAC drawing 1B34472 rev E.

TEMPERATURE TRANSDUCER, PART NO. 1B34472-503

The resistance wire temperature transducer (K502) measures the hydraulic oil temperature in the main pump inlet port for transmittal through telemetry to GSE.

1. VENDOR: Trans-Sonics, Inc. (part no. T4597-503)
2. LOCATION: K502: Main pump inlet port
3. SERVICE: Electrical and MIL-H-5606A hydraulic fluid
4. TEMPERATURE: -73 to 176°C (-100 to +350°F)
5. PRESSURE: 2520 N/cm² (3650 psia) (operating)
6. LEAKAGE: 2×10^{-8} sccs (0.1×10^{-8} scis) at standard conditions
7. ELECTRICAL CHARACTERISTICS:
   a. Insulation resistance: 50 MΩ at 100 Vdc
   b. Current: 20 mA max
8. REMARKS: This page reflects information on DAC drawing 1B34472 rev E.

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J. AUXILIARY PROPULSION SYSTEM

The auxiliary propulsion system (APS), which consists of two APS modules mounted π rad. (180 deg) apart on the aft skirt at Positions I and III, provides attitude control for the S-IVB stage and payload. Each module contains three 670 N (150 lbf) thrust liquid-propellant engines that are fired individually or in combinations to make attitude corrections. The modules are self-contained units requiring only propellant-valve actuation signals from the flight control computer for operation. The APS uses nitrogen tetroxide (N_2O_4) as oxidizer, and monomethyl hydrazine (MMH) as fuel. The propellant is pressure fed at 140 N/cm^2 (200 psia) to each engine. When the propellant valves at any engine open, fuel and oxidizer enter the engine combustion chamber and ignite on contact. Burn time for each engine depends on the duration of the attitude correction signal. The minimum burn time is approximately 50 ms.

Section III

AUXILIARY PROPULSIONS SYSTEM INFORMATION ILLUSTRATIONS

AUXILIARY PROPULSION SYSTEM CALLOUT LIST

FIND NO.	COMPONENT	PART NO.	PAGE
K600	Module, Oxidizer Tank, Low Pressure	1A49998-508	J-6
K601	Tank Assembly, Oxidizer	*	
K602	Potentiometer, APS Propellant Tank	1A74488-503	J-7
K603	Module, Fuel Tank Helium Low Pressure	1A49998-507	J-8
K604	Valve, Check, Quadruple, APS	1A67912-505	J-9
K605	Module, Propellant Control (Fuel)	1A49422-508	J-10
K606	Engine, APS, Attitude Control, 670 N (150 lbf)	1A39597-503	
K607	Module, Propellant Control (Oxidizer)	1A49422-507	J-10
K608	Disconnect, Helium Control	7851823-503	J-12
K609	Valve, Check, Quadruple, APS	1A67912-503	J-9
K610	Sphere Assembly	1A78094-1	
K611	Tank Assembly, Fuel	*	
K612	Potentiometer, APS Propellant Tank	1A74488-503	J-7
K613	Module, Helium Fill, APS	1A49996-509	J-13
K614	Helium Pressure Regulator Assembly	1B54709-1	J-14

*Part of 1A78096-501

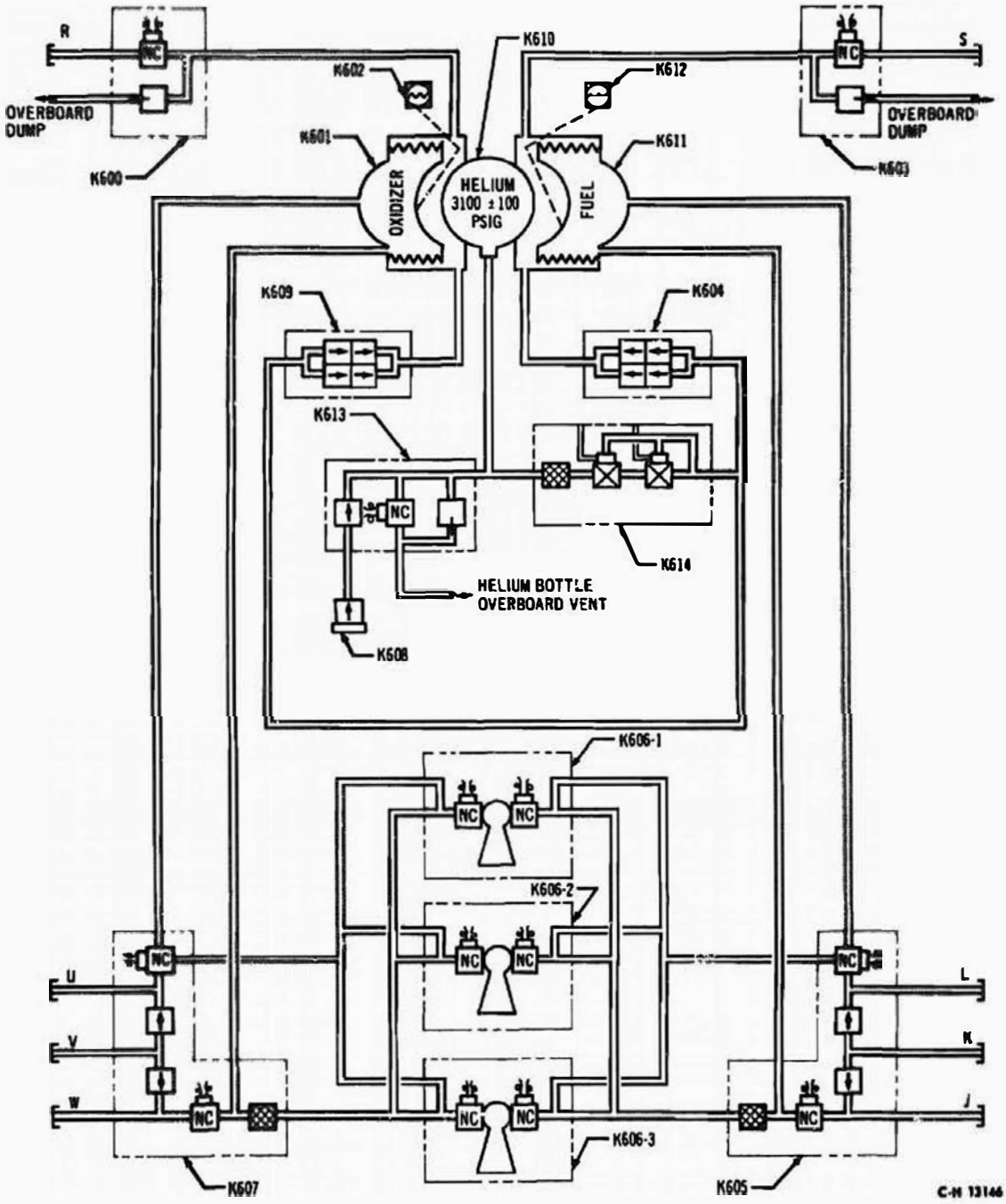


FIGURE J-1 AUXILIARY PROPULSION SYSTEM SIMPLIFIED SCHEMATIC

DETAILED SCHEMATIC CALLOUT LIST

FIND NO.	COMPONENT	PART NO.
1	Tube Assembly	1B55636-1
2	Tube Assembly	1A89508-1
3	Tube Assembly	1A89510-1
4	Fitting	1A33381-1
5	Tube Assembly	1A89512-1
6	Tube Assembly	1B55203-1
7	Tube Assembly	1B57799-1
8	Tube Assembly	1B57759-1
9	Tube Assembly	1B57757-1
10	Tube Assembly	1A82259-005-5
11	Tube Assembly	1A89522-1
12	Tube Assembly	1A82259-005-7
13	Tube Assembly	1B57756-1
14	Tube Assembly	1B57758-1
15	Tube Assembly	1B57800-1
16	Tube Assembly	1A89519-1
17	Tube Assembly	1B55204-1-001-501
18	Fitting	1B33380-1
19	Tube Assembly	1A89511-1
20	Tube Assembly	1B44103-1
21	Tube Assembly	1A89507-1
22	Tube Assembly	1B55637-1
23	Tube Assembly	1B55338-1
24	Fitting	1B57762-501
25	Fitting	1B57762-1
26	Tube Assembly	1A89515-1
27	Tube Assembly	1A95052-1
28	Tube Assembly	1B43399-1
29	Tube Assembly	1A92860-1
30	Tube Assembly	1A95043-1
31	Tube Assembly	1A95053-1
32	Tube Assembly	1A95054-1
33	Tube Assembly	1A95481-1
34	Tube Assembly	1A97417-1
35	Tube Assembly	1A89496-1
36	Tube Assembly	1B55429-1
37	Tube Assembly	1B55334-1
38	Tube Assembly	1A89497-1
39	Tube Assembly	1B55204-1-001-1

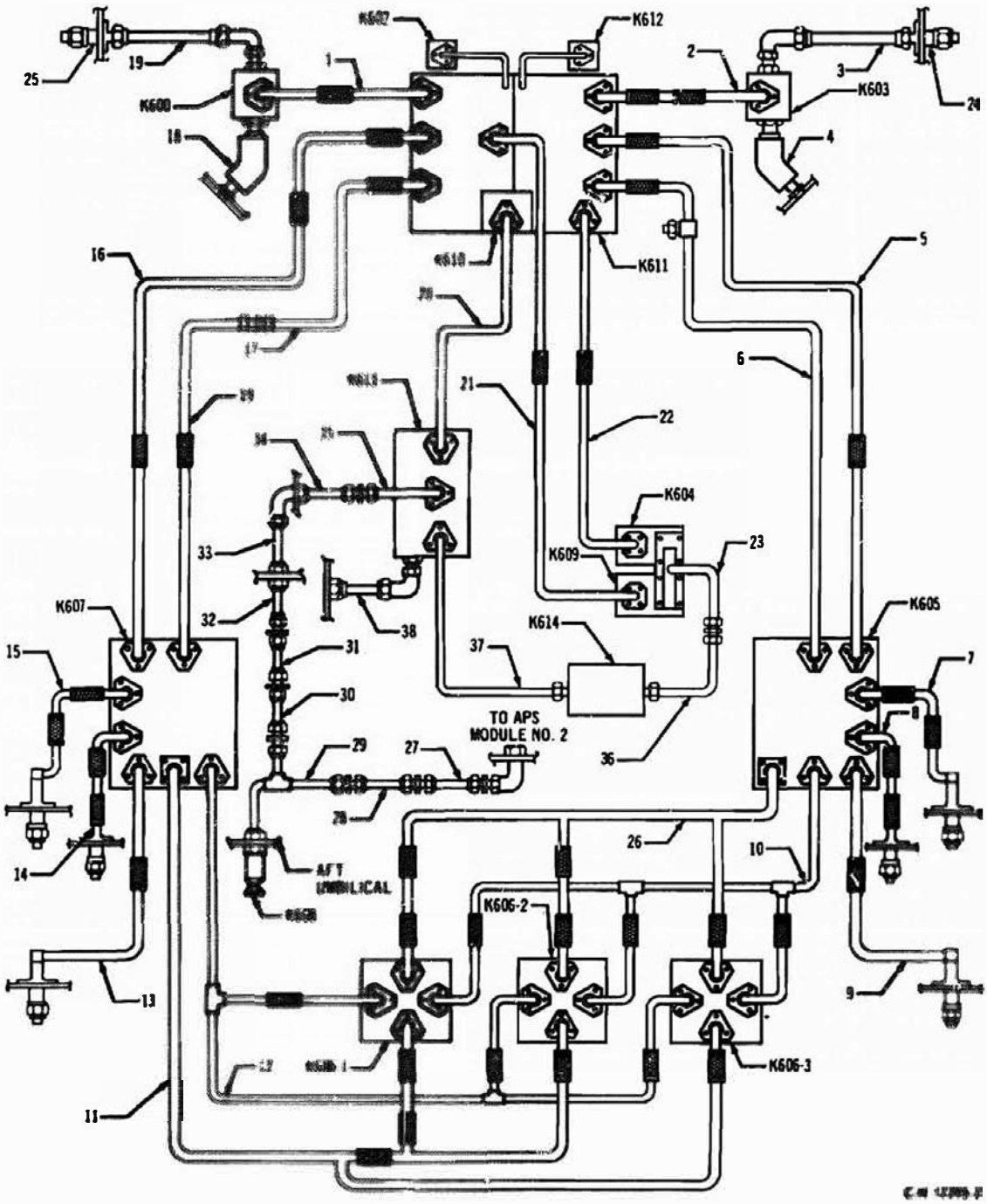


FIGURE 3-2 AUXILIARY PROPULSION SYSTEM - DETAILED SCHEMATIC

Section III

OXIDIZER TANK HELIUM LOW PRESSURE MODULE, PART NO. 1A49998-508

The oxidizer tank helium low pressure module (K600) receives helium at approximately 35 N/cm² (50 psig) from a ground source and supplies it to the propellant tank to collapse the oxidizer bellows prior to oxidizer loading. Venting of the oxidizer bellows is accomplished through the module as the bellows expands during oxidizer loading. This module contains a normally closed solenoid valve and a relief valve.

1. VENDOR: Vinson Mfg. Co. (part no. A62245-508)
2. LOCATION: In APS modules no. 1 and 2
3. SERVICE: Helium and electrical
4. TEMPERATURE (operating): -18 to +51.6°C (0 to +125°F)
5. PRESSURE:
   a. Operating: Zero to 280 N/cm² (400 psia)
   b. Proof: 400 N/cm² (600 psig) between ports A, B, C, and D
   c. Burst: 690 N/cm² (1000 psig) between ports A, B, C, and D
6. LEAKAGE ALLOWANCE:
   a. Internal (past relief valve): 1.0 sccm (0.06 scim) max before cracking and after reseat
   b. External: 1.0 scch (0.06 scih) max
7. ELECTRICAL CHARACTERISTICS:
   a. Solenoid operating current: 1.5 A max at 28 Vdc
   b. Insulation resistance: 100 MΩ min at 500 ± 10 Vdc between each isolated terminal and body assembly
8. OTHER FUNCTIONAL CHARACTERISTICS:
   a. Relief valve:
      (1) Cracking pressure: 224 to 240 N/cm² (325 to 350 psi) differential pressure
      (2) Reseat pressure: 196 N/cm² (285 psi) min differential pressure
      (3) Flow rate: 0.147 kg/s (0.104 lb/s) min of 21°C (70°F) helium at atmospheric pressure when pressurized at port A to 258 N/cm² (375 psig)
   b. Solenoid valve:
      (1) Cracking pressure: 2 N/cm² (3 psi) min to 10 N/cm² (15 psi) max differential pressure
      (2) Flow rate: 0.011 kg/s (0.025 lbm/s) min of 21°C (70°F) helium to atmosphere when pressurized at port A or C to 140 N/cm² (200 psig)
9. REMARKS: These pages reflect information on DAC drawing 1A49998 rev W and AEO's through AB.

APS PROPELLANT TANK POTENTIOMETER, PART NO. 1A74488-503

The APS propellant tank potentiometer is a variable resistor that translates the linear movement of the APS propellant level to a proportionate dc voltage. There are two potentiometers mounted on the APS propellant tank. One potentiometer (K602) indicates the oxidizer level, and the other (K612) indicates the fuel level.

1. VENDOR: Technology Instrument Corp. of Calif. (model no. 546A)
2. LOCATION: In APS modules no. 1 and 2 on each APS propellant tank
3. SERVICE: Electrical and pneumatic
4. TEMPERATURE (operating): -54 to +71°C (-65 to +160°F)
5. PRESSURE:
   a. Operating: 190 N/cm² (275 psia)
   b. Proof: 286 N/cm² (415 psia)
   c. Burst: 474 N/cm² (688 psia)
6. LEAKAGE (external): 1×10^{-7} cm³/s ($.06 \times 10^{-7}$ in³/s) at an internal pressure of 190 N/cm² (275 psia) through the operating temperature range
7. ELECTRICAL CHARACTERISTICS:
   a. Voltage (operating): 5 ± 0.5 Vdc
   b. Insulation resistance: 100 MΩ at 500 Vdc min
   c. Pot. resistance: 5000Ω ± 5 pct
   d. Dielectric strength: 50 μA max with 1000 Vrms min at 60 Hz applied between current carrying parts and ground for 1 min
8. REMARKS: This page reflects information on DAC drawing 1A74488 rev J and AEO's through N.

FUEL TANK HELIUM LOW PRESSURE MODULE, PART NO. 1A49998-507

The fuel tank helium low pressure module (K603) receives helium at approximately 35 N/cm² (50 psig) from a ground source and supplies it to the propellant tank to collapse the fuel bellows prior to fuel loading. Venting of the fuel bellows is also accomplished through this module as this bellows expands during fuel loading. This module contains a normally closed solenoid valve and a relief valve.

1. VENDOR: Vinson Mfg. Co. (part no. A62245-507)
2. LOCATION: In APS modules no. 1 and 2
3. SERVICE: Helium and electrical
4. TEMPERATURE (operating): -18 to +51.6°C (0 to +125°F)
5. PRESSURE:
   a. Operating: 0 to 280 N/cm² (0 to 400 psia)
   b. Proof: 400 N/cm² (600 psig) between ports A, B, C, and D
   c. Burst: 690 N/cm² (1000 psig) between ports A, B, C, and D
6. LEAKAGE ALLOWANCE:
   a. Internal (past relief valve): 1.0 sccm (0.06 scim) max before cracking and after reseat
   b. External: 1.0 scch (0.06 scih) max
7. ELECTRICAL CHARACTERISTICS:
   a. Solenoid operating current: 1.5 A max at 28 Vdc
   b. Insulation resistance: 100 MΩ min at 500 ± 10 Vdc between each isolated terminal and body assembly
8. OTHER FUNCTIONAL CHARACTERISTICS:
   a. Relief valve:
      (1) Cracking pressure: 224 to 240 N/cm² (325 to 350 psi) differential pressure
      (2) Reseat pressure: 196 N/cm² (285 psi) min differential pressure
      (3) Flow rate: 471 x 10^{-1} kg/s (0.104 lb/s) min of 21°C (70°F) helium to atmosphere pressure when pressurized at port A to 258 N/cm² (375 psig)
   b. Solenoid valve:
      (1) Cracking pressure: 2 N/cm² (3 psi) min to 10 N/cm² (15 psi) maximum differential pressure
      (2) Flow rate: 0.011 kg/s (0.025 lb/s) min of 21°C (70°F) helium to atmosphere when pressurized at port A or C to 138 N/cm² (200 psig)
9. REMARKS: This page reflects information on DAC drawing 1A49998 rev W and AEO's through AB.

APS QUADRUPLE CHECK VALVE, PART NOS. 1A67912-503 AND 1A67912-505

The quad check valves (K609 and K604) prevent helium reverse flow from the oxidizer and fuel bellows compartments. The module contains two parallel flow paths with two series check valves in each path.

1. VENDOR:
   a. 1A67912-503: Vinson Mfg. Co. (part no. A-63077-503)
   b. 1A67912-505: Vinson Mfg. Co. (part no. A-63077-505)
2. LOCATION: In APS modules no. 1 and 2
3. SERVICE: Helium
4. TEMPERATURE:
   a. Operating: -54 to +71°C (-65 to +160°F)
   b. System blowdown: -88 to +71°C (-125 to +160°F)
5. PRESSURE:
   a. Operating: 117 N/cm² to 690 N/cm² (170 to 1000 psia)
   b. Proof: 1000 N/cm² (1500 psig)
   c. Burst: 1700 N/cm² (2500 psig)
   d. Cracking (for the quadruple check valve assembly): 1.3 N/cm² (2.0 psi) min to 3.4 N/cm² (5.0 psi) max
6. LEAKAGE ALLOWANCE:
   a. Internal: 3.0 sccm (0.2 scim) of helium with differential pressure up to 224 N/cm² (325 psi) and temperature from -28.8 to +71.1°C (-20 to +160°F)
   b. External: 1.0 scch (0.06 scih) max
7. REMARKS: This page reflects information on DAC drawing 1A67912 rev G and AEO's through K.

Section III

PROPELLANT CONTROL MODULE, PART NOS. 1A49422-507 AND 1A49422-508

The propellant control modules receive propellant (K605 for fuel and K607 for oxidizer) from a ground source and supply it to the tanks and engine feed lines. Recirculation, transfer and purge operations also occur through the control modules. Each module contains a two position, three way, normally closed solenoid valve, a two position, two way normally closed solenoid valve, two check valves, and a filter.

1. VENDOR: Wallace O. Leonard, Inc.
   a. K606: Part no. 219040-11
   b. K611: Part no. 219040-10
2. LOCATION: In APS modules no. 1 and 2
3. SERVICE:
   a. K606: Monomethyl hydrazine and helium
   b. K611: Nitrogen tetroxide and helium
4. TEMPERATURE (operating): -29 to +71°C (-20 to +160°F)
5. PRESSURE:
   a. Operating: 0 to 189 N/cm² (0 to 275 psia)
   b. Proof: 286 N/cm² (415 psig) min
   c. Yield: 320 N/cm² (460 psig)
   d. Burst: 480 N/cm² (690 psig) min
   e. Check valve cracking: 3 ± 2 N/cm² (5 ± 3 psi)
6. LEAKAGE ALLOWANCE:
   a. Internal (test pressure 189 N/cm² (275 psig) for (1), (2), and (3) following):
      (1) Through solenoid to fill-drain port: 0.2 scc/day (0.01 sci/day) of propellant, 0.03 sccm (0.002 scim) of helium
      (2) Through 3-way solenoid valve to vent-purge port: 0.02 scc/day (0.01 sci/day) of propellant, 0.03 sccm (0.002 scim) of helium
      (3) Through vent-purge or fill-drain port to purge port: 3.0 scc/day (0.183 sci/day) of propellant. 0.21 sccm (0.013 scim) of helium
      (4) The internal leakage rate from port D to port C or from port C to port D when subjected to a differential pressure of 3 N/cm² (5 psi) shall not exceed 5.0 sccm (0.3 scim) of propellant or 300 sccm (18.3 scim) of helium. The total internal leakage rate from the fill-drain port to ports A and B shall not exceed the following:

Differential Pressure		Propellant Leakage		Helium Leakage	
N/cm²	psi	sccm	scim	sccm	scim
0 to 24	0 to 35	1.0	0.06	10	0.6
25 to 28	36 to 40	5.0	0.31	500	30.5

PROPELLANT CONTROL MODULE, PART NOS. 1A49422-507 AND 1A49422-508 (CONT.)

(5) The total internal leakage rate from the vent-purge port to ports C and D shall not exceed the values shown in the table under (4).

b. External: The external leakage of the module during exposure to any ambient pressure between 10.1 N/cm² (14.7 psia) and 10^{-9} mm (.04 x 10^{-9} in.) Hg for any internal propellant or helium pressure up to 189 N/cm² (275 psia) shall not exceed 0.001 scc/day (6 x 10^{-5} sci/day) of propellant or 7 x 10^{-5} sccm (0.4 x 10^{-5} scim) of helium.

7. ELECTRICAL CHARACTERISTICS:
   a. Solenoid operating current: 2.5 A max from each solenoid valve at operating temperature
   b. Insulation resistance: 100 MΩ min at 500 ± Vdc between each insulated terminal and assembly housing
   c. Drop-out voltage: 8 Vdc max, 2 Vdc min
   d. Pull-in voltage: 23 Vdc max, 5 Vdc min
   e. Response time: 0.125 sec at max opening pressure
8. REMARKS: These pages reflect information on DAC drawing 1A49422 rev T and AEO's through Y.

HELIUM CONTROL DISCONNECT, PART NO. 7851823-503

The helium control disconnect (K608) is a male-type coupling nipple with an internal sealing poppet to prevent reverse flow. This disconnect is used to connect to the ground equipment fill hose for filling the APS helium sphere.

1. VENDOR: On Mark Coupling Corp. (part no. 1198004-02)
2. LOCATION: Aft umbilical plate, which is located on the aft skirt
3. SERVICE: Helium
4. TEMPERATURE (operating): -40 to +71°C (-40 to +160°F)
5. PRESSURE:
   a. Operating: 2100 N/cm² (3100 psig) max
   b. Proof: 3210 ± 34 N/cm² (4650 ± 50 psig)
   c. Burst: 5340 N/cm² (7750 psig) min
6. LEAKAGE:
   a. External: 160 sccm (10 scim) max at 2900 ± 70 N/cm² (3000 ± 100 psig)
   b. Internal: 16 sccm (1 scim) max
7. REMARKS: This page reflects information on DAC drawing 7851823 rev M.

HELIUM FILL MODULE, PART NO. 1A49996-509

The helium fill module (K613) receives helium from a ground source and supplies it to the APS helium sphere. This module contains a check valve in the fill line, a solenoid valve in the vent line, and a relief valve parallel to the solenoid dump valve.

1. VENDOR: Vinson Mfg. Co. (part no. A62394-509A)
2. LOCATION: In APS modules no. 1 and 2
3. SERVICE: Helium
4. TEMPERATURE:
   a. Operating: -54 to +71°C (-65 to +160°F)
   b. System blow-down: +71 to -87.5°C (+160 to -125°F)
5. PRESSURE:
   a. Operating: 0 to 2200 N/cm² (0 to 3200 psia)
   b. Proof: 3300 N/cm² (4800 psig) min applied at inlet and outlet simultaneously
   c. Burst: 5500 N/cm² (8000 psig) min
   d. Check valve cracking pressure: 3 ± 2 N/cm² (5 ± 3 psi)
   e. Relief valve:
      (1) Cracking pressure: 2300 N/cm² (3300 psig) min
      (2) Reseat pressure: 2200 N/cm² (3200 psig) min
6. LEAKAGE ALLOWANCE:
   a. Internal:
      (1) Solenoid dump valve and relief valve: 3.0 sccm (0.2 scim) max throughout the operating temperature range
      (2) Check valve: 1.0 sccm (0.06 scim) max throughout the operating temperature range
   b. External: 1.0 scch (0.06 scih) max
7. ELECTRICAL CHARACTERISTICS:
   a. Solenoid operating current: 1.5 A max with 28 Vdc applied at terminals
   b. Insulation resistance: 100 MΩ min at 500 ± 10 Vdc
   c. Operating voltage: 24 to 30 Vdc
   d. Pull-in voltage: 18 Vdc max, 5 Vdc min
   e. Drop out voltage: 8 Vdc max, 0.5 Vdc min
   f. Response time: 0.5 sec max
8. REMARKS: This page reflects information on DAC drawing 1A49996 rev V and AEO's through AA.

HELIUM PRESSURE REGULATOR ASSEMBLY, PART NO. 1B54709-1

The helium pressure regulator assembly (K614), utilizing a 1B54601-1 pressure regulator, supplies helium to the APS propellant tank to pressurize the fuel and oxidizer bellows compartments.

1. VENDOR: Fairchild Hiller (part no. 65-168)
2. LOCATION: In APS modules no. 1 and 2
3. SERVICE: Helium
4. TEMPERATURE (operating): -35 to +71°C (-30 to +160°F)
5. PRESSURE:
   a. Regulated output: (differential between output and ambient pressure)
      (1) Primary regulator: 135 ± 2 N/cm² (196 ± 3 psi)
      (2) Secondary regulator: 138 ± 2 N/cm² (200 ± 3 psi)
   b. Input: 240 to 2200 N/cm² (350 to 3200 psia)
   c. Proof: 3300 N/cm² (4800 psig) at inlet and 258 N/cm² (375 psig) at outlet simultaneously
   d. Burst: 5500 N/cm² (8000 psig) at inlet and 438 N/cm² (625 psig) at outlet simultaneously
6. LEAKAGE ALLOWANCE:
   a. External: 1.0 scch (0.06 scih)
   b. Internal: 2.5 sccm (0.15 ccim)
7. FLOW RATE: 0.16×10^{-1} to 0.90×10^{-1} kg 1 min (0.036 to 0.2 lb/min) with inlet pressure of 2200 to 240 N/cm² (3200 to 350 psia)
8. REMARKS: This page reflects information on the following DAC drawings:
   a. 1B54709 rev NEW and AEO's A and B
   b. 1B54601 rev C and AEO's through G

K. STAGE SEPARATION SYSTEM

The S-IB stage and aft interstage separate from the S-IVB stage immediately after S-IB stage outboard engine cutoff. Parallel leads of mild detonating fuse (MDF) encircle the vehicle at station 1186.804. Two EBW firing units and two EBW detonators detonate the MDF, which severs a tension plate that secures the S-IVB aft skirt to the aft interstage. Five blast deflectors mounted just forward of the separation plane prevent tension plate fragments from damaging the APS modules and the ullage rockets.

Four retromotors operating simultaneously, each ignited by its own independent ignition system consisting of two firing units and two EBW initiators, decelerate the S-IB stage and aft interstage. The retromotors are mounted at $\pi/2$ rad. (90 deg) intervals around the aft interstage.

Three ullage rockets mounted on the S-IVB stage aft skirt operate for 3.9 sec during the separation operation to maintain a slight acceleration for the S-IVB stage until the J-2 engine fires. This acceleration keeps the S-IVB stage propellant seated in the bottom of the containers for J-2 engine start. Two EBW firing units in each ullage rocket fairing assembly ignite the ullage rocket motors.

Approximately 15 sec after stage separation, the S-IVB stage jettisons the ullage rockets and fairing assemblies. Frangible nuts that secure each ullage rocket and fairing assembly are broken by charge assemblies installed on confined detonating fuse (CDF) assemblies. Two EBW firing units detonate two EBW detonators, which in turn detonate the CDF assemblies. Spring-loaded jettison assemblies propel the spent ullage rockets and fairing assemblies away from the stage.

Section III

STAGE SEPARATION SYSTEM INFORMATION ILLUSTRATIONS

STAGE SEPARATION SYSTEM CALLOUT LIST

FIND NO.	COMPONENT	PART NO.	PAGE
K700	Firing Unit, Exploding Bridgewire	40M39515-107	K-5
K701	Block Assembly, Detonator, Stage Separation System	1B55619-503	K-10
K702	Detonator, Electric-Exploding Bridgewire Type	7865742-1	K-7
K703	Fuse Assembly, Detonating, Separation System	1A93438-507	K-8
K704	Firing Unit, Exploding Bridgewire	40M39515-105	K-5
K705	Initiator:		
	TX346-1, Thiokol Chemical Corp.	FR40479	K-14
	AGX2008, Aerojet-General Corp.	505850	K-14

STAGE SEPARATION SYSTEM CALLOUT LIST (CONT.)

F N	COMPONENT	PART NO.	PAGE
K7[illegible]	Motor, Retrorocket	1A59670-1	K-15
K707	Firing Unit, Exploding Bridgewire	40M39515-107	K-5
K708	Initiator:		
	TX346-1, Thiokol Chemical Corp.	FR40479	K-14
	AGX2008, Aerojet-General Corp.	505850	K-14
K709	Motor, Ullage Rocket	1A81960-1	K-19
K710	Firing Unit, Exploding Bridgewire	40M39515-101	K-5
K711	Explosive Fuse Assembly, Ullage Rocket Jettison	1A84225-507	K-23
K712	Detonator, Electric-Exploding Bridgewire Type	7865742-1	K-7
K713	Nut, Frangible - 1/2	1A72620-1	K-25
K714	Block, Detonator, Ullage Rocket Jettison	1A84223-503	K-24

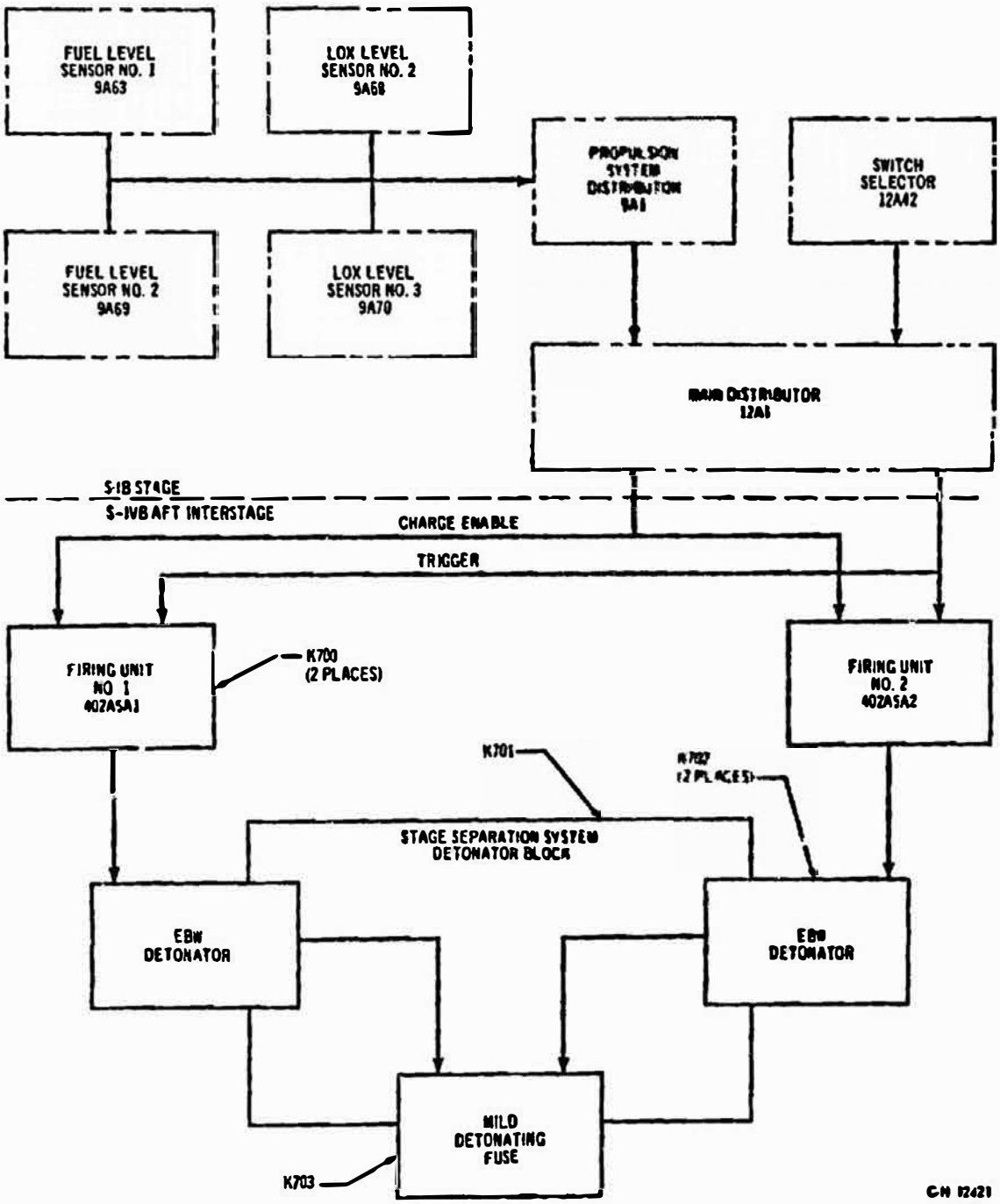


FIGURE K-1 STAGE SEPARATION SYSTEM - BLOCK DIAGRAM

EXPLODING BRIDGEWIRE (EBW) FIRING UNIT, PART NO. (See below.)

The EBW firing unit is a solid-state electronic device that generates a high voltage, high energy, short duration pulse to fire an EBW detonator or squib. Two input signals are necessary to the firing unit function. The first signal applies power to the circuitry, allowing a system storage capacitor to charge to 2300 ± 100 Vdc. The second signal triggers an electronic switch, permitting the storage capacitor to discharge.

1. VENDOR: GFE (part nos. 40M39515-101, -105, and -107)
2. LOCATION:

Find No.	Part No.	System	Qty	Cable Length cm (in.)	Sta Loc	Installation View
K700	40M39515-107	Separation	2	91 (36)	1168	Fig. K-2
K704	40M39515-105	Retromotor Ignition	8	76 (30)	980	Fig. K-6
K707	40M39515-107	Ullage Rocket Ignition	6	91 (36)	1216	Fig. K-10
K710	40M39515-101	Ullage Rocket Jettison	2	46 (18)	1200	Fig. K-13
K756	40M39515-107	S-IVB Stage PDS	2	91 (36)	1654	Fig. L-4 (Sheet 2)

3. SERVICE: Electrical
4. TEMPERATURE (operating): -18 to +93°C (-65 to +200°F)
5. ELECTRICAL CHARACTERISTICS:
   a. Input voltage: 24 Vdc to 32 Vdc; max continuous, 36 Vdc
   b. System storage capacitor charge time: 1.5 sec
   c. Trigger voltage: 28 ± 4 Vdc
   d. Output voltage: 2300 ± 100 Vdc
   e. Trigger circuit response time: 4 ± 1 ms
6. REMARKS: This page reflects information in MSFC specification 40M39515B.

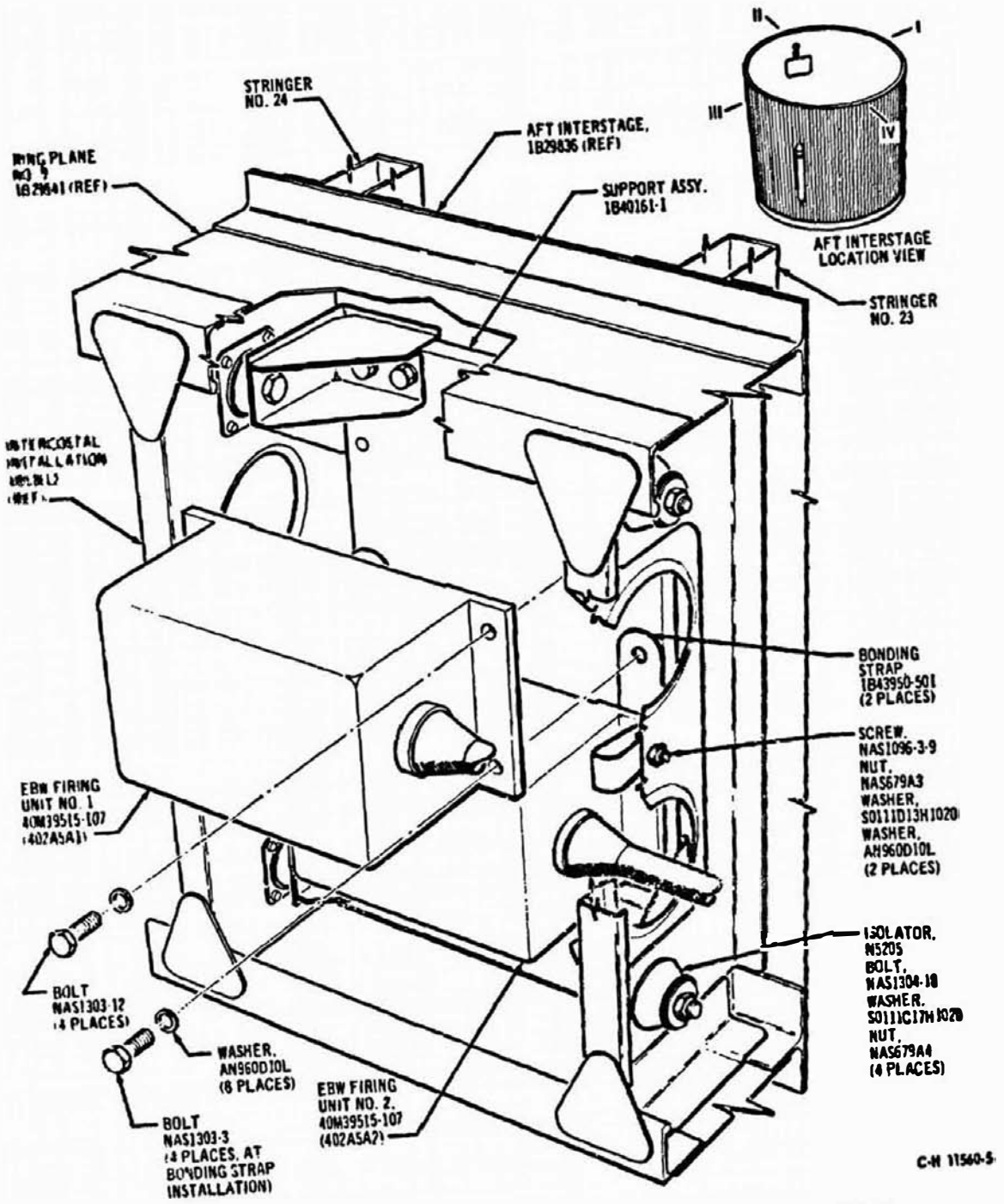


FIGURE K-2 SEPARATION SYSTEM EBW FIRING UNITS - INSTALLATION VIEW

EXPLODING BRIDGEWIRE (EBW) DETONATOR, PART NO. 7865742-1

The EBW detonator serves as the interface between the electrical equipment and ordnance components in the separation system, ullage rocket jettison system, and PDS. Redundant detonator installations in each system ensures detonation of ordnance components when the command is received.

The detonator contains an exploding bridgewire connected between two electrical pins and embedded in a PETN acceleration charge. Application of 2300 ± 100 Vdc from the EBW firing unit across the pins causes the bridgewire to explode and detonate the acceleration charge. The acceleration charge then detonates a PETN main charge, also contained in the detonator case, which propagates the explosion to its respective fuse assembly.

A spark gap created by a mica spacer inserted between segments of one electrical connector pin precludes accidental dudding of the detonator by inadvertent application of electrical power.

1. VENDOR: Douglas Aircraft Company, Inc. (part no. 7865742-1)
2. LOCATION:

Find No.	Part No.	System	Qty	Sta. Loc.	Installation View
K702	7865742-1	Separation	2	1183	Fig. K-4
K712	7865742-1	Ullage Rocket Jettison	2	1195	Fig. K-13
K763	7865742-1	S-IVB Stage PDS	2	1154	Fig. L-4 (Sheet 2)

3. SERVICE: Ordnance
4. TEMPERATURE (operating): -18 to +74°C (-65 to +165°F)
5. ELECTRICAL CHARACTERISTICS:
   a. Input voltage: 2300 ± 100 Vdc
   b. Spark gap breakdown voltage: 600 Vdc to 1200 Vdc
   c. Detonator circuit resistance: 100 MΩ between pins, measured in either direction at 500 Vdc and 20°C (70°F)
   d. Bridgewire resistance: 0.17 ± 0.03Ω
6. HAZARDOUS MATERIALS:
   a. Acceleration charge: 67.5 ± 2.0 mg of class 2 PETN
   b. Main charge: 90.7 ± 16 mg (1.40 ± 0.25 gr) of class 4 PETN
7. REMARKS: This page reflects information in DAC specification 7865742 rev N.

Section III

SEPARATION SYSTEM DETONATING FUSE ASSEMBLY, PART NO. 1A93438-507

The separation system detonating fuse assembly (K703) consists of parallel lengths of mild detonating fuse (MDF) encased in a polyethylene plastic cover. Each MDF length has a PETN core encased in a lead sheath. The MDF effects stage separation by severing a tension plate that secures the aft skirt assembly and aft interstage assembly.

1. VENDOR: Douglas Aircraft Company, Inc. (part no. 1A93438-507)
2. LOCATION: The MDF is installed in a groove around the base of the aft skirt assembly at vehicle station 186.804. See fig. K-3.
3. SERVICE: Ordnance
4. TEMPERATURE (operating): -18 to +74°C (-65 to +165°F)
5. CHARACTERISTICS:
   a. Detonation velocity: 6,096 to 7,618 m/s (20,000 to 25,000 ft/s)
   b. Critical temperature: Greater than 99°C (210°F)
6. HAZARDOUS MATERIALS: 2 mg/m (10 gpf) of class 4 PETN
7. REMARKS: This page reflects information in DAC specification 1A93438 rev B and AEO's through G.

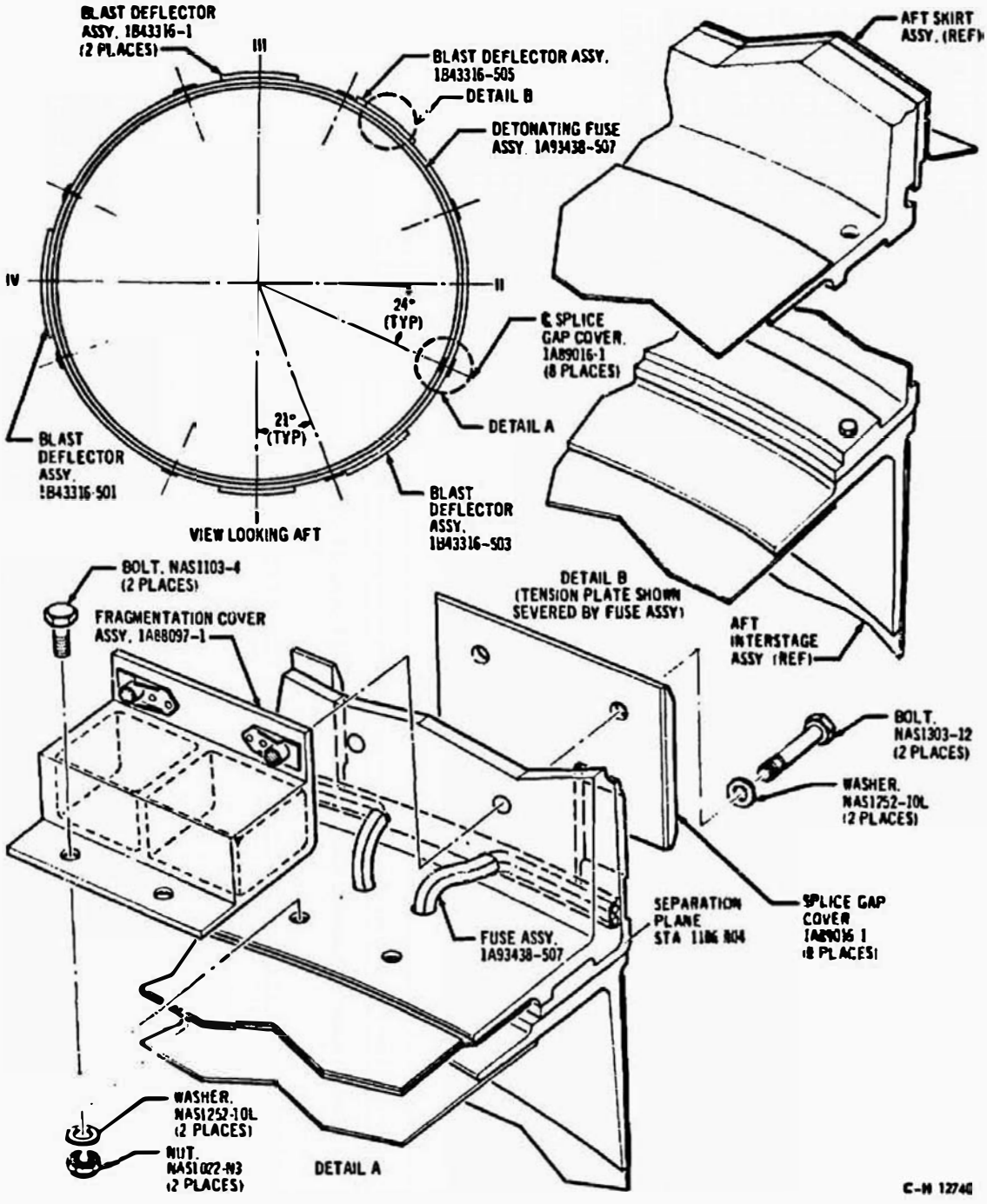


FIGURE K-3 SEPARATION SYSTEM DETONATING FUSE ASSEMBLY - INSTALLATION VIEW

Section III

SEPARATION SYSTEM DETONATOR BLOCK ASSEMBLY, PART NO. 1B55619-503

The separation system detonator block assembly (K701) consists of a detonator block and two spacers. The detonator block serves as a junction for the MDF ends and two EBW detonators, and contains the heat and shock created by the exploding detonators. The detonator block has two threaded receptacles for installing the EBW detonators and two drilled passages perpendicular to the receptacles for inserting the MDF ends. The two spacers, one installed in each passage, secures and correctly positions the MDF ends with the EBW detonators to ensure propagation to the MDF when the detonators fire.

1. VENDOR: Douglas Aircraft Company, Inc. (part no. 1B55619-503)
2. LOCATION: Installed in the aft interstage just below the aft skirt/aft interstage mating plane approximately 0.44 rad. (25 deg) from position II toward position I. See fig. K-4.
3. SERVICE: Ordnance
4. REMARKS: This page reflects information on DAC drawing 1B55619-503 rev new and AEO A, and 1A93439 rev A.

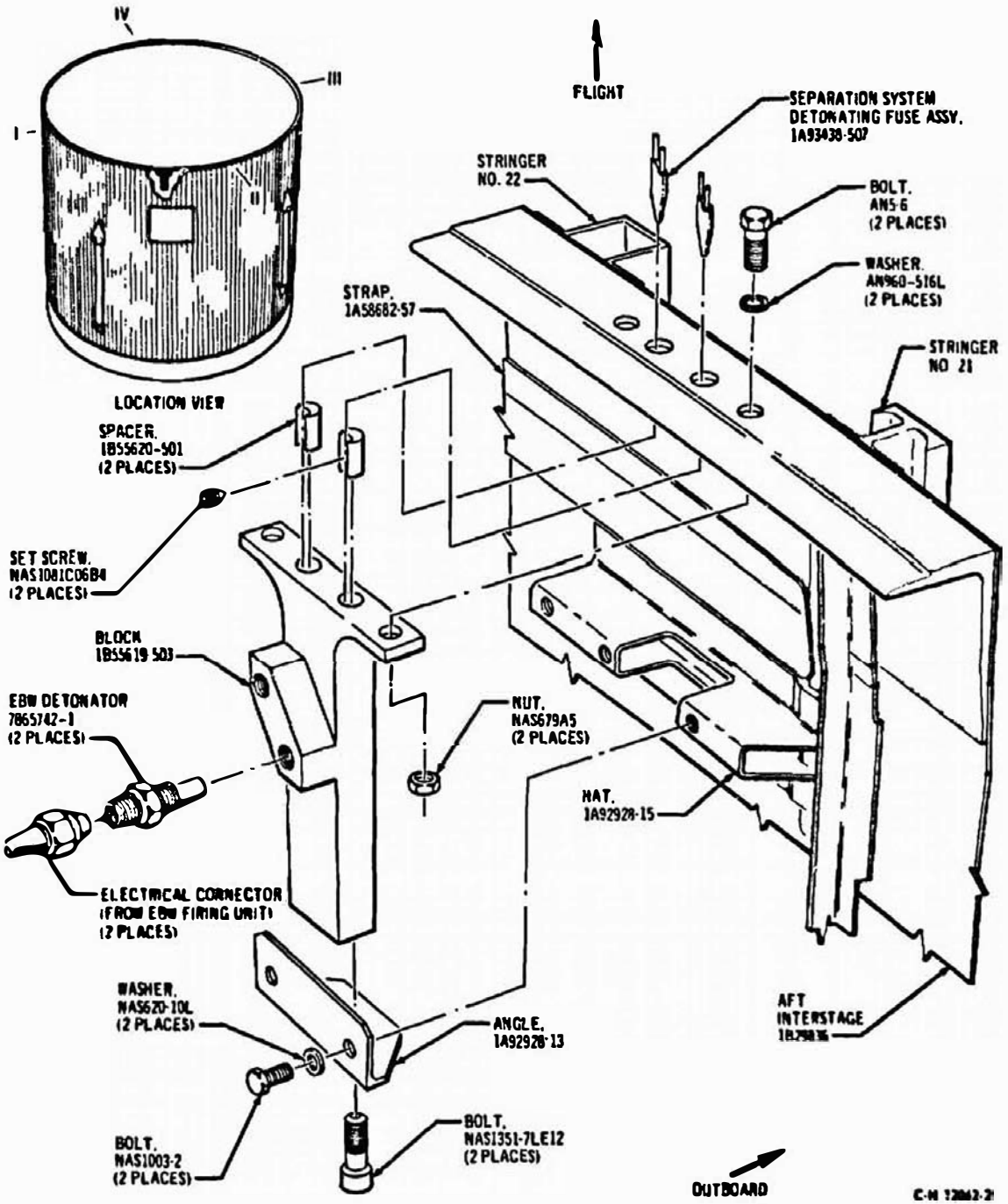


FIGURE K-4 SEPARATION SYSTEM DETONATOR BLOCK AND EBW DETONATOR - INSTALLATION VIEW

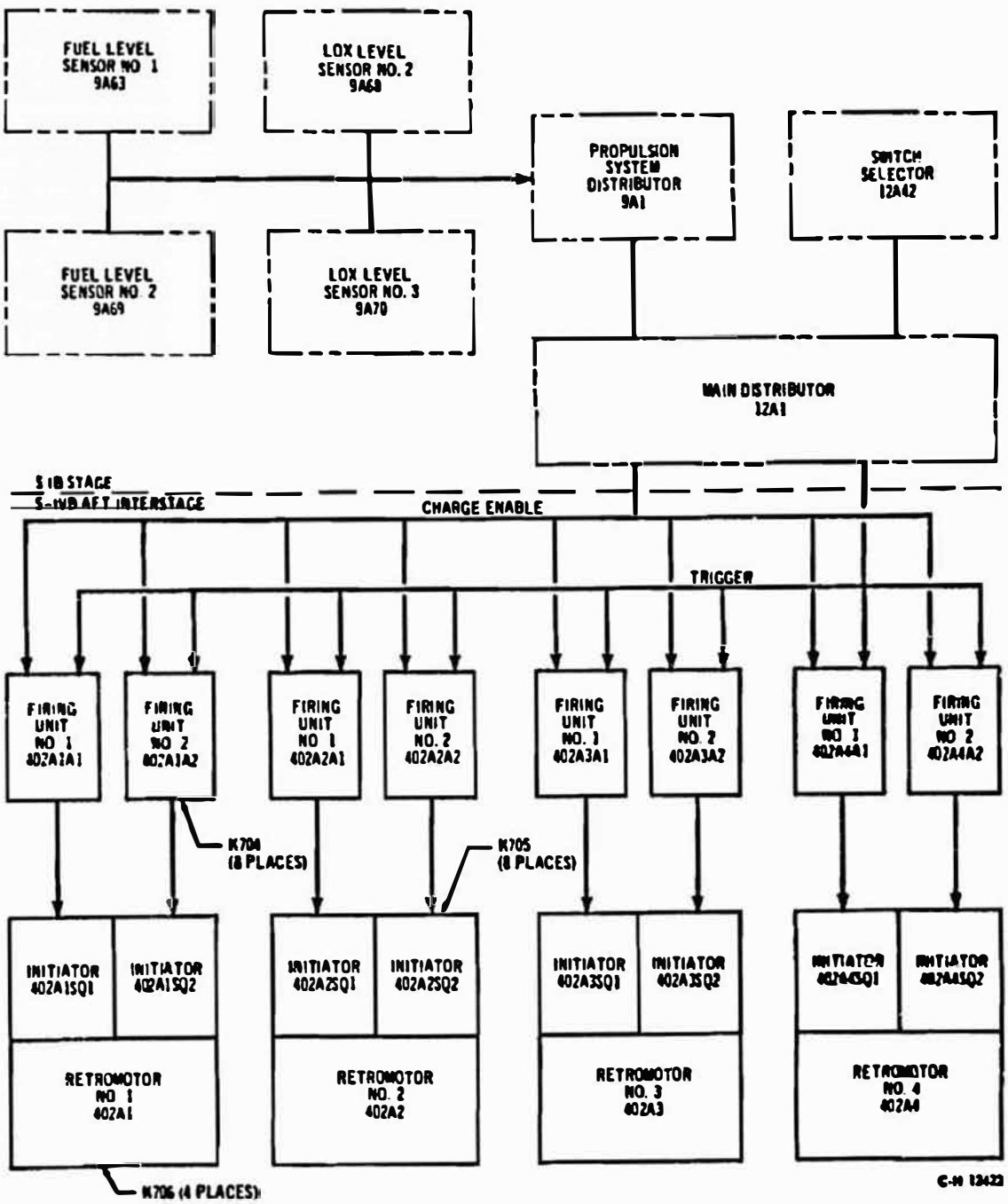


FIGURE K-5 RETROMOTOR IGNITION SYSTEM - BLOCK DIAGRAM

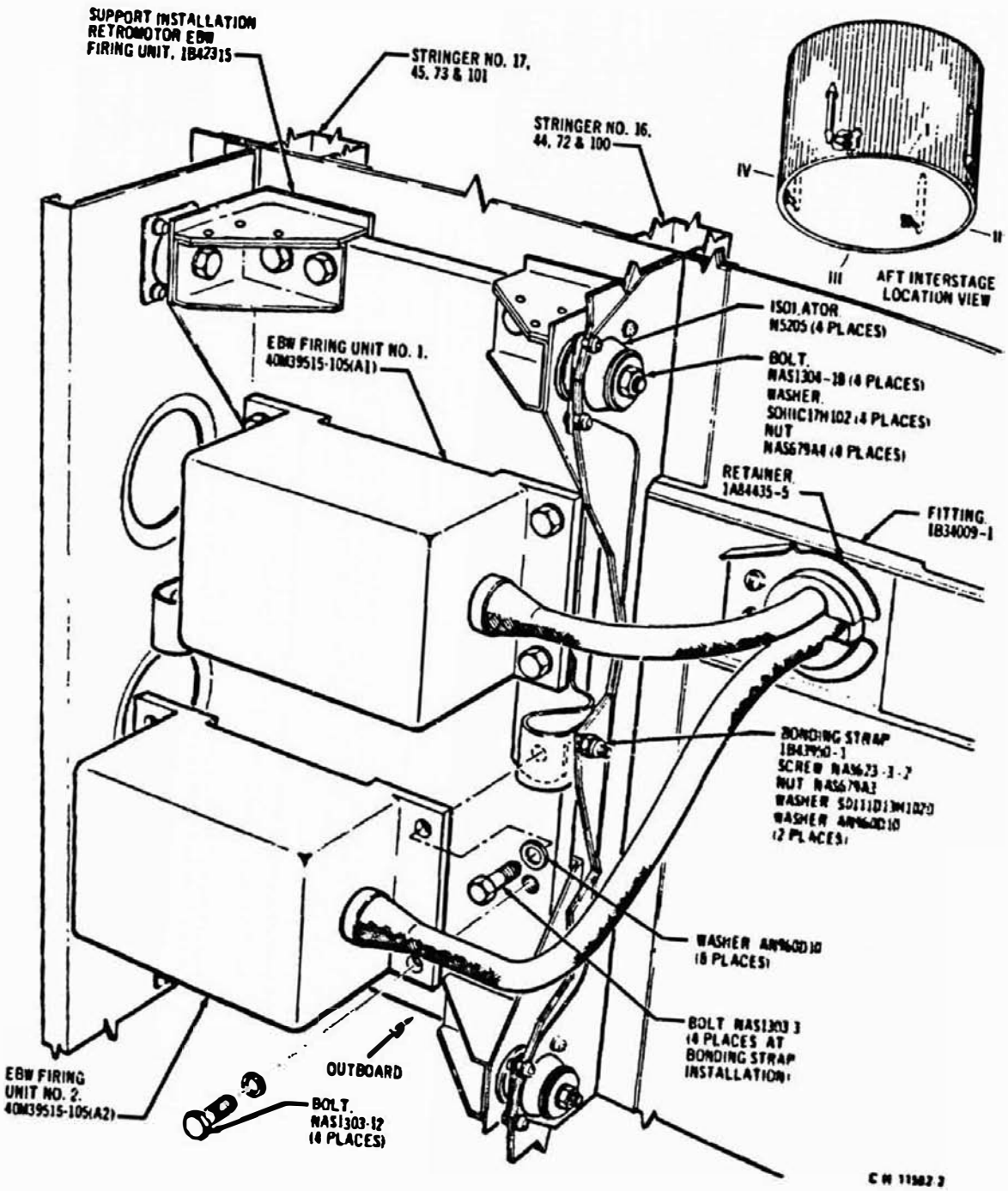


FIGURE K-6 RETROMOTOR EBW FIRING UNITS - INSTALLATION VIEW

Section III

INITIATOR, PART NOS. FR40479 AND 505850

The initiators (K705) are the first-fire components used in the retromotor and ullage rocket ignition systems. They fire an igniter, which in turn ignites the solid propellant motors. Redundant initiator installations in each igniter assures motor ignition. Either of two initiators, the TX-346-1 produced by Thiokol Chemical Corporation or the AGX-2008 produced by Aerojet-General Corporation, may be used. The internal design of the initiators differs slightly, but both have identical outputs. Both initiators have a spark gap in their electrical circuits to prevent firing or dudding of the unit through inadvertent application of power. Both initiators use an exploding bridgewire to detonate the pyrotechnic charges. The TX-346-1 initiator contains a bead charge on the bridgewire that detonates a main charge. The AGX-2008 initiator bridgewire is embedded in the main charges and detonates the charge directly.

1. VENDOR:
   a. Thiokol Chemical Corporation (model TX-346-1, part no. FR40479)
   b. Aerojet General Corporation (model AGX-2008, part no. 505850)
2. LOCATION: Two initiators are installed in aft end of each retromotors at vehicle station 970, approximately; and two initiators installed in the forward end of each ullage rocket at vehicle station 1235, approximately. See fig. K-7 and K-10.
3. SERVICE: Ordnance
4. TEMPERATURE (operating): -23 to +66°C (-10 to +150°F)
5. ELECTRICAL CHARACTERISTICS:
   a. Input voltage: 2300 $\pm$ 100 Vdc
   b. Spark gap breakdown voltage: 700 Vdc to 1300 Vdc
   c. Bridgewire resistance:
      (1) TX-346-1: 0.15 $\pm$ 0.04
      (2) AGX-2008: 1.94 $\pm$ 0.20
6. HAZARDOUS MATERIALS:
   a. TX-346-1: 605 mg pyrotechnic charge (chemical composition propriety information of TCC)
   b. AGX-2008: 800 mg pyrotechnic charge (chemical composition propriety information of AGC)
7. REMARKS: This page reflects information in Thiokol specification SP-529 and SP-534 and Aerojet General specification 540480.

RETROMOTOR, PART NO. 1A59670-1

The solid propellant retromotors decelerate the S-IB stage and aft interstage during S-IB/S-IVB separation. Each motor contains an igniter that directs hot particles and gases to the propellant surface causing instant ignition of the entire surface. Each retromotor exhaust nozzle cants 16.5 drad (9.5 deg) outboard from the vehicle centerline, to direct hot exhaust gases away from the S-IVB stage.

1. VENDOR: Thiokol Chemical Corporation (part no. TE-M-29-4)
2. LOCATION: Mounted at π/2 rad. (90 deg) intervals around the aft interstage: fin lines 2, 4, 6, and 8. See fig. K-7 and K-8.
3. SERVICE: Ordnance
4. THRUST: 135,336 N (30,425 lbf) at 60,900 m (200,000 ft) altitude and 16°C (60°F)
5. BURN TIME: 1.543 sec (average)
6. PROPELLANT:
   a. Designation: Thiokol TP-E-8035
   b. Type of grain: Case bonded, internal burning, tapered 5-point star configuration
7. WEIGHT:
   a. Loaded: 169 kg (372 lb)
   b. Propellant: 121 kg (267 lb)
8. TEMPERATURE:
   a. Storage: -36 to +37°C (-32 to +100°F)
   b. Firing: -26 to +71°C (-15 to +160°F)
   c. Autoignition: 121°C (250°F) after 8 hr; 268°C (515°F) after 5 sec
9. REMARKS: This page reflects information in DAC specification 1A59670 rev H.

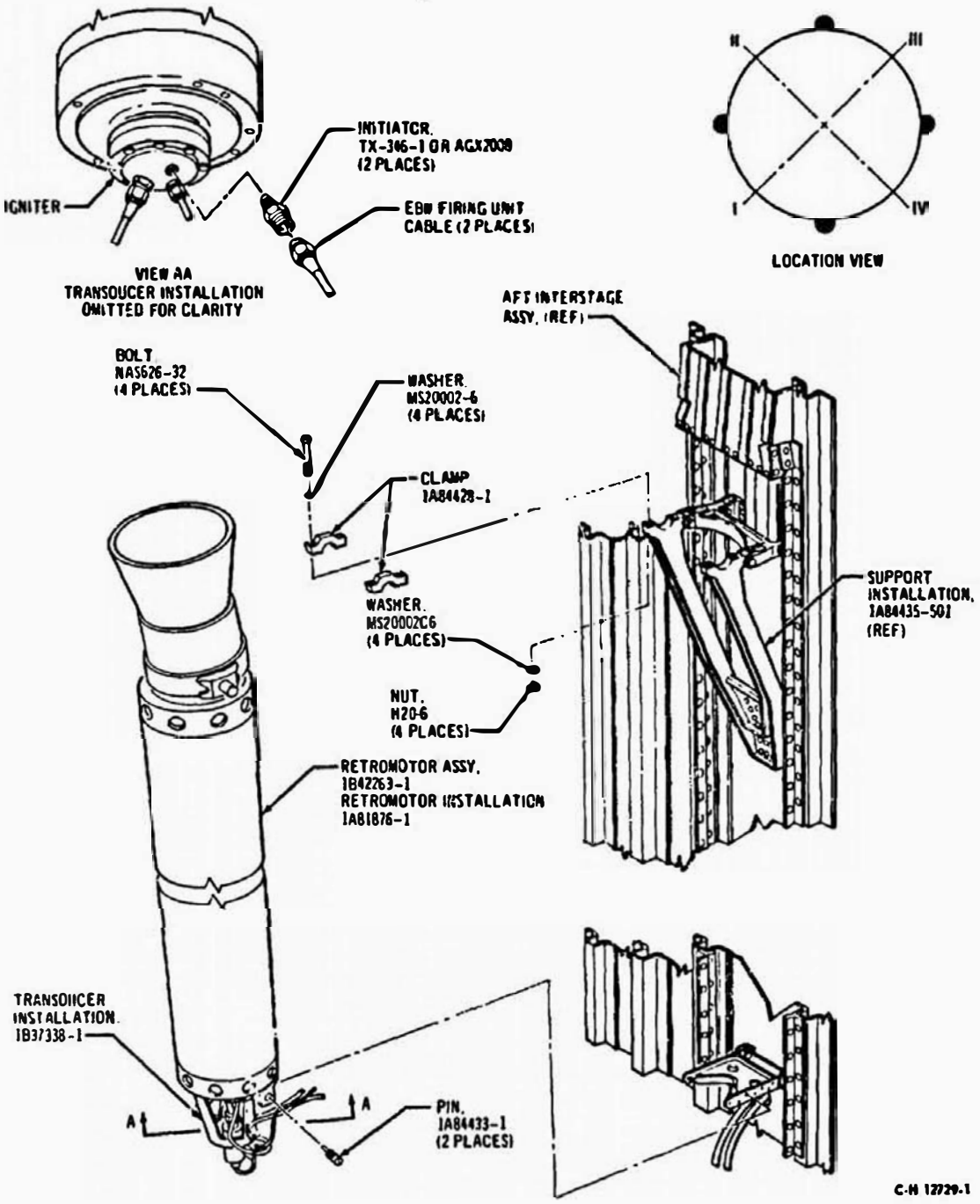


FIGURE K-7 RETROMOTOR AND INITIATOR - INSTALLATION VIEW

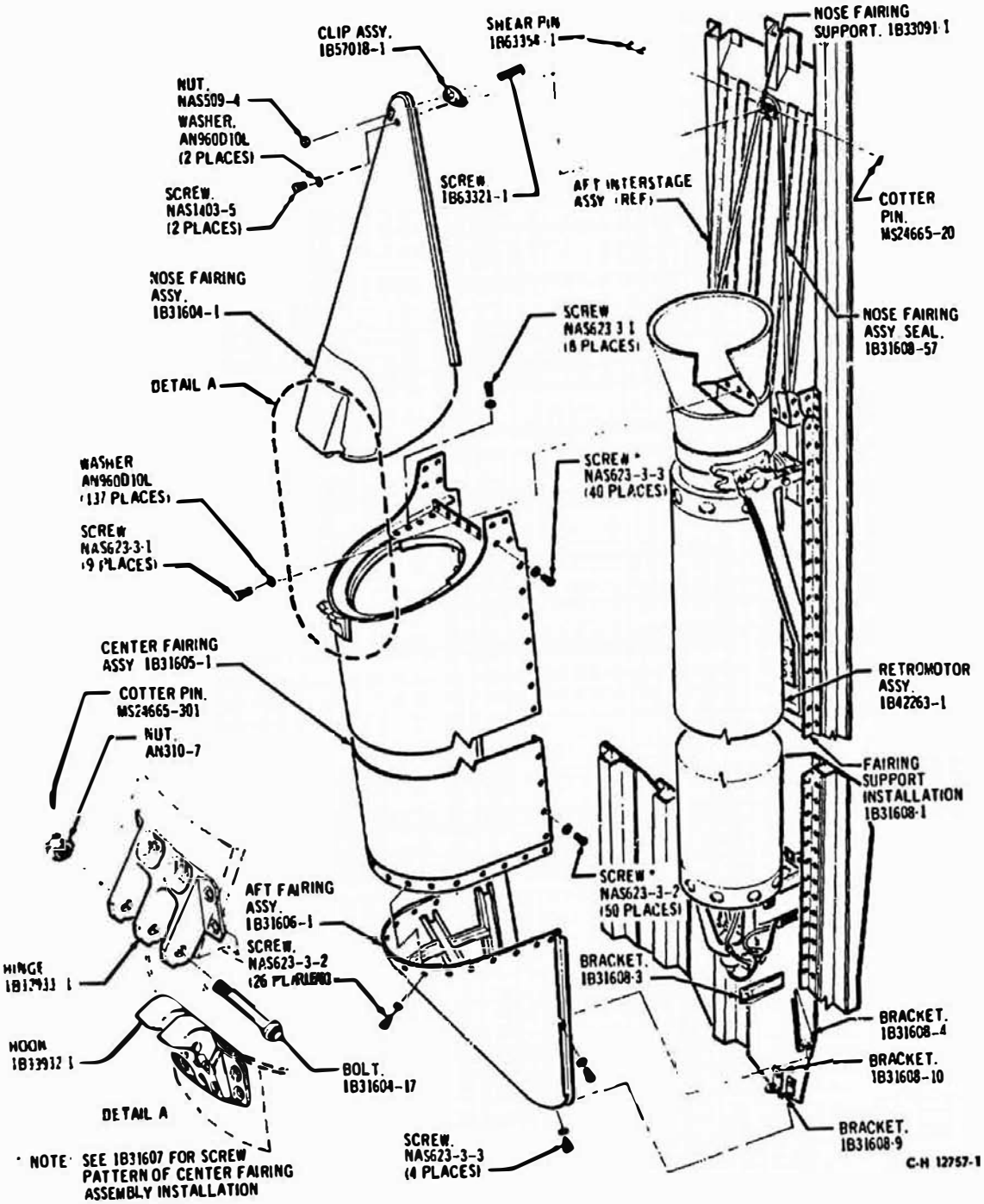


FIGURE K-8 RETROMOTOR FAIRINGS - INSTALLATION VIEW

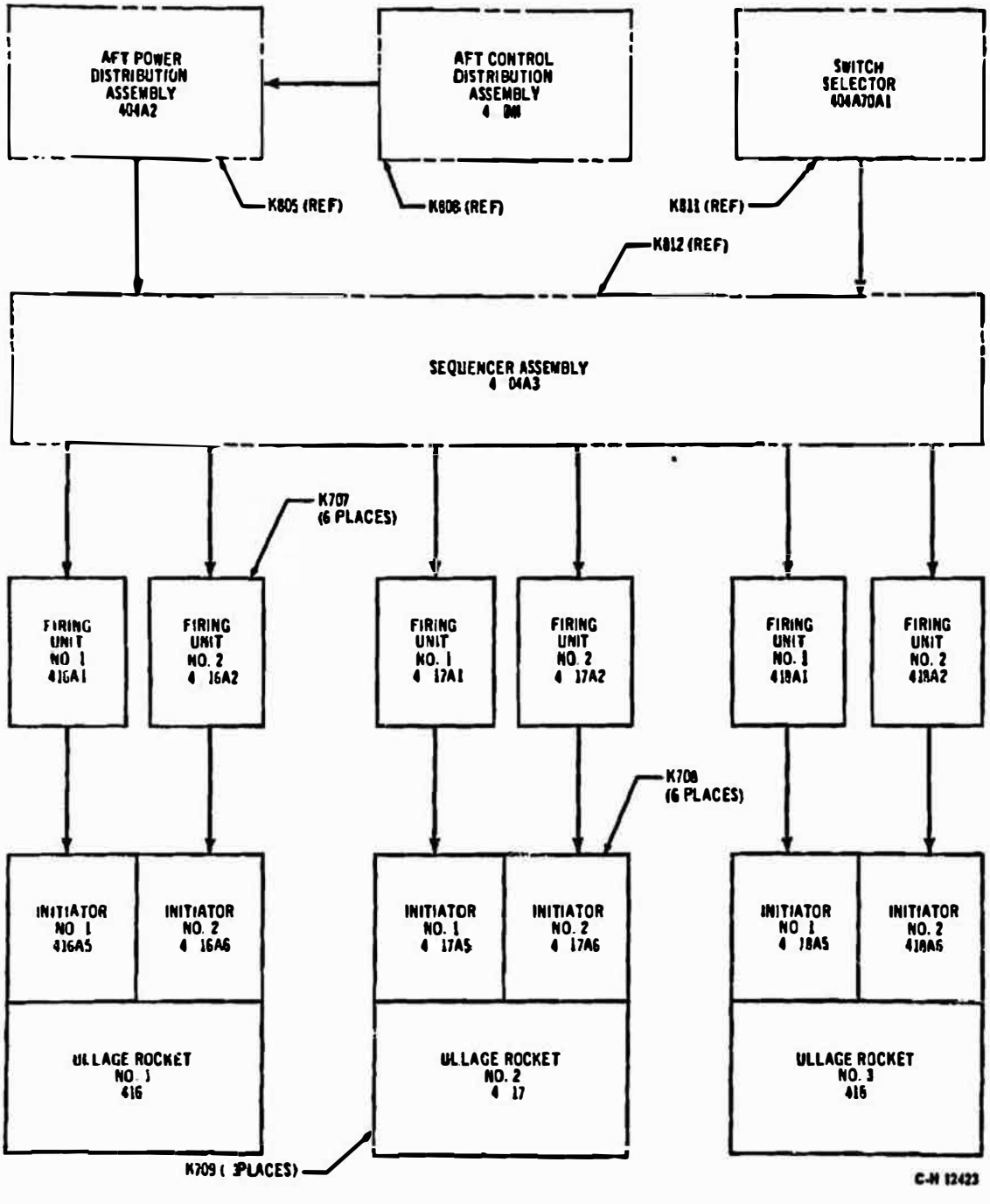


FIGURE K-9 ULLAGE ROCKET IGNITION SYSTEM - BLOCK DIAGRAM

ULLAGE ROCKET MOTOR, PART NO. 1A81960-1

The solid propellant ullage rockets (K709) maintain a slight S-IVB stage acceleration during stage separation operation to keep the S-IVB stage propellant properly seated in the bottom of the containers for J-2 engine start. An igniter that is an integral part of the ullage rocket has two threaded receptacles for installation of initiators.

1. VENDOR: Thiokol Chemical Corporation (part no. TX-280-10)
2. LOCATION: Mounted on the aft skirt assembly approximately 2.09 rad. (120 deg) apart. See fig. K-10 and K-11.
3. SERVICE: Ordnance
4. THRUST: 15,400 N (3,460 lb_f) at 304,800 m (1,000,000 ft) and 21°C (70°F)
5. BURN TIME: 3.9 sec (average)
6. PROPELLANT: Case bonded, internal burning, 5-point star solid propellant (composition classified confidential by Thiokol Chemical Corporation)
7. WEIGHT:
   a. Loaded: 59.3 kg (130.8 lb, approx)
   b. Propellant: 26.6 kg (58.8 lb)
8. TEMPERATURE:
   a. Storage: -29 to +66°C (-20 to +150°F)
   b. Firing: -29 to +63°C (-20 to +145°F)
   c. Autoignition: 163°C (325°F) after 8 hr, 177°C (350°F) after 1 hr
9. REMARKS: This page reflects information in DAC specification 1A81960 rev F and AEO G.

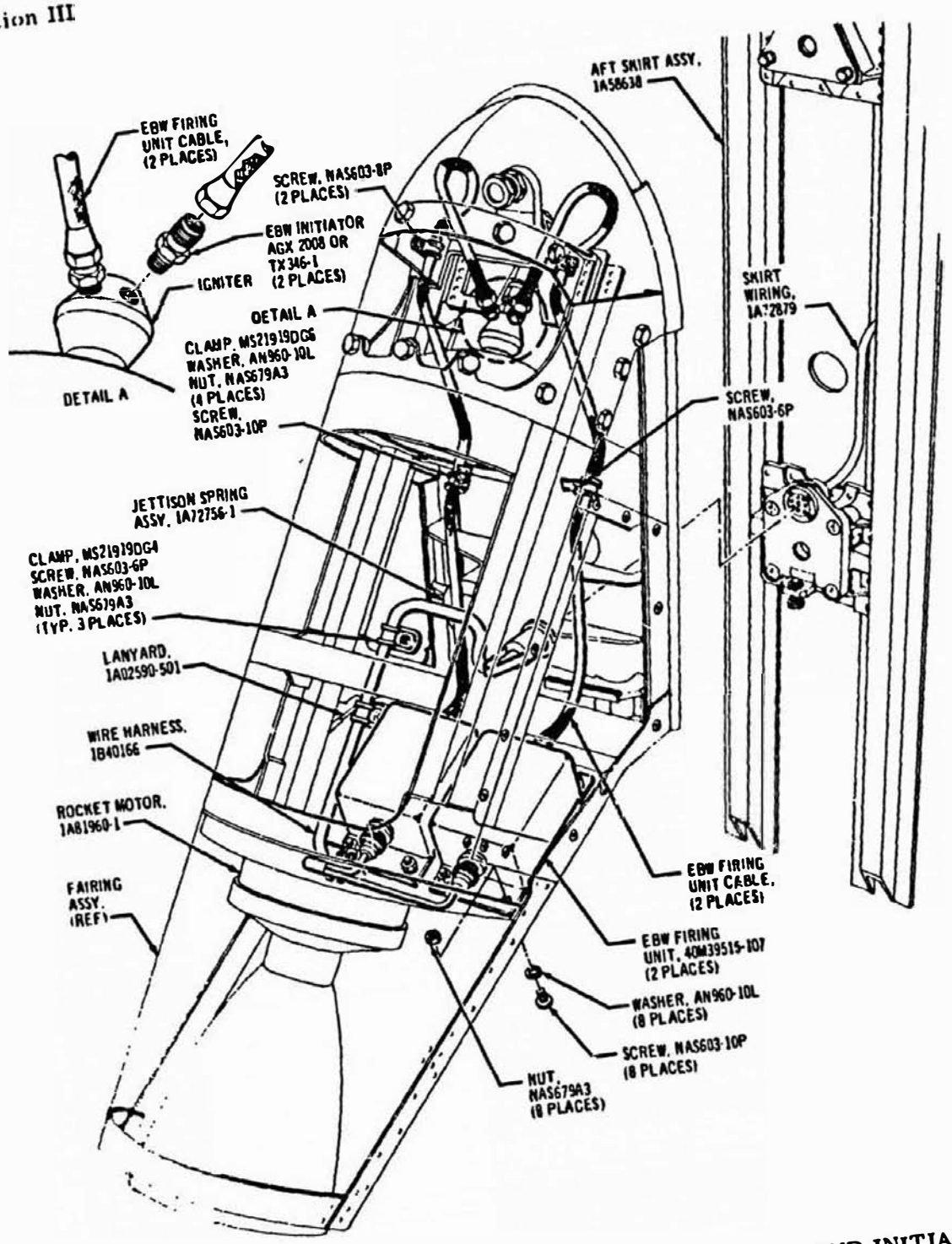


FIGURE K-10 ULLAGE ROCKET EBW FIRING UNITS AND INITIATOR - INSTALLATION VIEW

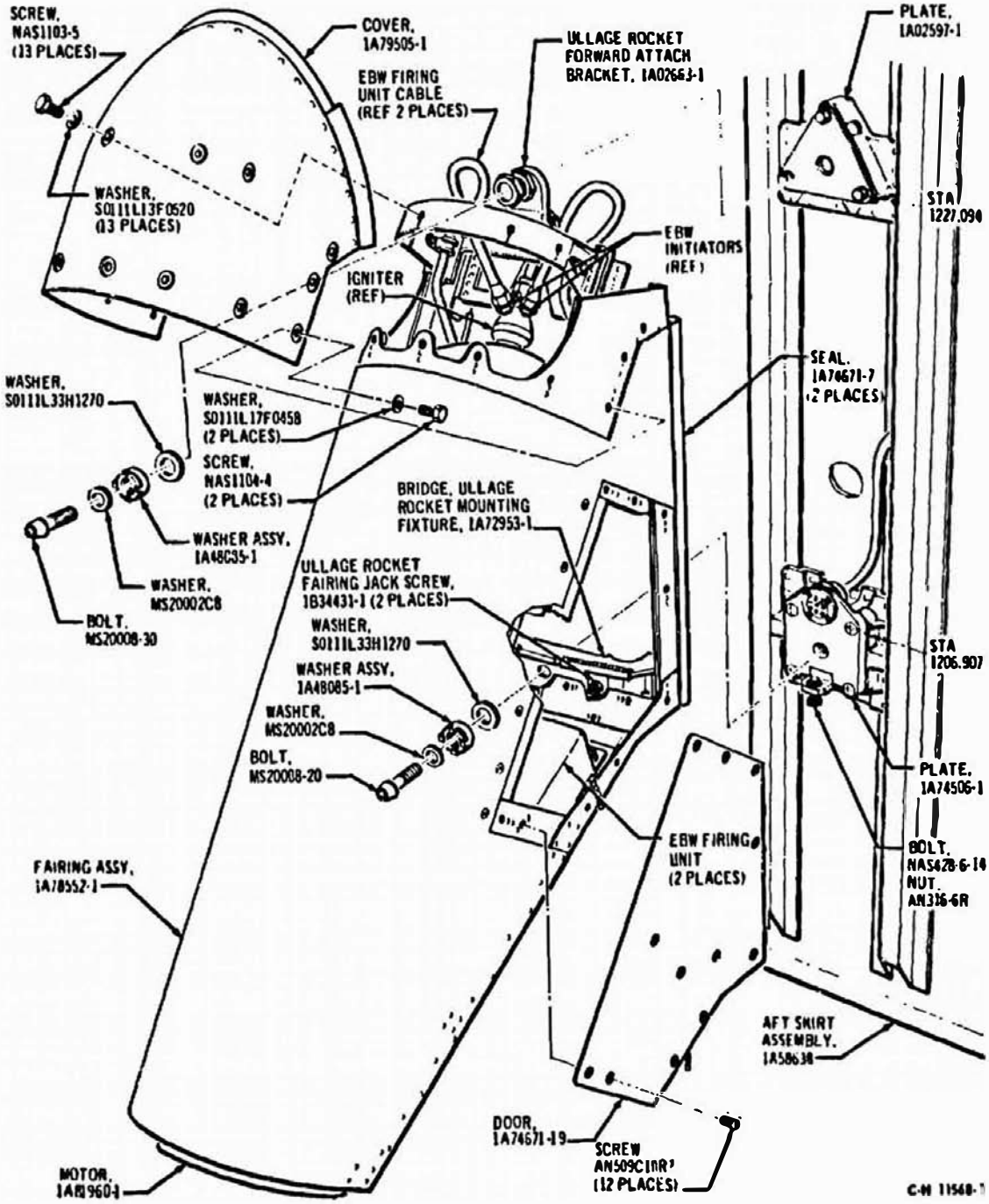


FIGURE K-11 ULLAGE ROCKET FAIRING - INSTALLATION VIEW

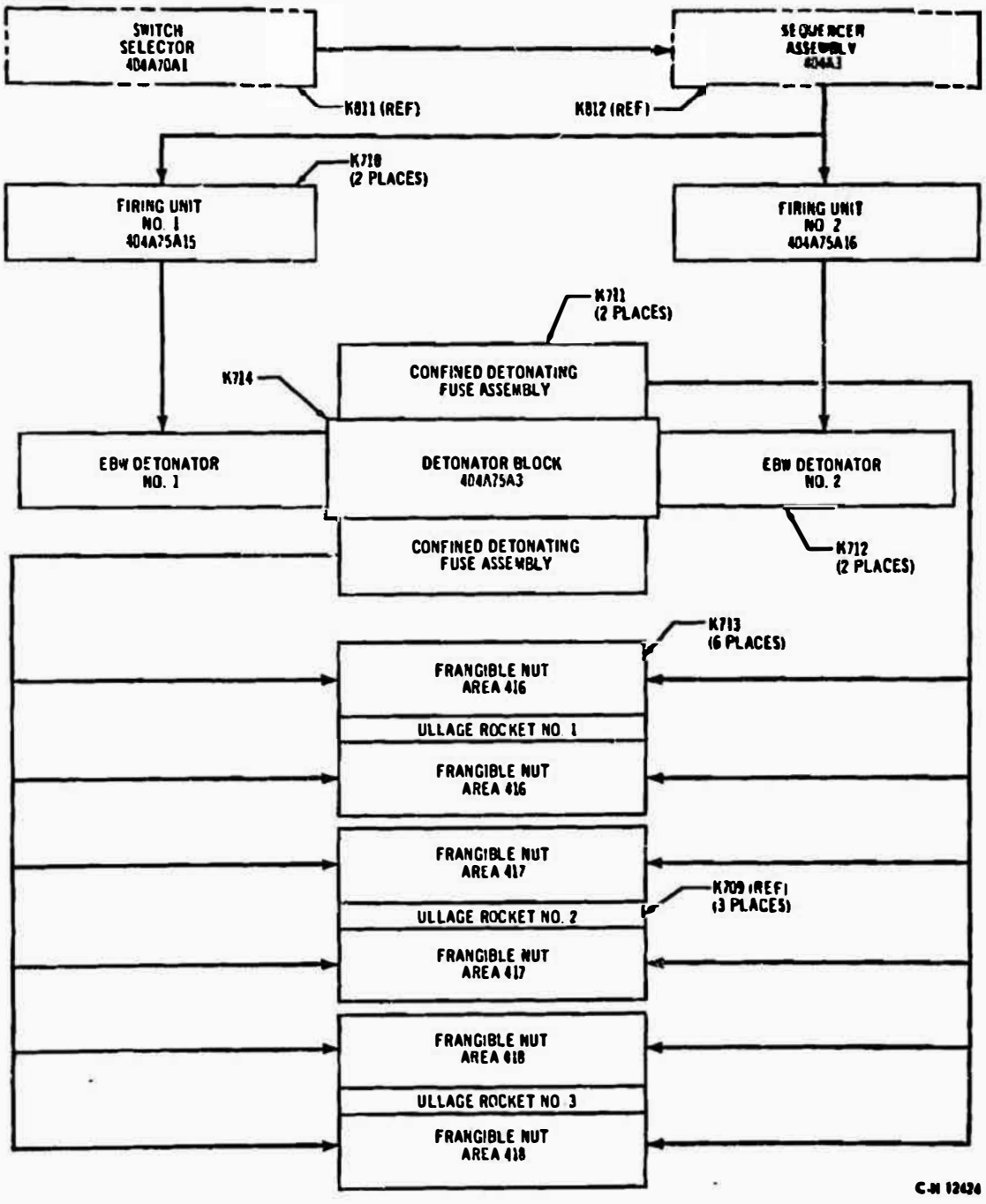


FIGURE K-12 ULLAGE ROCKET JETTISON IGNITION SYSTEM - BLOCK DIAGRAM

ULLAGE ROCKET JETTISON SYSTEM EXPLOSIVE FUSE ASSEMBLY, PART NO. 1A84225-507

The ullage rocket jettison system explosive fuse assembly (K711) simultaneously detonates explosive charges that fracture the nuts securing the ullage rocket fairing to the aft skirt assembly. Two fuse assemblies are used for redundancy. Each fuse assembly consists of three lengths (1484.6 cm [584.5 in.], 826.6 cm [321.5 in.], 367.0 cm [144.5 in.] respectively) of confined detonating fuse (CDF), six charge assemblies (two per length), and an end fitting assembly, which contains a PETN booster charge. One end of each CDF length is bonded in the end fitting with the CDF cores butted against the booster charge. The booster charge picks up the detonation created by an EBW detonator and propagates the detonation through the CDF lengths to the charge assemblies. One charge assembly from each fuse assembly is inserted into each nut.

1. VENDOR: Douglas Aircraft Company, Inc. (part no. 1A84225-507)
2. LOCATION: Installed in the aft skirt assembly just forward of separation plane, station 1186.804 connecting between panel position no. 18 and each ullage rocket position. See fig. K-14.
3. SERVICE: Ordnance
4. HAZARDOUS MATERIALS:
   a. CDF: 0.4 mg/m (2 gpf) core of class 4 PETN
   b. Booster charge: 0.13 mg (2 gr) of class 4 PETN
   c. Charge assembly:
      (1) Pick-up charge: 35 ± 5 mg of class 4 PETN
      (2) Acceleration charge: 17 ± 5 mg of class 4 PETN
      (3) Base charge: 260 ± 5 mg of class 4 PETN
5. REMARKS: This page reflects information on DAC drawing 1A84225 rev J and 1A86541 rev C.

Section III

DETONATOR BLOCK, PART NO. 1A84223-503

The detonator block (K714) is a single unit containing four threaded receptacles for installing two EBW detonators and two jettison fuse assembly end fittings. The detonator block contains the shock created by the EBW detonators permitting the detonation to propagate to two end fittings.

1. VENDOR: Douglas Aircraft Company, Inc. (part no. 1A84223-503)
2. LOCATION: Mounted in the aft skirt assembly at panel position 18. See fig. K-13.
3. SERVICE: Ordnance
4. REMARKS: This page reflects information on DAC drawings 1A84223 rev C and 1A86541 rev C.

FRANGIBLE NUT, PART NO. 1A72620-1

Two frangible nuts (K713) at each ullage rocket position secures the ullage rocket fairing to the aft skirt assembly. Designed with a structurally weak plane, the frangible nuts break open along this plane upon detonation of either or both charge assemblies. Two receptacles in each frangible nut receive a CDF charge assembly from each jettison fuse assembly. Two retaining pins lock the charge assemblies in the frangible nut.

1. VENDOR: Douglas Aircraft Company, Inc. (part no. 1A72620-1)
2. LOCATION: Two frangible nuts located at each ullage rocket position. See fig. K-14, sheet 3.
3. SERVICE: Ordnance
4. REMARKS: This page reflects information on DAC drawing 1A72620 rev C and 1A86541 rev C.

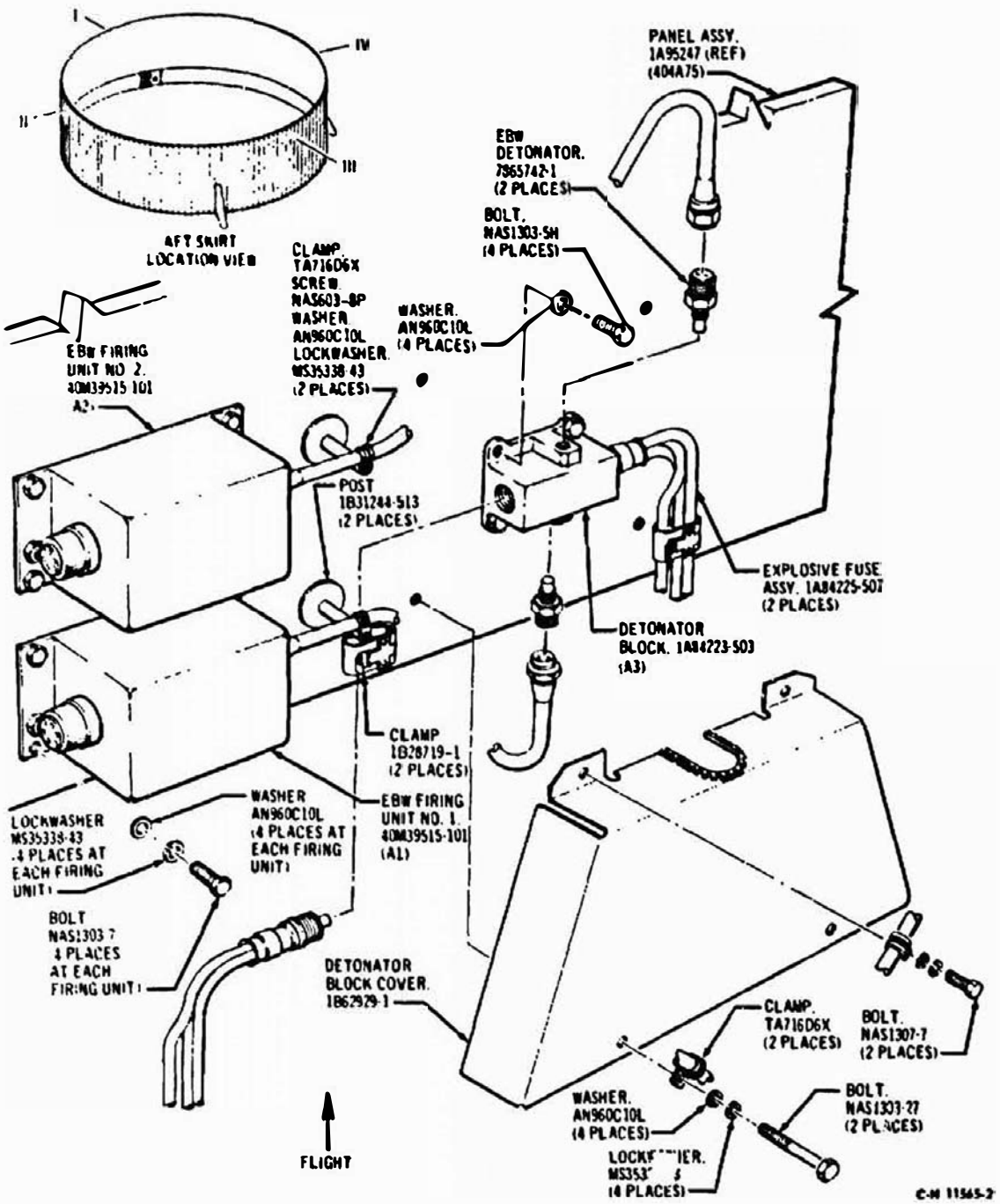


FIGURE K-13 ULLAGE ROCKET JETTISON SYSTEM EBW FIRING UNITS AND DETONATOR BLOCK - INSTALLATION VIEW

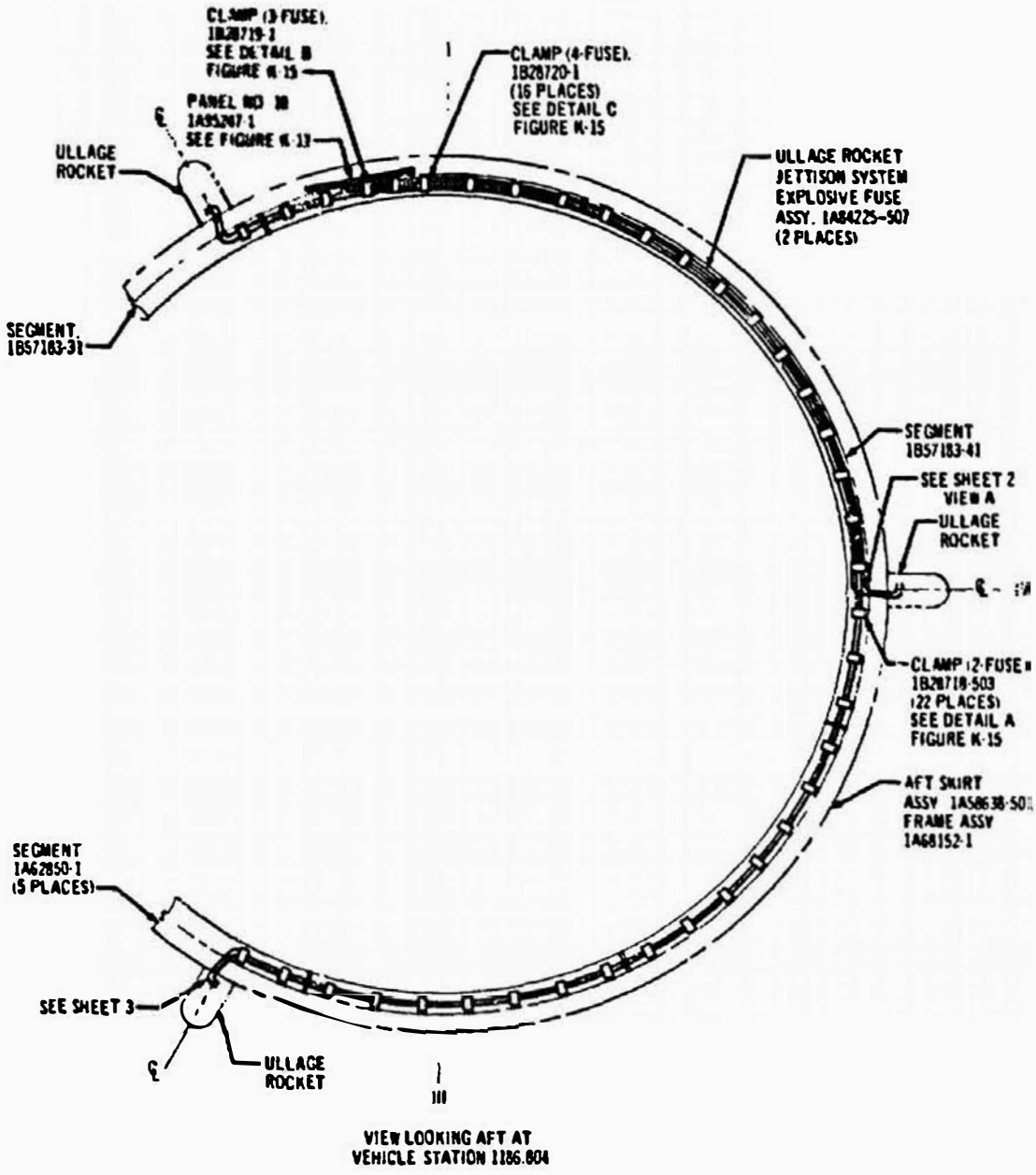


FIGURE K-14 ULLAGE ROCKET JETTISON SYSTEM EXPLOSIVE FUSE ASSEMBLY AND FRANGIBLE NUT - INSTALLATION VIEW (Sheet 1 of 3)

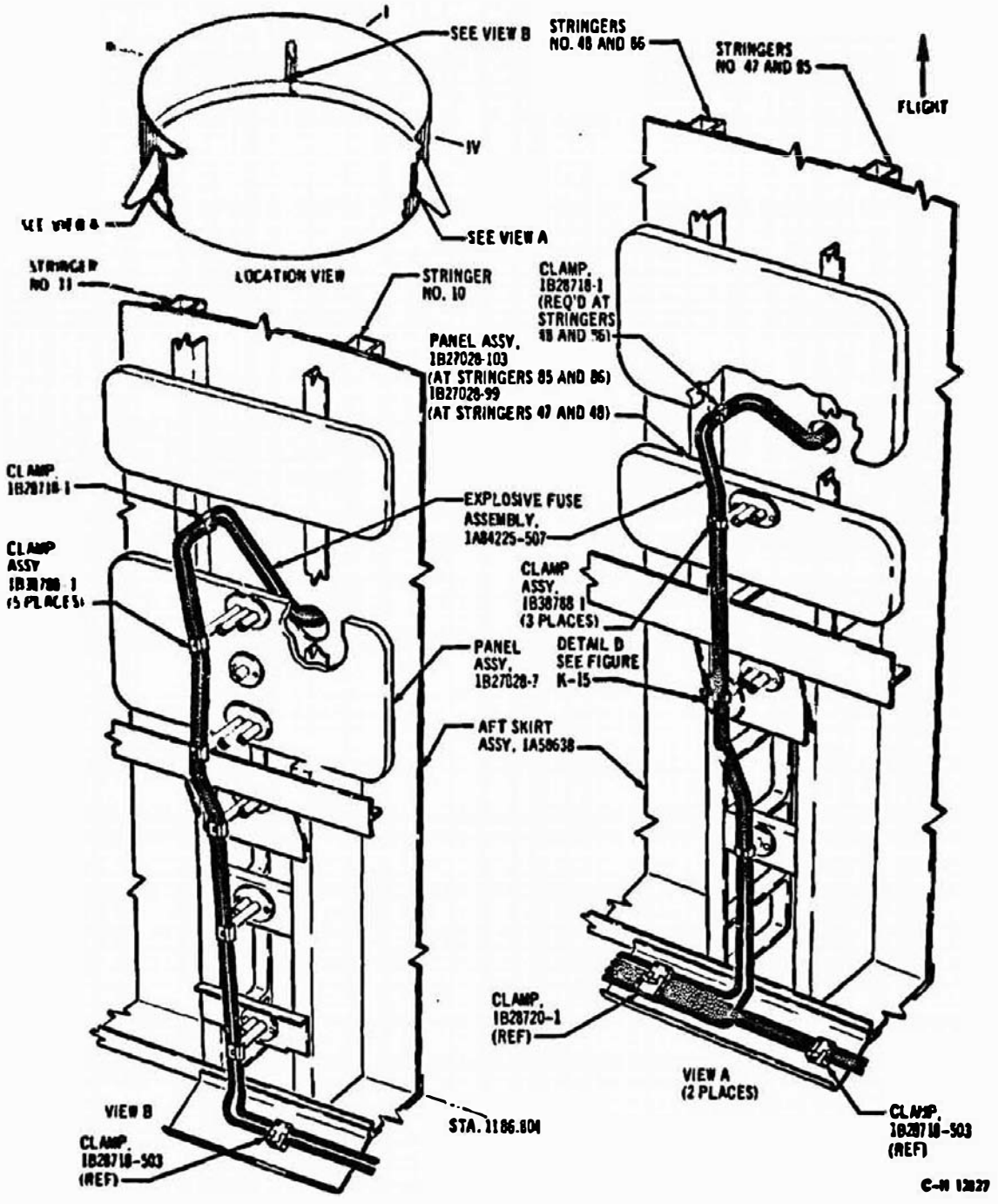


FIGURE K-14 ULLAGE ROCKET JETTISON SYSTEM EXPLOSIVE FUSE ASSEMBLY AND FRANGIBLE NUT - INSTALLATION VIEW (Sheet 2 of 3)

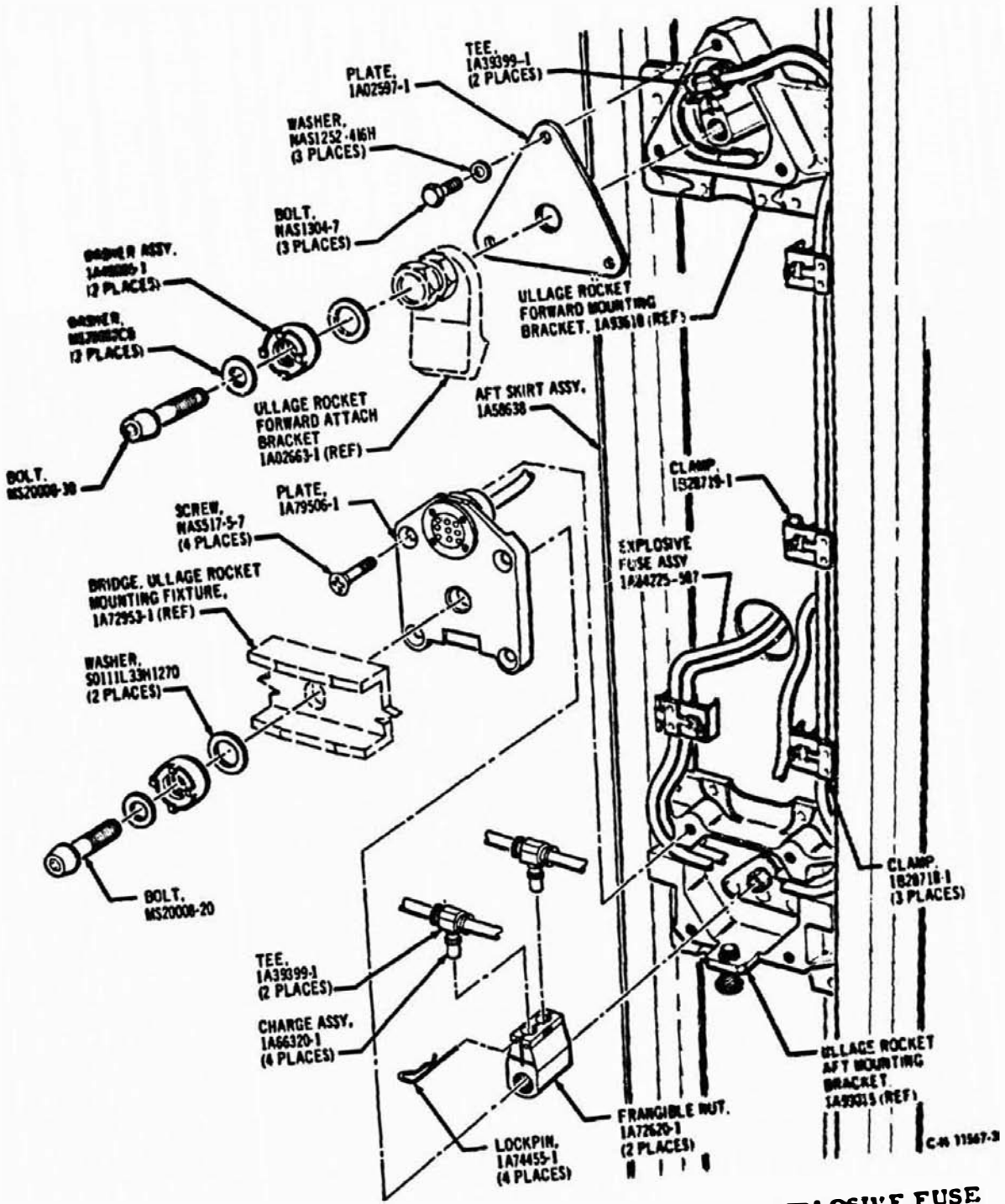


FIGURE K-14 ULLAGE ROCKET JETTISON SYSTEM EXPLOSIVE FUSE ASSEMBLY AND FRANGIBLE NUT - INSTALLATION VIEW (Sheet 3 of 3)

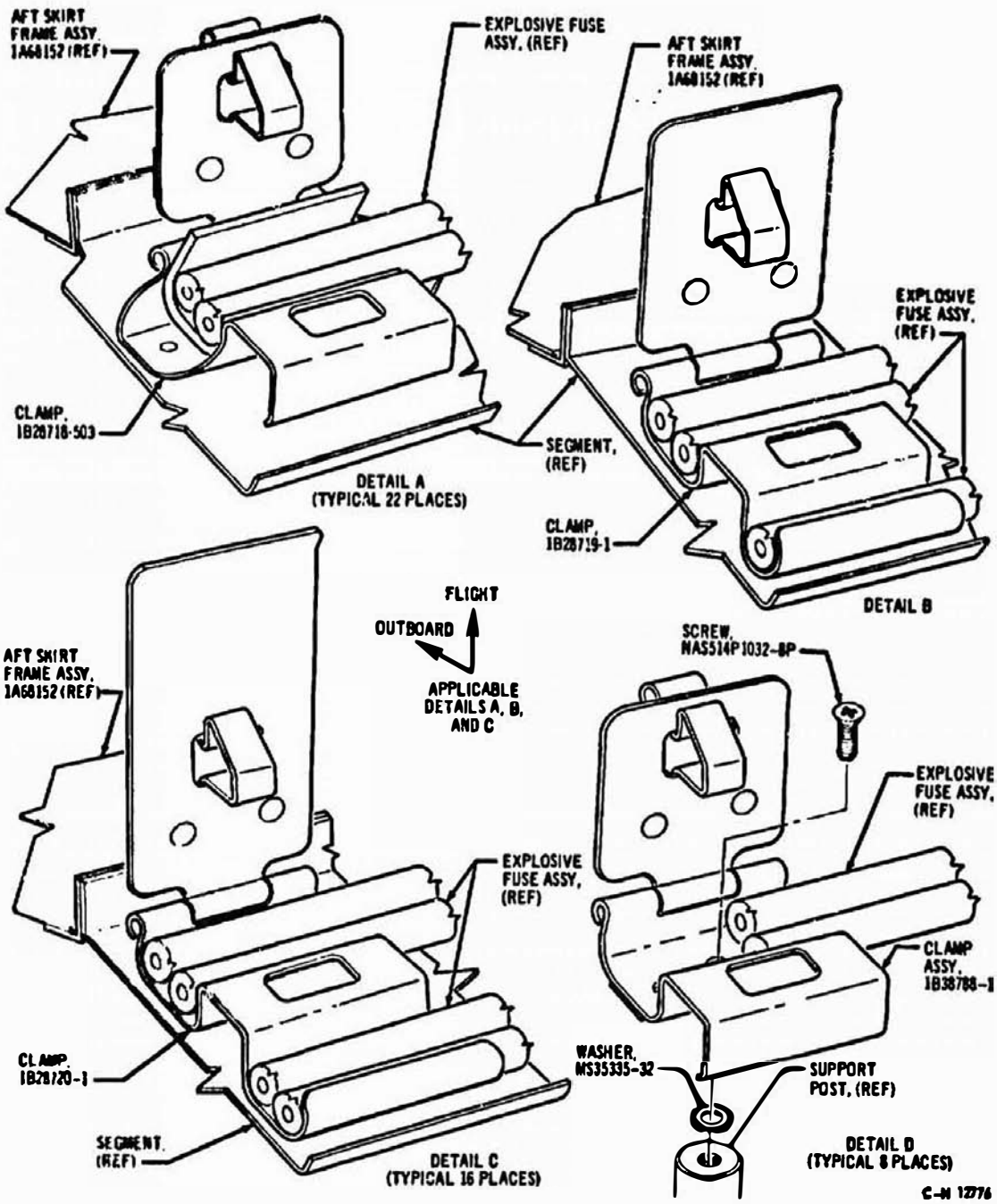


FIGURE K-15 ULLAGE ROCKET JETTISON SYSTEM - ATTACHMENT HARDWARE

L. FLIGHT TERMINATION SYSTEM

The flight termination system permits the range safety officer at AMR to destroy the vehicle if it becomes a safety hazard during the powered phase of flight. A secure range safety command system and a propellant dispersion system (PDS) comprise the flight termination system. The secure range safety command system consists of electrical and electronic equipment that receives, amplifies, and decodes command signals transmitted from ground stations. The PDS ordnance components, detonated by electrical signals from the secure range safety command system, sever the side of the LH_2 container and the bottom of the LOX container aft dome, permitting the propellant to disperse and burn.

Section III

FLIGHT TERMINATION SYSTEM INFORMATION ILLUSTRATIONS

FLIGHT TERMINATION SYSTEM CALLOUT LIST

FIND NO.	COMPONENT	PART NO.	PAGE
K750	Antenna (2 places)	1A69207-1	L-6
K751	Power Divider, Radio Frequency, Range Safety	1A74778-501	L-8
K752	Power Divider, Directional, Checkout Module, Range Safety	1B38999-1	L-9
K753	Digital Command Receiver -503, Range Safety (2 places)	50M10697	L-10
K754	Decoder, Range Safety (2 places)	50M10698	L-11
K755	Controller Assembly, Range Safety (2 places)	1B33084-1	L-12
K756	Firing Unit, Exploding Bridgewire (2 places)	40M39515-107	K-5
K757	Fuse Assembly, Aft Dome Propellant Dispersion System	1A92993-1	L-20
K758	Shaped Charge Assembly, LOX Tank, Propellant Dispersion System		L-23
	K758-1	1A93709-2	
	K758-2	1A93710-1	
	K758-3	1A93709-1	
K759	Fuse Assembly, Shroud, Propellant Dispersion System	1A93803-1	L-25

FLIGHT TERMINATION SYSTEM CALLOUT LIST (CONT.)

FIND NO.	COMPONENT	PART NO.	PAGE
K760	Shaped Charge Assembly, LH_2 Tank, Propellant Dispersion System		L-18
	K760-1 (2 places)	1A93712-501	
	K760-2 (4 places)	1A93712-1	
	K760-3 (2 places)	1A93713-1	
K761	Fuse Assembly, Forward Skirt, Propellant Dispersion System	1A92992-1	L-16
K762	Safety and Arming Device	1A02446-1	L-13
K763	Detonator, Electric-Exploding Bridgewire Type (2 places)	7865742-1	K-7

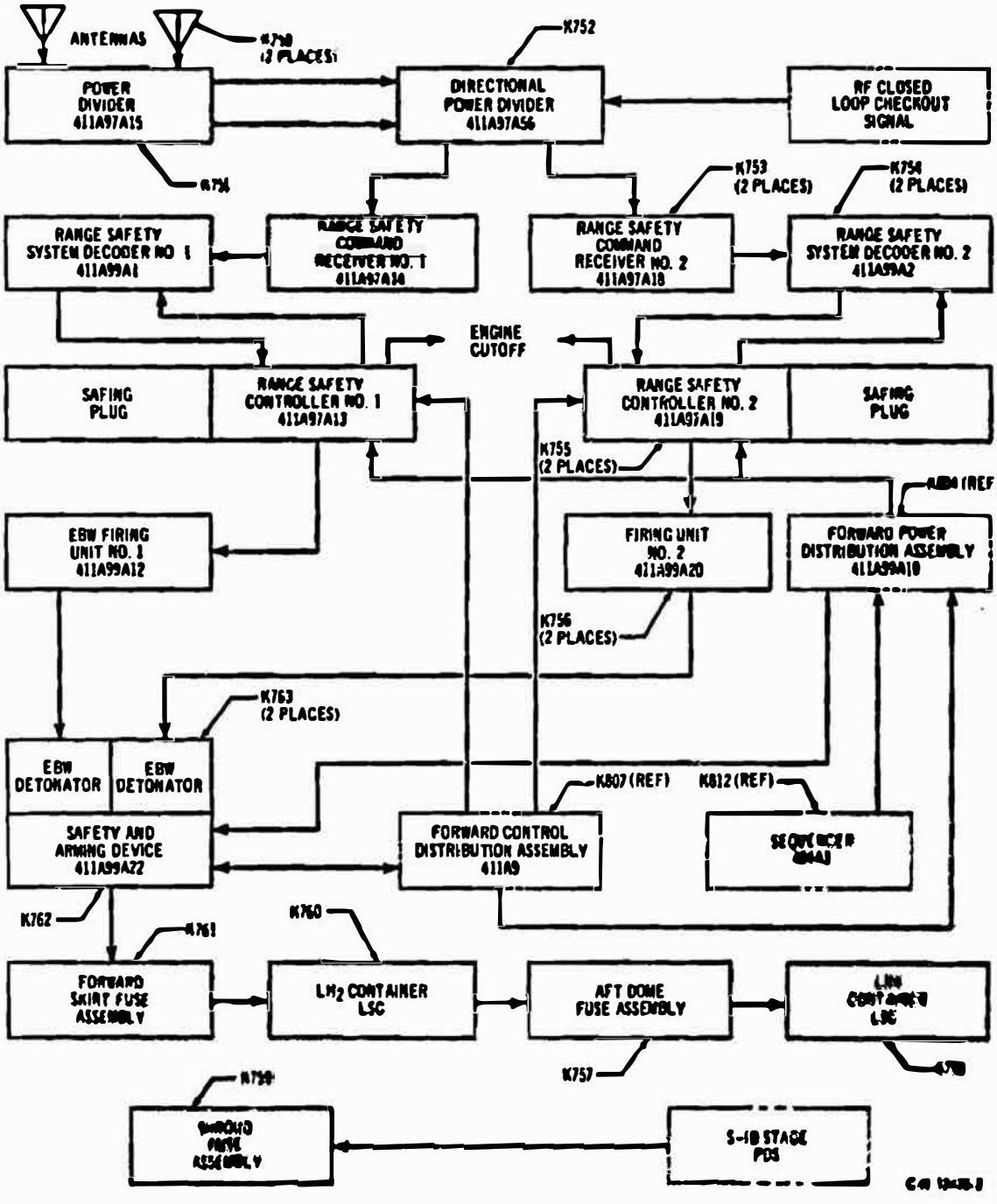


FIGURE L-1 FLIGHT TERMINATION SYSTEM - BLOCK DIAGRAM

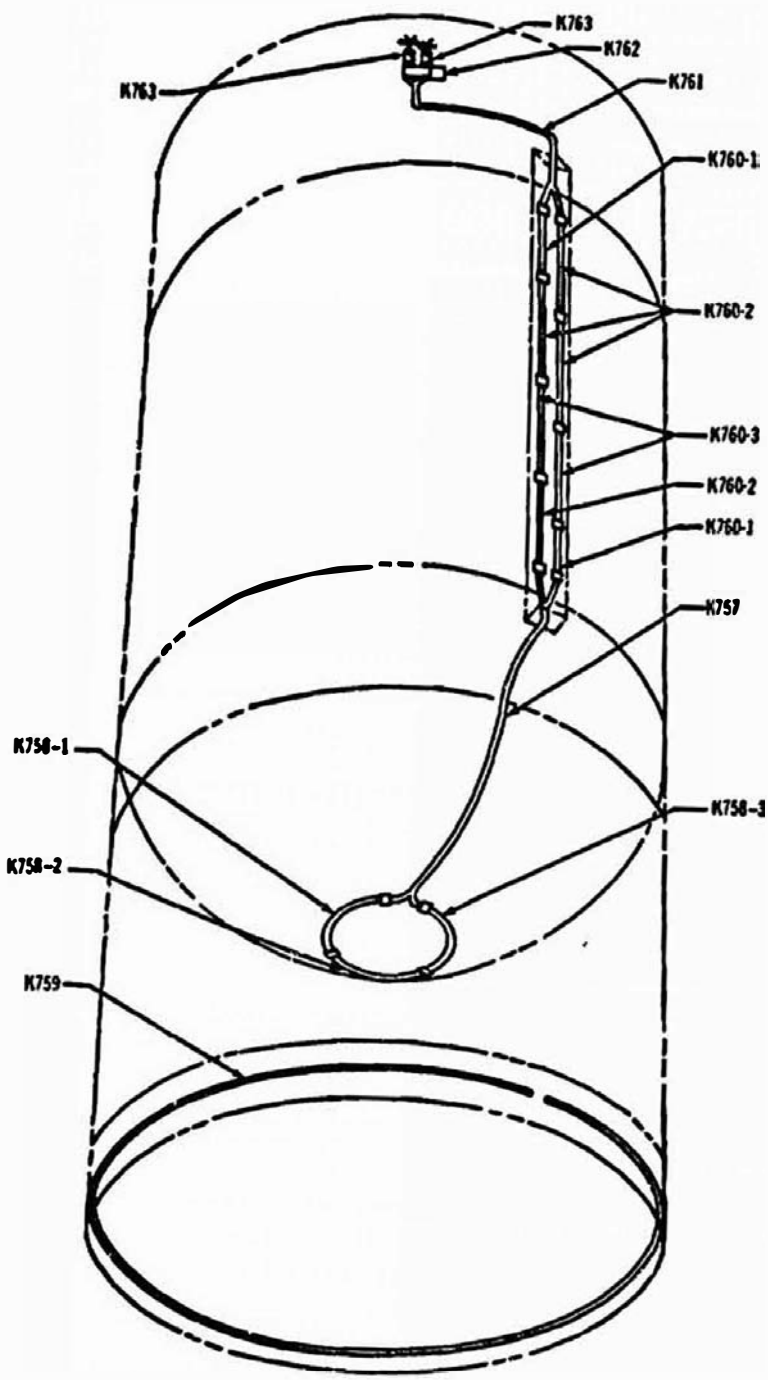


FIGURE L-2 PROPELLANT DISPERSION SYSTEM - SIMPLIFIED SCHEMATIC

Section III

ANTENNA, PART NO. 1A69207-1

Two antennas (K750), mounted π rad. (180 deg) apart on the forward skirt assembly, couple the range safety input signals to the hybrid power divider. The antenna assembly is a folded-sleeve unit. The antenna cover is of epoxy-glass laminate and foam construction.

1. VENDOR: Douglas Aircraft Company, Inc. (part no. 1A69207-1)
2. LOCATION: Station 1627.08. One antenna at 0.84 rad. (48.33 deg) from position I toward position II; the other at 0.84 rad. (48.33 deg) from position III toward position IV. See fig. L-3.
3. SERVICE: Electrical
4. CHARACTERISTICS:
   a. Type: Folded sleeve
   b. Dimensions: 34.45 x 17.14 x 4.68 cm (13 9/16 x 6 3/4 x 1 27/32 in.)
   c. Weight: 13 N (3 lb_f)
   d. Connector type: TNC
5. ELECTRICAL CHARACTERISTICS:
   a. Frequency range: 440 to 460 MHz
   b. Bandwidth: 15 MHz for 1.5:1 VSWR
   c. Polarization: Linear
   d. Gain: Unity
6. REMARKS: This page reflects information on the following drawings:
   a. DAC 1A69207 rev C
   b. MSFC 60C09058

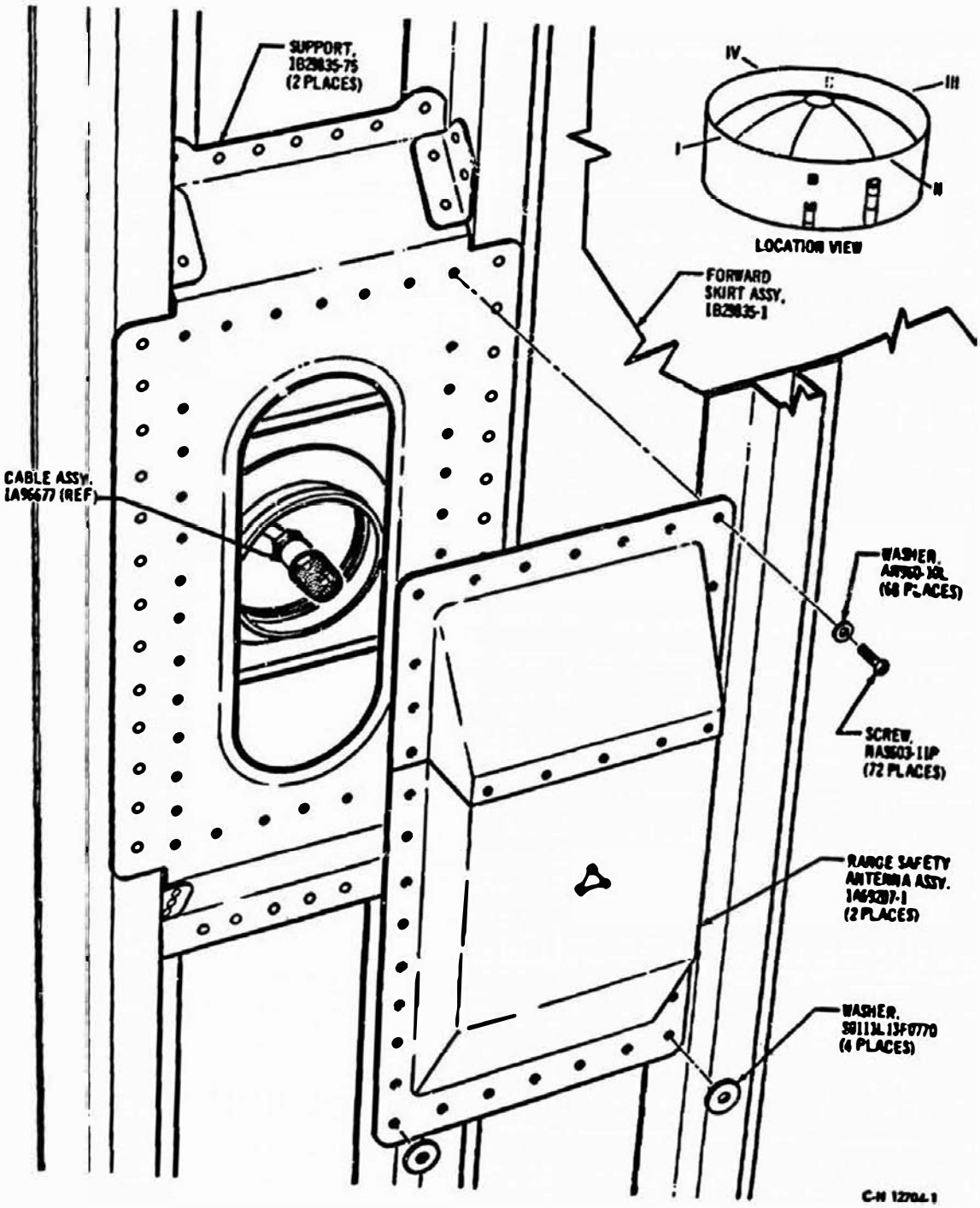


FIGURE L-3 SECURE RANGE SAFETY ANTENNAS - INSTALLATION VIEW

April 1, 1966

Section III

HYBRID POWER DIVIDER, PART NO. 1A74778-501

The hybrid power divider (K751) couples the range safety antennas to the receiver assemblies, providing input signals of equal strength to each receiver from each antenna.

1. VENDOR: Douglas Aircraft Company, Inc. (part no. 1A74778-501)
2. LOCATION: Mounted in the forward skirt section at panel position no. 14. See fig. L-4.
3. SERVICE: Electrical
4. REMARKS: This page reflects information on the following DAC drawings:
   a. 1A74778 rev C, AEO's D and E
   b. 1B56223 new, AEO's A and B

DIRECTIONAL POWER DIVIDER, PART NO. 1B38999-1

The directional power divider (K752), functionally installed between the hybrid power divider and the receiver assemblies, permits preflight checkout of the flight termination system electronic components through hardwire umbilical connections.

1. VENDOR: Douglas Aircraft Company, Inc. (part no. 1B38999-1)
2. LOCATION: Mounted in the forward skirt section of panel position no. 14. See fig. L-4, sheet 1.
3. SERVICE: Electrical
4. REMARKS: This page reflects information on the following DAC drawings:
   a. 1B38999 rev B
   b. 1B56223 new, AEO's A and B

Section III

RANGE SAFETY COMMAND RECEIVER, PART NO. 50M10697

The receiver (K753) demodulates and amplifies command signals from Range Safety, and provides two isolated audio output signals plus an output signal for telemetry purposes. The receiver consists of a preselector, first and second IF amplifiers, a limiter-discriminator, an audio amplifier, an output amplifier for the two isolated outputs, and a control amplifier for the telemeter output.

1. VENDOR: GFE (part no. 50M10697)
2. LOCATION: Mounted in the forward skirt assembly at panel position no. 14. See fig. L-4, sheet 1.
3. SERVICE: Electrical
4. TEMPERATURE (operating): -54 to +85°C (-65 to +185°F)
5. ELECTRICAL CHARACTERISTICS:
   a. Input voltage: 22 Vdc to 36 Vdc
   b. Frequency range: 406 MHz to 450 MHz
   c. Maximum RF input: 2.0 Vrms
   d. Audio output level: 1.4 Vrms into 75Ω (with two tones, ± 30 kHz deviation per tone)
   e. Power: 3.5 W at 28 Vdc
6. REMARKS: This page reflects information on the following drawings:
   a. MSFC 5010697 new
   b. NASA TM-53162
   c. DAC 1B56223 new, AEO's A and B

RANGE SAFETY SYSTEM DECODER, PART NO. 50M10698

The decoder (K754) discriminates between properly and improperly coded commands transmitted to the secure range safety command system. Audio input signals to the decoder must have the same format as that required by a quick-disconnect code plug attached to the decoder. The decoder can accept 21 signal characters of which only 9 are used to command a decoder output. Each signal character consists of 2 simultaneously transmitted tones selected from seven basic tones. The remaining 12 signal characters are used in the decoder to determine proper coding and sequencing of the 9 signal characters. The decoder produces an output on receipt of a proper address word consisting of 9 signal characters and a function word consisting of 2 signal characters. The function word determines which of the decoder outputs is actuated.

1. VENDOR: GFE (part no. 50M10698)
2. LOCATION: Mounted in the forward skirt assembly at panel position no. 16. See fig. L-4, sheet 2.
3. SERVICE: Electrical
4. TEMPERATURE (operating): -54 to +85°C (-65 to +185°F)
5. ELECTRICAL CHARACTERISTICS:
   a. Input voltage: 24 Vdc to 38 Vdc
   b. Power:
      (1) Quiescent: 2.5 W
      (2) Operating: 3 W
   c. Type of input: Audio (75Ω)
   d. Audio input level: 1 Vrms per tone (1.4 Vrms per tone pair)
   e. Type of output: Switched 28 Vdc, rated at 2 A (resistive) each output
   f. Output duration: Approximately 25 ms
6. REMARKS: This page reflects information on the following drawings:
   a. DAC 1B56223 new, AEO's A and B
   b. MSFC 50M10698 new
   c. NASA TM 53162

RANGE SAFETY CONTROLLER ASSEMBLY, PART NO. 1B33084-1

The range safety controller assembly (K755) consists of a mounting plate, part no. 1B33084-3 and an EBW destruct system controller assembly, part no. 40M32016-1. Only the information pertaining to the latter is presented. The controller assembly contains relays that control power to the digital decoder and EBW firing unit, and control signals to the sequencer assembly for engine cutoff and to the EBW firing unit charge and trigger circuits. After the S-IVB stage no longer presents hazardous conditions to ground personnel, the controller enables flight termination system 'off' circuitry. Through circuitry of the safing plug attached to the controller assembly, a 'safe' command from the decoder actuates the internal-external power relay to the external position which removes power from the decoder and the EBW firing unit. A resistor module in the controller assembly provides outputs for prelaunch monitoring and telemetry.

1. VENDOR: GFE (part no. 40M32016-1)
2. LOCATION: Mounted in the forward skirt assembly at panel position no. 14. See fig. L-4, sheet 1.
3. SERVICE: Electrical
4. TEMPERATURE (operating): -54 to +93°C (-65 to +200°F)
5. ELECTRICAL CHARACTERISTICS:
   a. Input voltage: 28 Vdc
   b. Type of output: 28 Vdc (relay controlled)
6. REMARKS: This page reflects information on the following drawings:
   a. DAC 1B33084 rev E
   b. DAC 1B56223 new, AEO's A and B
   c. MSFC 40M32016 rev A

SAFETY AND ARMING DEVICE, PART NO. 1A02446-1

The safety and arming device (K762) is an electromechanical assembly that arms the flight termination system by aligning two explosive leads with the explosive trains of the flight termination system. An arm-command signal originates in the ground support equipment just prior to launch. The device cannot be actuated after launch.

1. VENDOR: Douglas Aircraft Company, Inc. (part no. 1A02446-1)
2. LOCATION: Mounted in the forward skirt section at panel position no. 16 (13 drad [7.5 deg] from position II toward position I). See fig. L-4, sheet 2.
3. SERVICE: Electrical
4. ELECTRICAL CHARACTERISTICS:
   a. Current: 3 A
   b. Voltage: 28 ± 4 Vdc
5. OPERATING TEMPERATURE: -54 to +74°C (-65 to +165°F)
6. HAZARDOUS MATERIALS: Two explosive lead inserts, 0.16 mg (2.5 gr) PETN, part no. 1A00913-1
7. ROTOR ASSEMBLY ROTATION: 2 π rad. (360 deg) π/2 rad. (90 deg) increment from safe to armed
8. REMARKS: This page reflects information on the following DAC drawings:
   a. 1A02446 rev L
   b. Model specification DS-2355

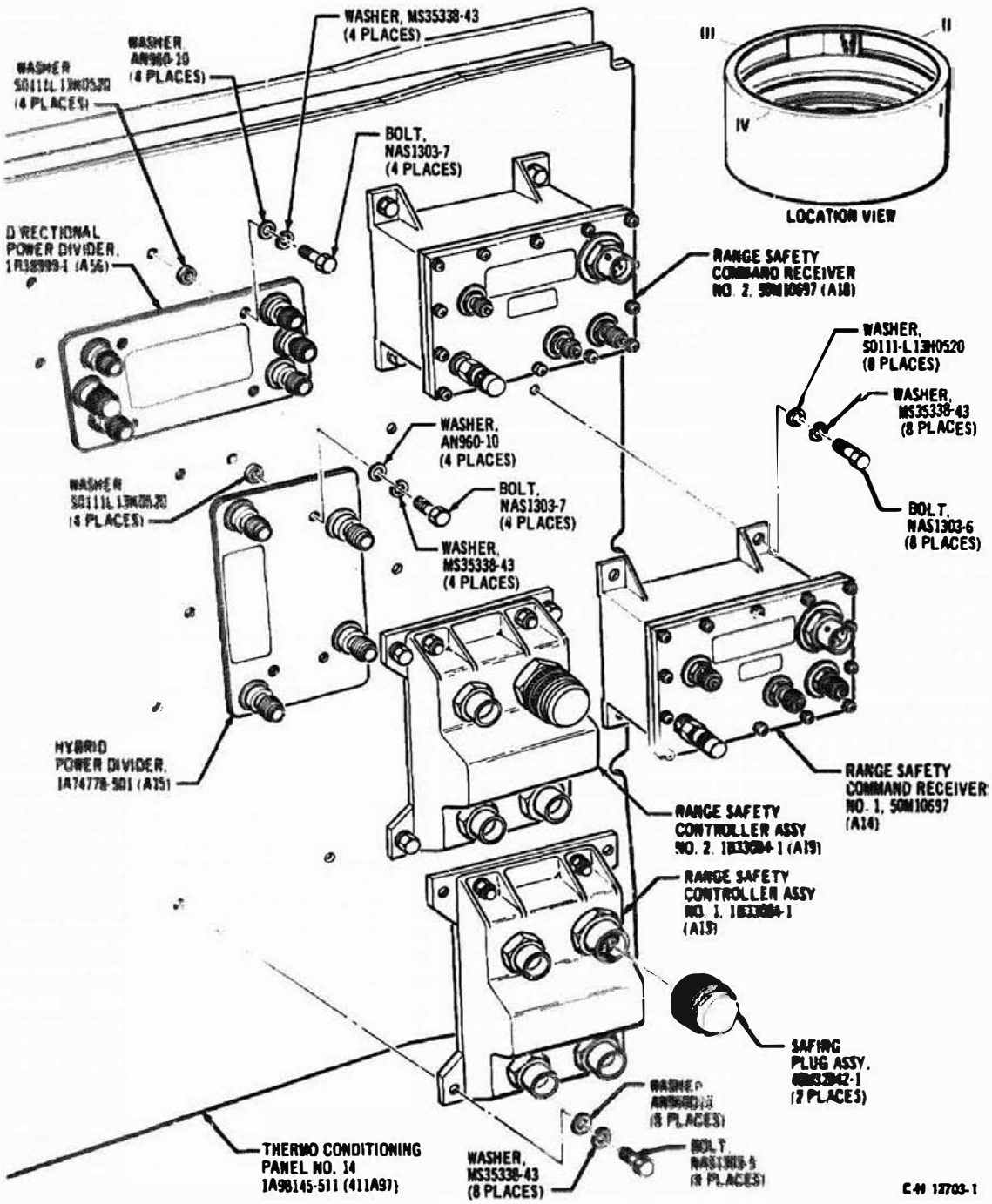


FIGURE L-4 SECURE RANGE SAFETY COMMAND SYSTEM ELECTRICAL COMPONENTS - INSTALLATION VIEW (Sheet 1 of 2)

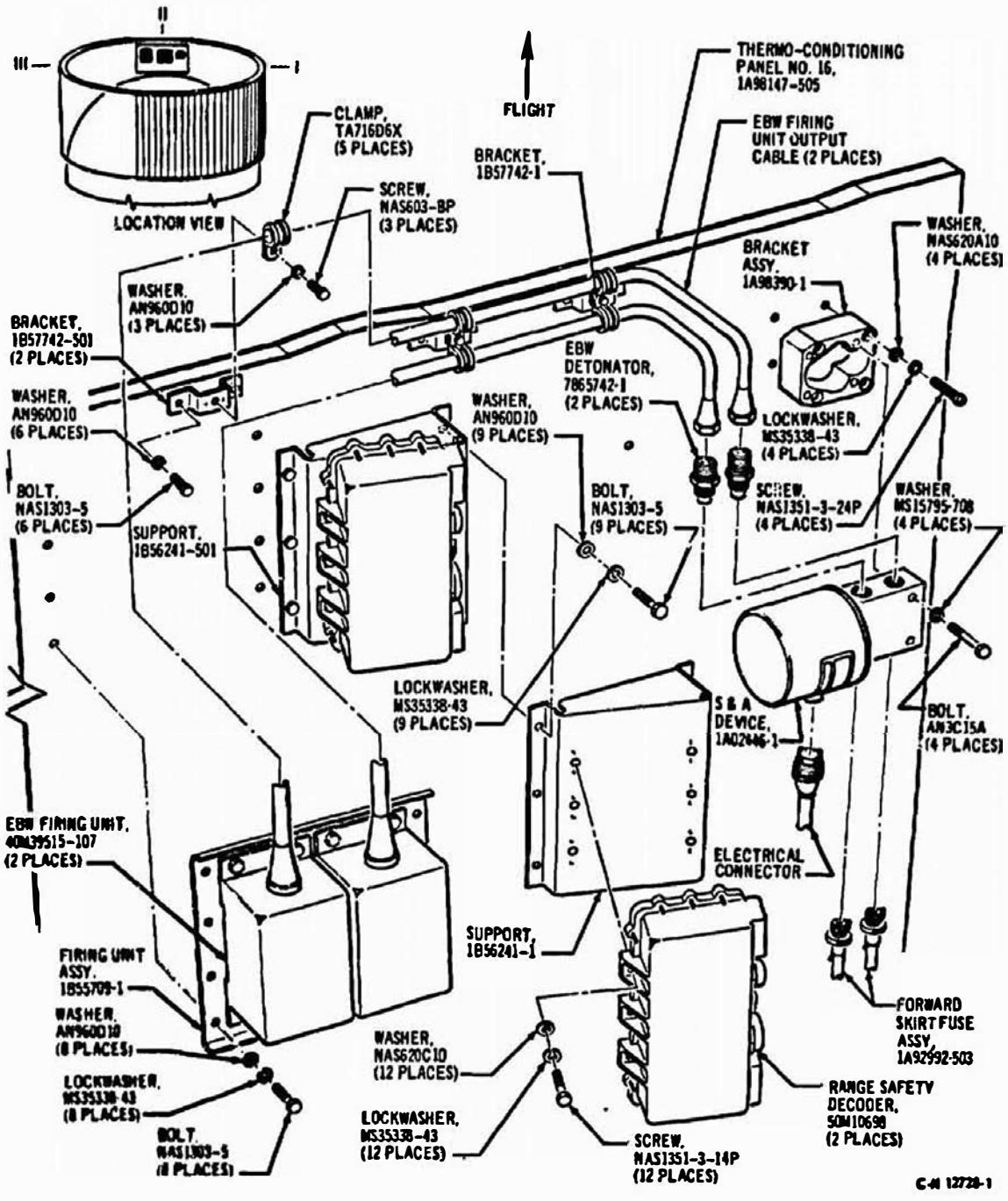


FIGURE L-4 SECURE RANGE SAFETY COMMAND SYSTEM ELECTRICAL COMPONENTS - INSTALLATION VIEW (Sheet 2 of 2)

Section III

FORWARD SKIRT FUSE ASSEMBLY, PART NO. 1A92992-503

The forward skirt fuse assembly (K761) consists of two parallel lengths of 12 mg/m (60 gpf) PETN Primacord with end fittings containing 0.39 mg (6 gr) PETN booster charges. The fuse assembly propagates the detonation from the safety and arming device to the LH_2 container shaped charge.

1. VENDOR: Douglas Aircraft Company, Inc. (part no. 1A92992-503)
2. LOCATION: Installed between the safety and arming device at sta 1654 and the top of LH_2 container LSC at sta 1536. Connects to LSC at approximately 1 drad (6 deg) from position II toward position III. See fig. L-5.
3. SERVICE: Ordnance
4. EXPLOSIVE CORE: PETN, 12 mg/m (60 gpf)
5. BOOSTER CHARGE: PETN, 0.4 mg (6 gr)
6. LENGTH: 394.9 cm (155.5 in)
7. REMARKS: This page reflects information on the following DAC drawings:
   a. 1A92992 rev F
   b. 1A93612 rev C

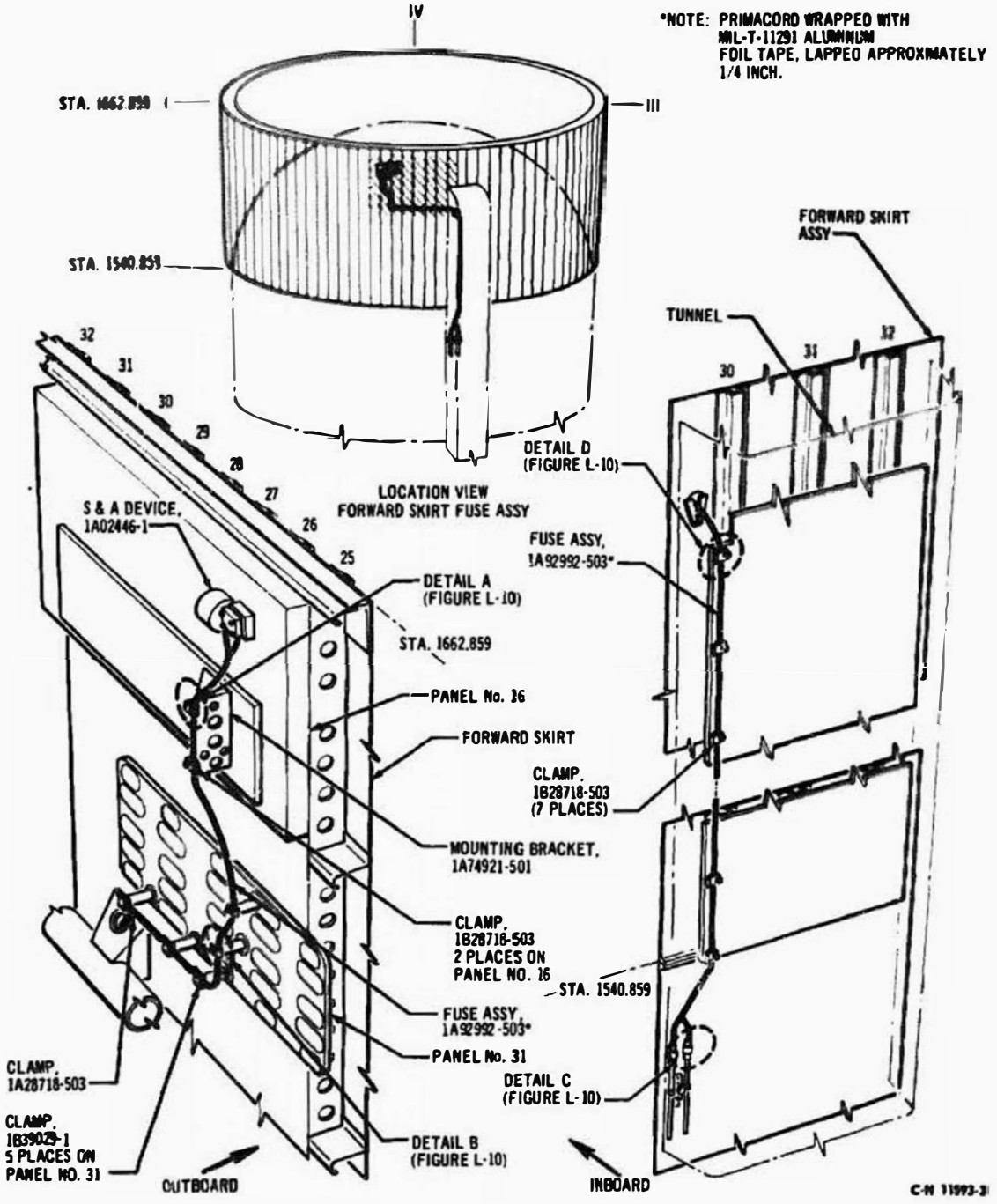


FIGURE L-5 FORWARD SKIRT FUSE ASSEMBLY - INSTALLATION VIEW

Section III

LH_2 CONTAINER LINEAR SHAPED CHARGE ASSEMBLY (LSC). PART NO. (SEE BELOW)

The LH_2 container LSC (K760) severs the cylindrical portion of the LH_2 container skin to allow LH_2 dispersion. The assembly consists of parallel LSC lengths, with each length consisting of four LSC sections connected by end fittings containing PETN booster charges.

1. VENDOR: Douglas Aircraft Company, Inc. (part no. 1A93712-1, 1A93712-501, and 1A92713-1
2. LOCATION: Installed between sta 1536 and sta 1276 on the outside of the LH_2 container approximately 1 drad (6 deg) from position II toward position III. See fig. L-6.
3. SERVICE: Ordnance
4. LSC EXPLOSIVE CORE: Cyclotrimethylene trinitramine (RDX), 32 mg/m (150 gpf)
5. BOOSTER CHARGE: PETN, 0.6 mg (10 gr)
6. REMARKS: This page reflects information on the following DAC drawings:
   a. 1A93712 rev C
   b. 1A93713 rev B
   c. 1A93612 rev C

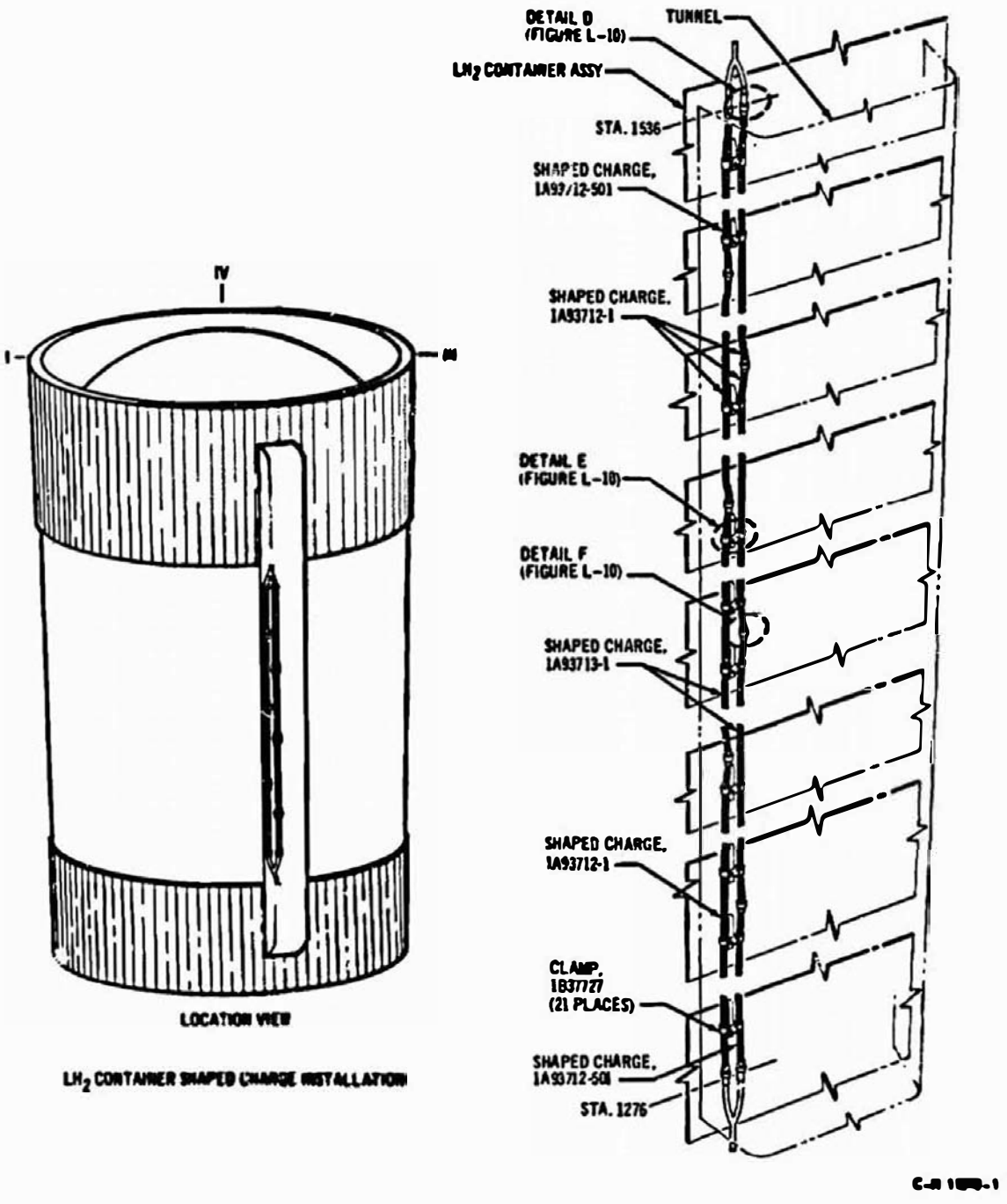
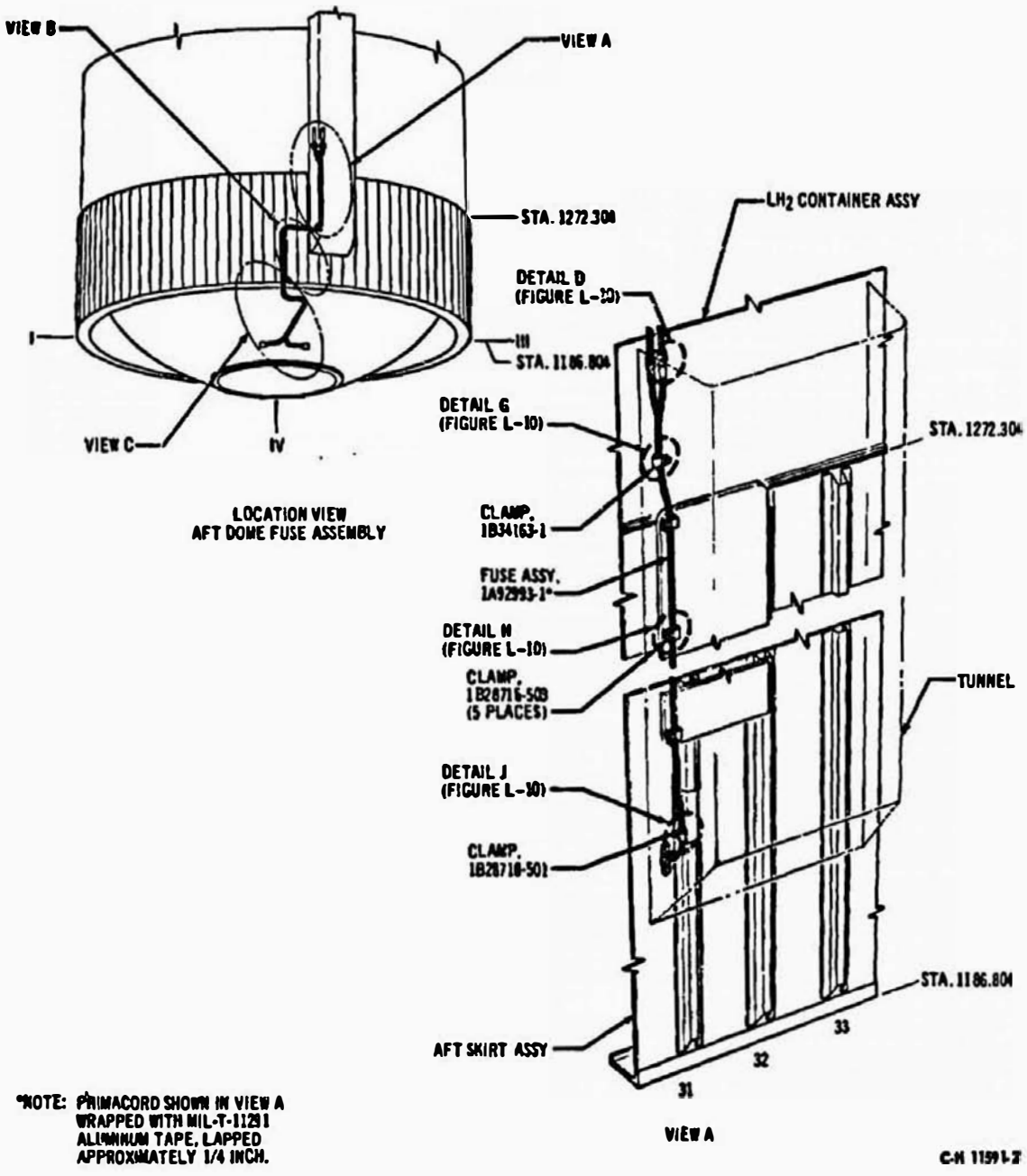


FIGURE L-6 LH_2 CONTAINER SHAPED CHARGE ASSEMBLY - INSTALLATION VIEW

AFT DOME FUSE ASSEMBLY, PART NO. 1A92993-1

The aft dome fuse assembly (K757) consists of two parallel lengths of Primacord with end fittings, connecting the LH_2 and LOX container LSC assemblies. This assembly propagates detonation between the LH_2 and LOX container LSC assemblies in the event of PDS actuation.

1. VENDOR: Douglas Aircraft Company, Inc. (part no. 1A92993-1)
2. LOCATION: Installed between the bottom of the LH_2 LSC at sta 1276 and the LOX LSC at sta 1144; radially, approximately 1 drad (6 deg) from position II toward position III. See fig. L-7.
3. SERVICE: Ordnance
4. EXPLOSIVE CORE: PETN, 12 mg/m (60 gpf)
5. BOOSTER CHARGE: PTETN, 0.4 mg (6 gr)
6. REMARKS: This page reflects information on the following DAC drawings:
   a. 1A92993 rev E
   b. 1A93612 rev C



*NOTE: PRIMACORD SHOWN IN VIEW A WRAPPED WITH MIL-T-11291 ALUMINUM TAPE, LAPPED APPROXIMATELY 1/4 INCH.

FIGURE L-7 AFT DOME FUSE ASSEMBLY - INSTALLATION VIEW (Sheet 1 of 2)

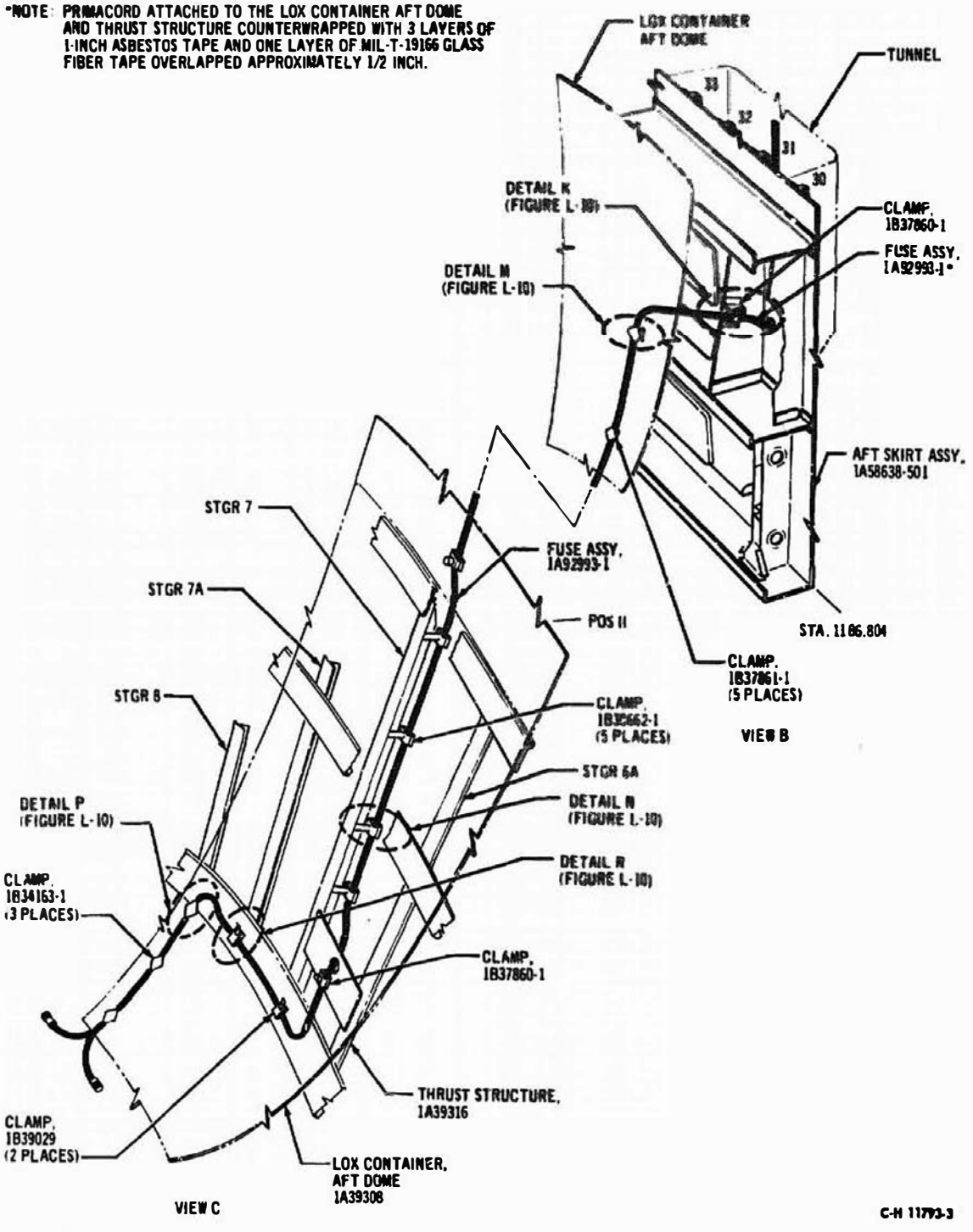


FIGURE L-7 AFT DOME FUSE ASSEMBLY - INSTALLATION VIEW (Sheet 2 of 2)

LOX CONTAINER LINEAR SHAPED CHARGE ASSEMBLY (LSC), PART NO. (SEE BELOW)

The LOX container LSC (K758) severs the base of the LOX container aft dome, directing LOX dispersion away from the LH_2 container. The LOX container LSC assembly consists of three LSC lengths connected by end fittings containing booster charges.

1. VENDOR: Douglas Aircraft Company, Inc. (part nos. 1A93709-1, 1A93709-2, and 1A93710-1)
2. LOCATION: Encircles the base of the LOX container aft dome on a 58 cm (23 in.) radius at sta 1144. See fig. L-8.
3. SERVICE: Ordnance
4. LSC EXPLOSIVE CORE: Cyclotrimethylene trinitramine (RDX), 32 mg/m (150 gpf)
5. BOOSTER CHARGE: PETN, 0.6 mg (10 gr)
6. REMARKS: This page reflects information on the following DAC drawings:
   a. 1A93709 rev A
   b. 1A93710 rev C
   c. 1A93612 rev C

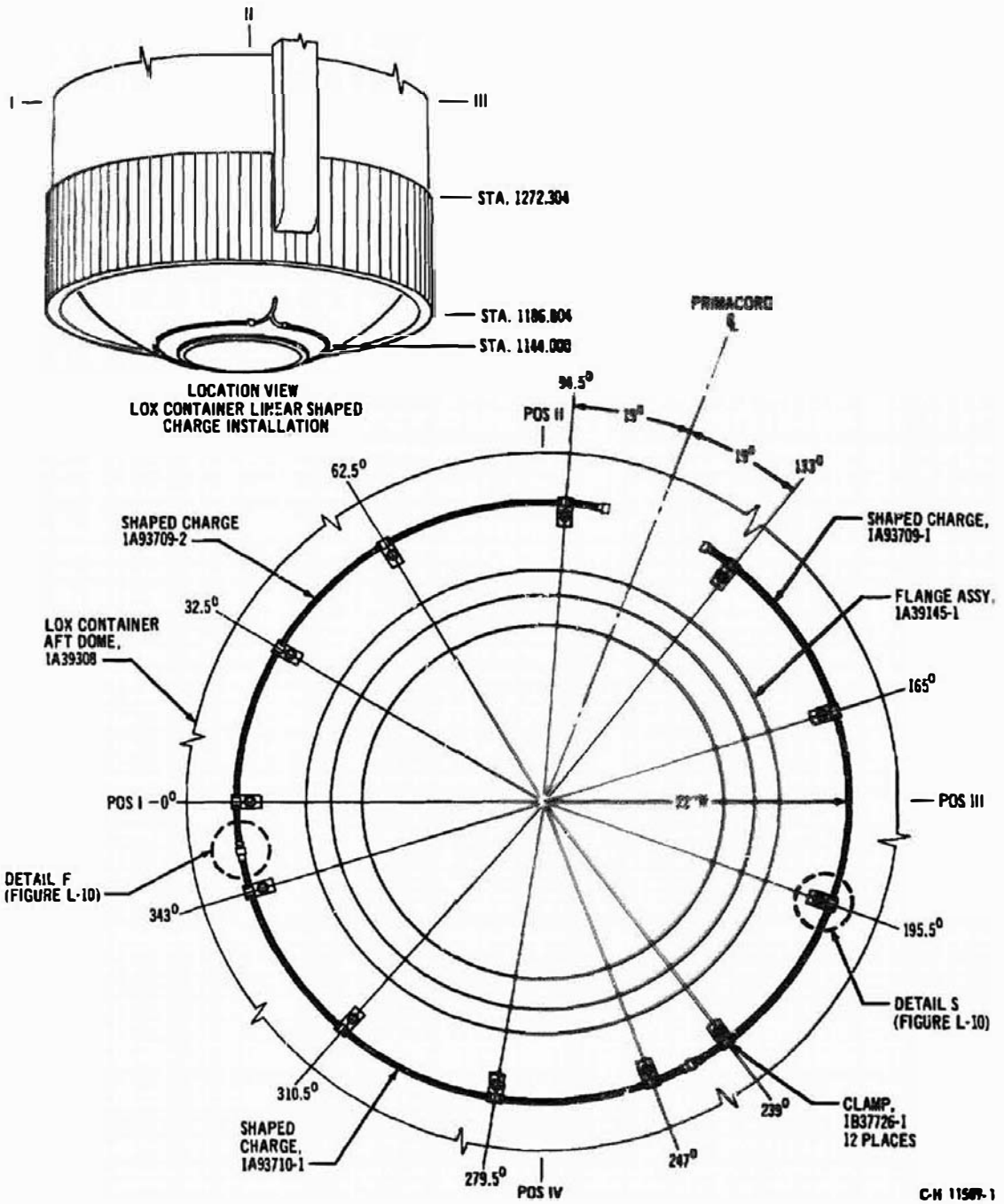


FIGURE L-8 LOX CONTAINER SHAPED CHARGE - INSTALLATION VIEW

SHROUD FUSE ASSEMBLY, PART NO. 1A93803-1

The shroud fuse assembly (Primacord ringline) (K759), installed in the aerodynamic fairing encircles the forward end of the S-IB stage and functions with the S-IB stage PDS. It propagates the detonation from the S-IB stange S&A device through Primacord splices to each propellant container FLSC assembly. Tape secures the FLSC Primacord leads to the ringline at each splice location. Quick-release clamps attach the shroud fuse assembly to the aerodynamic fairing.

1. VENDOR: Douglas Aircraft Company, Inc. (part no. 1A93803-1)
2. LOCATION: Installed on the inner periphery of the aerodynamic fairing at sta 942.240. See fig. L-9.
3. SERVICE: Ordnance
4. EXPLOSIVE CORE: PETN, 12 mg/m (60 gpf)
5. LENGTH: 2,151 cm (826 in.)
6. REMARKS: This page reflects information on the following DAC drawings:
   a. 1A93803 rev A
   b. 1A93612 rev C

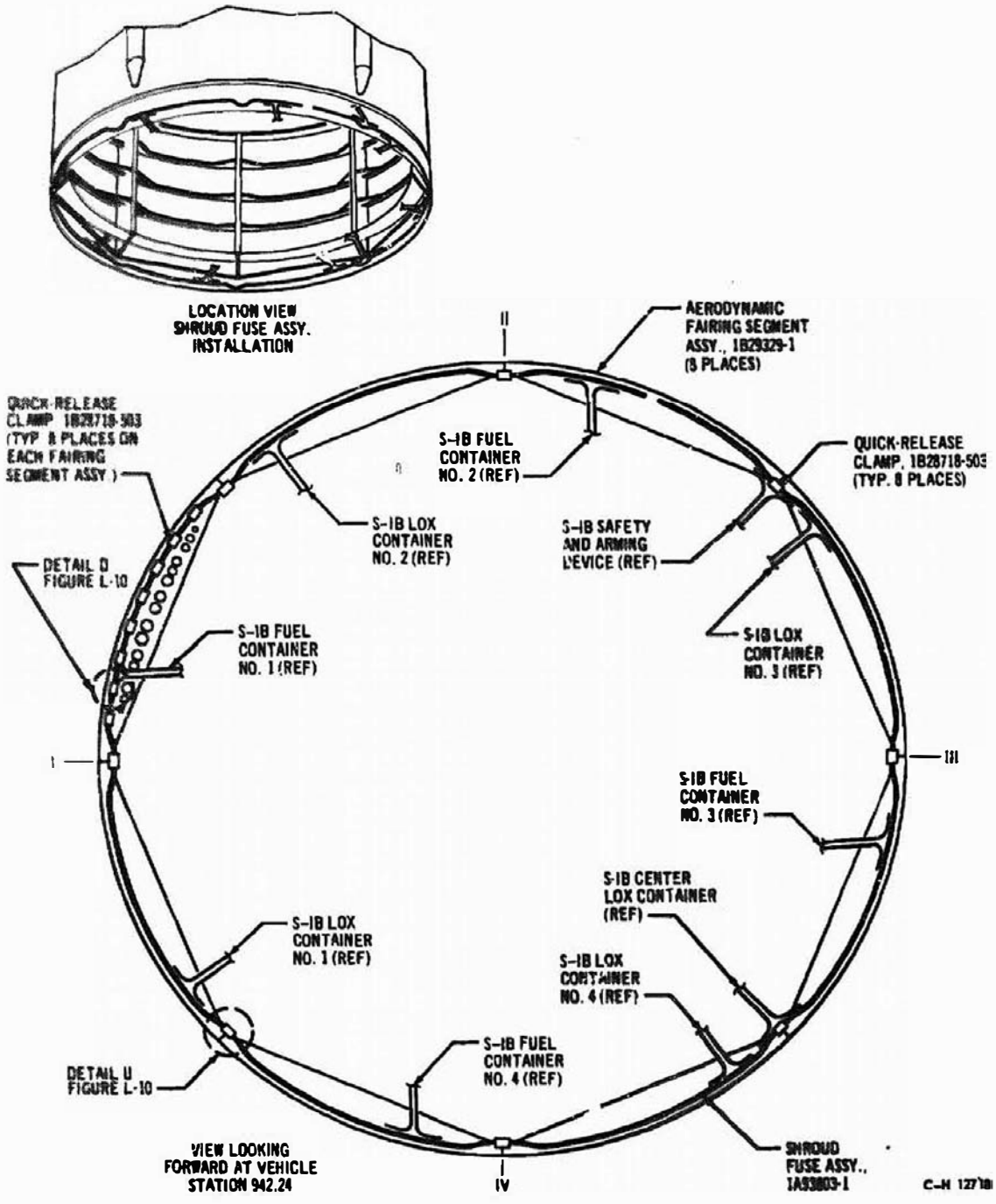


FIGURE L-9 SHROUD FUSE ASSEMBLY - INSTALLATION VIEW

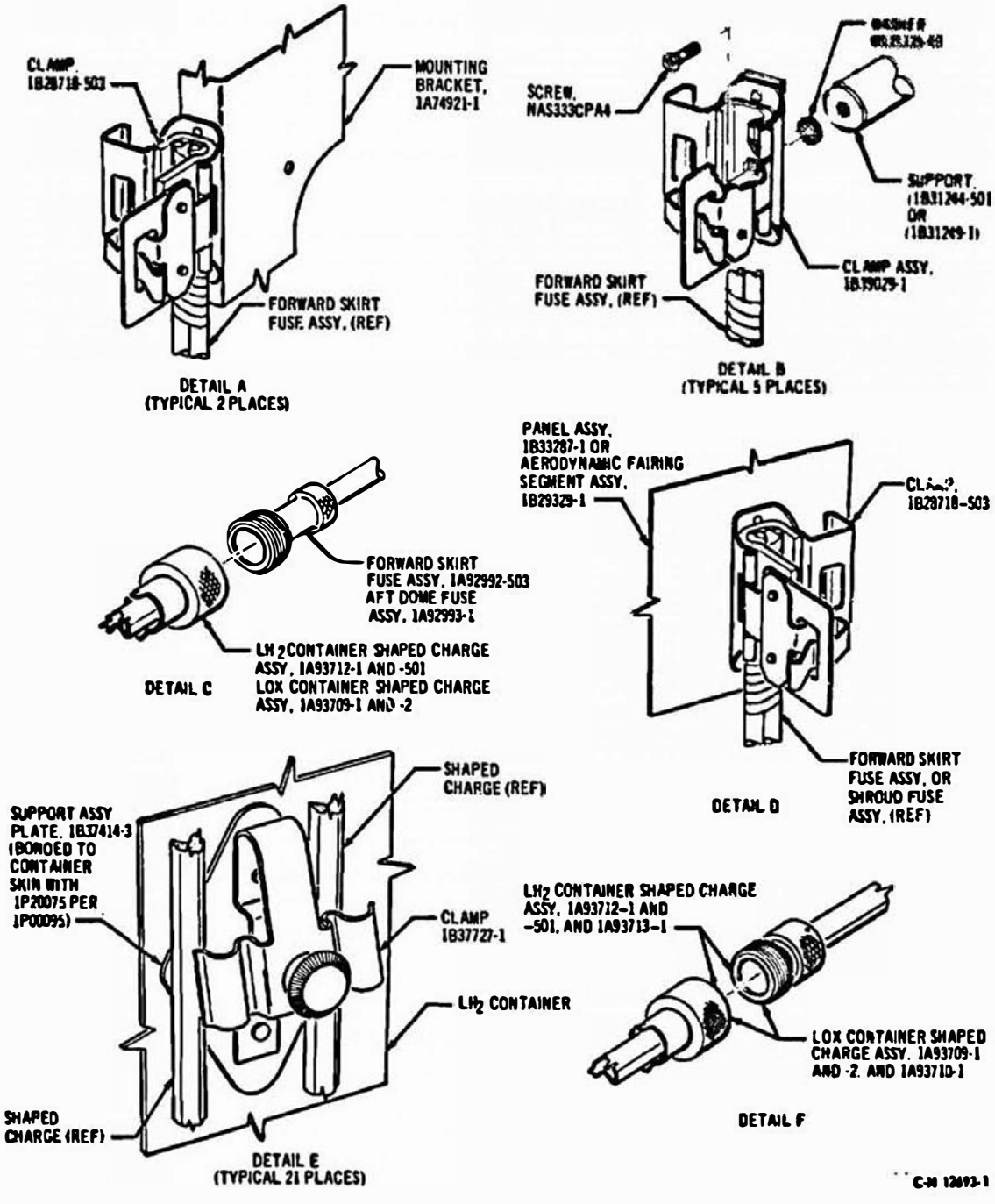


FIGURE L-10 PROPELLANT DISPERSION SYSTEM - ATTACHMENT HARDWARE (Sheet 1 of 3)

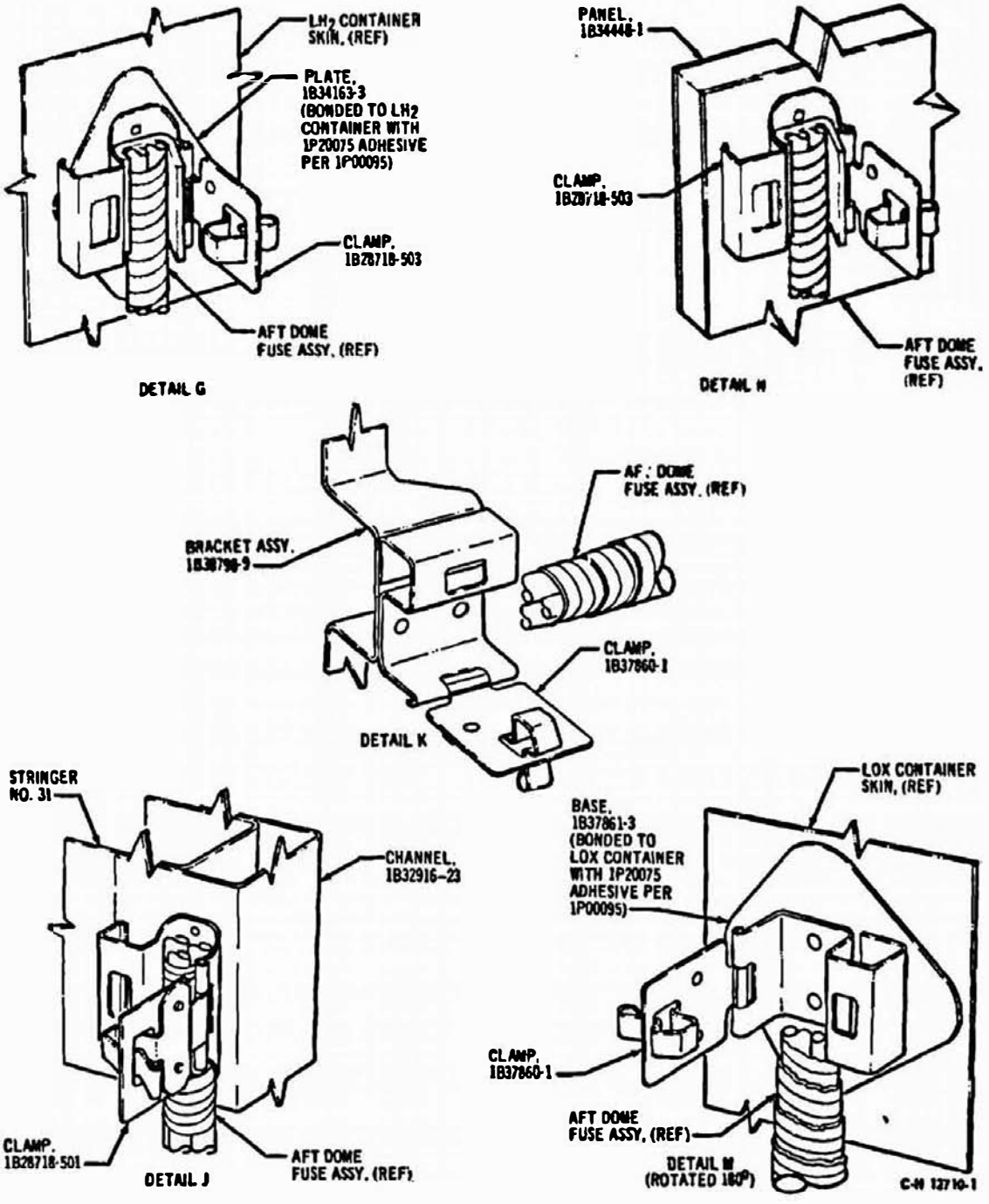


FIGURE L-10 PROPELLANT DISPERSION SYSTEM - ATTACHMENT HARDWARE (Sheet 2 of 3)

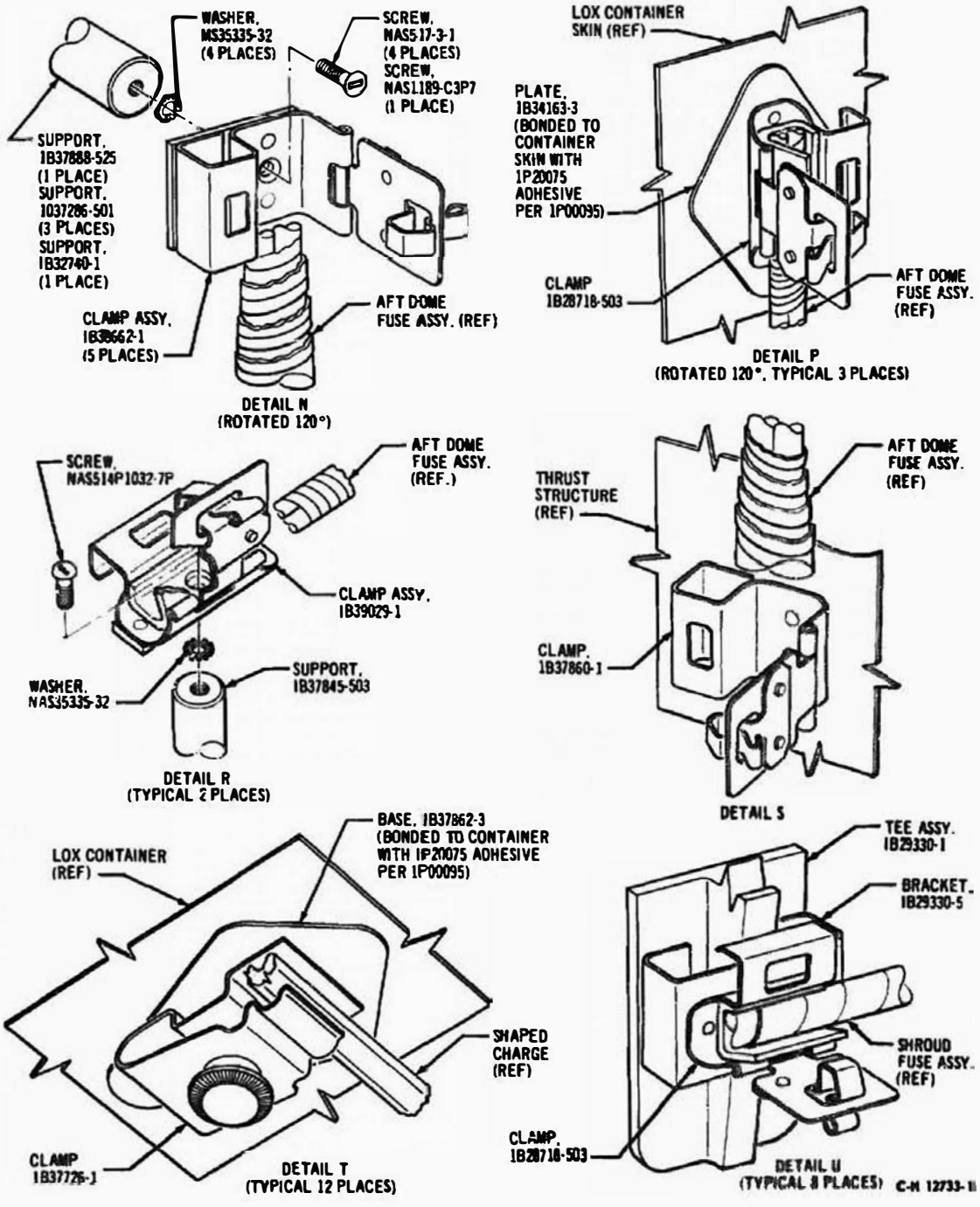


FIGURE L-10 PROPELLANT DISPERSION SYSTEM - ATTACHMENT HARDWARE (Sheet 3 of 3)

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M. ELECTRICAL POWER AND SEQUENCING

Five batteries, three located in the forward skirt and two in the aft skirt, provide primary electrical power during flight. Power distribution assemblies distribute battery power to onboard equipment, and distribute ground power during prelaunch checkout. (See figures M-1 and M-2.)

Forward battery no. 1 (packaged as two separate units) supplies 28 Vdc for the switch selector, telemetry assemblies, range safety receiver no. 1, and dc-to-dc converter. Forward battery no. 2 supplies 28 Vdc for the inverter-converter assembly, both 5-volt excitation modules, PU electronics assembly, range safety receiver no. 2. Forward battery no. 3 supplies 28 Vdc to TV camera lights and heaters.

Aft battery no. 1 supplies 28 Vdc for the sequencer assembly, J-2 engine, pressurization system, auxiliary propulsion system (APS), and ullage rocket system firing units. Aft battery no. 2 supplies 56 Vdc for the LOX and fuel chilldown assemblies and auxiliary hydraulic pump motor.

Equipment with power level requirements other than 28 Vdc and 56 Vdc has its own dc-to-dc converters and/or dc-to-ac inverters. These secondary power sources include: two excitation modules supplying isolated 5-Vdc and minus 20-Vdc for operation of various flight measurement devices; the inverter-converter assembly supplying the PU electronics assembly with 115 Vac, 117 Vdc, 44.2 Vdc, 21 Vdc and 2.5 Vpp square wave for various propellant utilization functions; the LOX and fuel inverters supplying 56 Vac for their respective chilldown pump motors; and, the dc-to-dc converter supplying regulated 28 Vdc to operate the single sideband isolation amplifier and telemeter assembly.

A stored program in the guidance computer controls inflight power sequencing, with the switch selector providing the IU/S-IVB communications link. The sequencer assembly receives switch selector commands, and relays decoder signals to the control distribution assemblies and the power distribution assemblies. (See figure M-3.)

Section III

ELECTRICAL POWER AND SEQUENCING INFORMATION ILLUSTRATIONS

ELECTRICAL POWER AND SEQUENCING CALLOUT LIST

FIND NO.	COMPONENT	PART NO.	PAGE
K800	Battery, Fwd No. 1	1B59741-1	M-8
K801	Battery, Fwd No. 2	1A83469-1	M-9
K802	Battery, Aft No. 1	1A83468-501	M-10
K803	Battery, Aft No. 2	1A83471-1	M-11
K804	Mounting Assembly, Fwd Power Distribution, 28 Vdc	1B51379-1	
K804-1	Switch, Power Transfer, 300A	1A68085-505	M-13
K804-2	Module, Relay, 50A	1A74890-501	M-23
K804-3	Module, Relay, 50A	1A74890-501	M-23
K804-4	Module, Relay, Magnetic Latching	1B40887-501	M-21
K804-5	Module, Relay, Magnetic Latching	1B40887-501	M-21
K804-6	Module, Relay, Magnetic Latching	1A74216-503	M-24
K804-10	Module, Relay, 10A	1A74218-503	M-22
K804-11	Module, Relay, 2A	1A74211-503	M-20
K804-12	Module, Relay, 2A	1A74211-503	M-20
K804-20	Module, Electrical Distribution	1A97868-507	
K804-21	Module, Electrical Distribution	1A97868-501	
K804-22	Module, Electrical Distribution	1A97868-503	
K804-23	Module, Electrical Distribution	1A97868-503	
K804-24	Module, Electrical Distribution	1A97868-1	
K804-25	Module, Electrical Distribution	1A97868-507	
K804-30	Module, Resistor	1B43810-1	M-19
K804-35	Module, Resistor	1B40464-1	M-18
K805	Mounting Assembly, Aft Power Distribution, 28 Vdc	1B51354-1	
K805-1	Switch, Power Transfer, 300A	1A68085-505	M-13
K805-2	Module, Relay, 10A	1A74218-503	M-22
K805-6	Module, Relay, 2A	1A74211-503	M-20
K805-7	Module, Relay, 50A	1A74890-501	M-23
K805-8	Module, Relay, 2A	1A74211-503	M-20
K805-9	Module, Relay, 50A	1A74890-501	M-23
K805-10	Module, Relay, 50A	1A74890-501	M-23
K805-17	Module, Diode	1B39975-1	M-16
K805-18	Module, Resistor	1B40464-1	M-18

ELECTRICAL POWER AND SEQUENCING CALLOUT LIST (CONT.)

FIND NO.	COMPONENT	PART NO.	PAGE
K805-19	Module, Bus	1B40619-1	
K805-21	Module, Electrical Distribution	1A97868-501	
K805-24	Module, Electrical Distribution	1A97868-503	
K805-25	Module, Electrical Distribution	1A97868-507	
K805-27	Module, Electrical Distribution	1A97868-1	
K805-28	Module, Electrical Distribution	1A97868-501	
K805-29	Module, Electrical Distribution	1A97868-1	
K805-30	Module, Resistor	1B43810-1	M-19
K805-31	Module, Resistor	1B43810-1	M-19
K805-32	Module, Resistor	1B43810-1	M-19
K805-33	Module, Resistor	1B43810-1	M-19
K806	Mounting Assembly, Aft Power Distribution, 56 Vdc	1B51211-1	
K806-1	Switch Power Transfer, 300A	1A68085-505	M-13
K806-2	Module, Relay, 50A	1A74890-501	
K806-3	Switch, Starter, Hydraulic Power Unit	1B32647-501	M-14
K806-4	Module, Relay, Magnetic Latching	1A74216-503	M-24
K806-5	Module, Relay, Magnetic Latching	1A74216-503	M-24
K806-6	Module, Relay, Magnetic Latching, 10A	1B40887-501	M-21
K806-7	Module, Relay, 2A	1A74211-503	M-20
K806-8	Module, Relay, 2A	1A74211-503	M-20
K806-9	Module, Relay, 2A	1A74211-503	M-20
K806-10	Module, Relay, 2A	1A74211-503	M-20
K806-11	Module, Relay, 10A	1A74218-503	M-22
K806-19	Module, Bus	1B40619-1	
K806-20	Module, Electrical Distribution	1A97868-507	
K806-21	Module, Electrical Distribution	1A97868-501	
K806-22	Module, Electrical Distribution	1A97868-1	
K806-23	Module, Electrical Distribution	1A97868-503	
K806-30	Module, Resistor	1B43810-1	M-19
K807	Mounting Assembly, Fwd Control Distribution	1A95142-503	
K808	Mounting Assembly, Aft Control Distribution	1A77040-505	
K809	Excitation Module, 5 Vdc, Fwd	1A77310-501	
K810	Excitation Module, 5 Vdc, Aft	1A77310-501	
K811	Switch Selector	50M04008	
K812	Mounting Assembly, Sequencer	1B39550-1	
K812-1	Module, Diode	1B39975-1	M-16
K812-2	Module, Relay, Magnetic Latching	1B40887-501	M-21

ELECTRICAL POWER AND SEQUENCING CALLOUT LIST (CONT.)

FIND NO.	COMPONENT	PART NO.	PAGE
K812-3	Module, Diode	1B39975-1	M-16
K812-4	Module, Relay, Magnetic Latching	1B40887-501	M-21
K812-5	Module, Diode	1B39975-1	M-16
K812-6	Module, Relay, Magnetic Latching	1B40887-501	M-21
K812-7	Module, Diode Assembly	1B40604-1	M-17
K812-8	Module, Relay, Magnetic Latching	1B40887-501	M-21
K812-9	Module, Relay, Magnetic Latching	1A74216-503	M-24
K812-10	Module, Relay, Magnetic Latching	1B40887-501	M-21
K812-11	Module, Relay, Magnetic Latching	1A74216-503	M-24
K812-12	Module, Relay, 10A	1A74218-503	M-22
K812-13	Module, Relay, Magnetic Latching	1A74216-503	M-24
K812-14	Module, Relay, 10A	1A74218-503	M-22
K812-15	Module, Relay 2A	1A74211-503	M-20
K812-16	Module, Relay, Magnetic Latching	1B40887-501	M-21
K812-17	Module, Relay, 2A	1B74211-503	M-20
K812-18	Module, Relay, Magnetic Latching	1B40887-501	M-21
K812-19	Module, Relay, 2A	1A74211-503	M-20
K812-20	Module, Relay, 10A	1A74218-503	M-22
K812-21	Module, Relay, Magnetic Latching	1A74216-503	M-24
K812-22	Module, Electrical Distribution	1A97868-505	
K812-23	Module, Relay, Magnetic Latching	1A74216-503	M-24
K812-24	Module, Electrical Distribution	1A97868-505	
K812-25	Module, Electrical Distribution	1A97868-1	
K812-26	Module, Electrical Distribution	1A97868-501	
K812-27	Module, Electrical Distribution	1A97868-501	
K812-28	Module, Electrical Distribution	1A97868-1	
K812-29	Module, Electrical Distribution	1A97868-1	
K812-32	Module, Electrical Distribution	1A97868-1	
K812-37	Module, Diode	1B39975-1	M-16
K812-39	Module, Diode	1B39975-1	M-16
K812-40	Module, Time-Delay Valve Actuator	1B54351-1	M-15
K812-42	Module, Diode Assembly	1B40604-1	M-17
K813	Electronics Assembly, Inverter-Converter, Static	1A66212-503	M-25
K814	Electronics Assembly, Inverter-LOX Chilldown	1A74039-507	M-26
K815	Electronics Assembly, Inverter-Fuel Chilldown	1A74039-507	M-26
K816	Converter, dc-to-dc	50M60040-17	M-12
K817	Battery, Fwd No. 3	1A83468-501	M-10
K818	Module Assembly, External-Internal	1B51527-1	M-13
K819	Module, Relay, 50A	1A74890-501	M-23
K820	Module, Relay, 50A	1A74890-501	M-23
K821	Module Assembly, Relay, 10A	1B51526-1	M-22

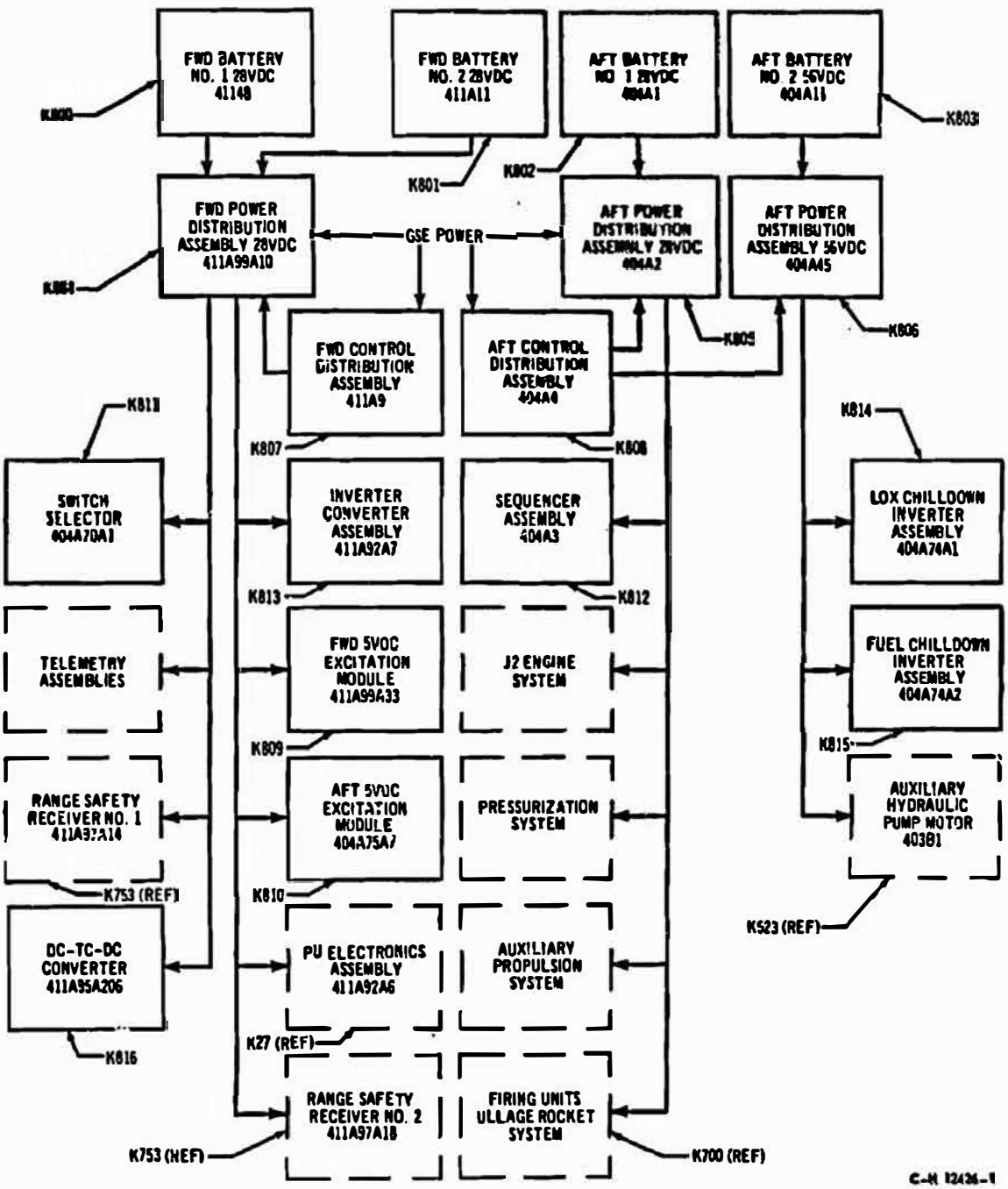

FIGURE M-1 PRIMARY ELECTRICAL POWER DISTRIBUTION

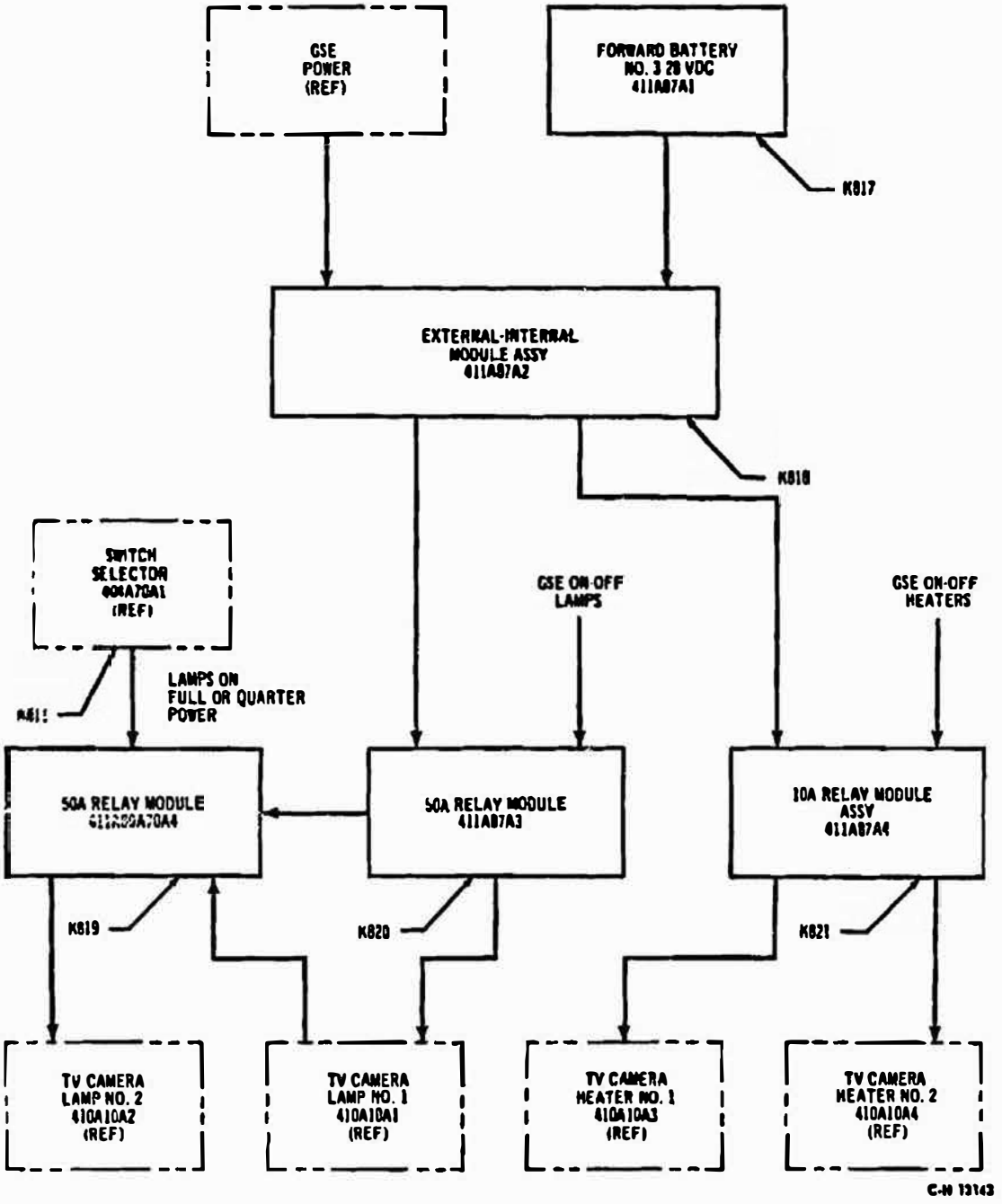

FIGURE M-2 ELECTRICAL POWER DISTRIBUTION FOR LH_2 EXPERIMENT

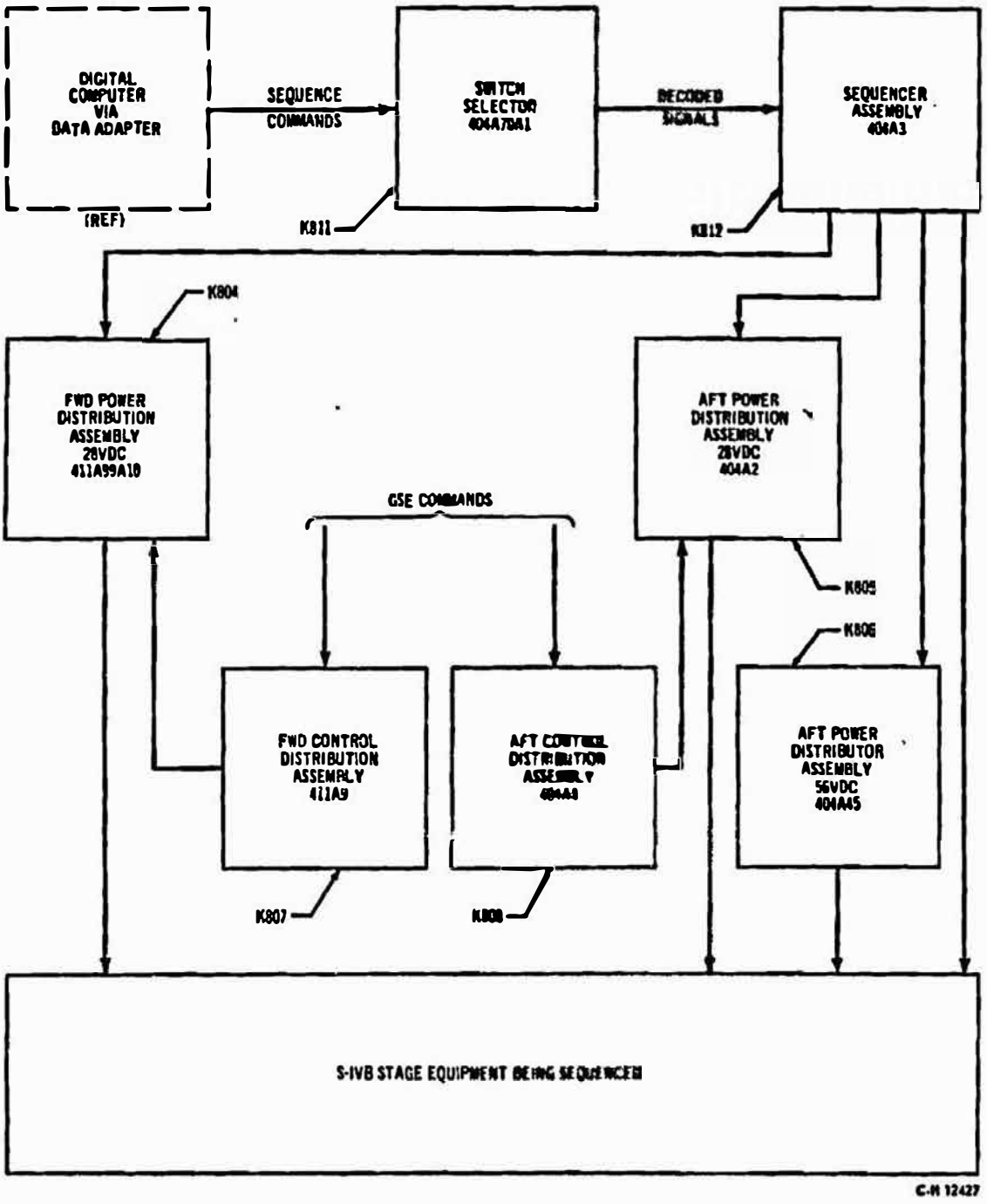

FIGURE M-3 FLIGHT SEQUENCING

FORWARD NO. 1 BATTERY, PART NO. 1A59741-1

This silver oxide/zinc battery (K800) is packaged in two separate units comprising a total of 20 cells. The entire battery unit powers forward bus no. 1 which includes buses +4D30 through +4D39.

1. VENDOR: Eagle-Picher Company (part no. MAP-4201-5 which consists of MAP-4201-1 and MAP-4201-3)
2. LOCATION: Fwd skirt between fin positions I and II
3. SERVICE: Electrical
4. TEMPERATURE: -143 to 51.7°C (-225 to +125°F)
5. ELECTRICAL CHARACTERISTICS:
   a. Output voltage: 28 ± 2.0 Vdc
   b. Reference designation: 411A8-A and 411A8-B
6. REMARKS: This page reflects information on DAC drawing 1A59741 rev F.

FORWARD NO. 2 BATTERY, PART NO. 1A83469-1

This silver oxide/zinc, 20-cell primary battery (K801) provides prime dc power to electrical assemblies in the forward skirt. It powers forward bus no. 2 which includes buses +4D20 through +4D29.

1. VENDOR: Eagle-Picher Company (part no. MAP-4205)
2. LOCATION: Forward skirt between fin positions I and II
3. SERVICE: Electrical
4. TEMPERATURE (operating): -143 to 51.7°C (-225 to +125°F)
5. ELECTRICAL CHARACTERISTICS:
   a. Output voltage: 28 ± 2.0 Vdc with 1.9 A starting current
   b. Insulation resistance: 1.0 MΩ min
   c. Reference designation: 411A11
6. REMARKS: This page reflects information on DAC drawing 1A83469 rev D and AEO's through F.

BATTERY, PART NO. 1A83468-501

This silver oxide/zinc, 20-cell primary battery provides primary dc power. Aft battery no. 1 (K802) supplies electrical assemblies in the aft skirt area via buses +4D10 through +4D19. Forward battery no. 3 (K817) supplies electrical components peculiar to the LH_2 experiment via buses +4D60 and +4D61.

1. VENDOR: Eagle-Picher Company (part no. MAP-4229)
2. LOCATION:
   a. K802: Aft skirt between panel positions 18 and 19
   b. K817: Fwd skirt panel position 4
3. SERVICE: Electrical
4. TEMPERATURE: -143 to 51.7°C (-225 to +125°F)
5. ELECTRICAL CHARACTERISTICS:
   a. Output voltage: 28 $\pm$ 2.0 Vdc
   b. Insulation resistance: 1.0 MΩ min
   c. Reference designation:
      (1) K802: 404A1
      (2) K817: 411A87A1
6. REMARKS: This page reflects information DAC drawing 1A83468 rev D and AEO's through F.

AFT NO. 2 BATTERY, PART NO. 1A83471-1

This silver oxide/zinc, 40-cell primary battery (K803) provides prime dc power to electrical assemblies in the aft skirt. It powers aft bus no. 2 which includes buses +4D40 through +4D49.

1. VENDOR: Eagle-Picher Company (part no. MAP-4206)
2. LOCATION: Aft skirt between panel positions 17 and 18
3. SERVICE: Electrical
4. TEMPERATURE (operating): -143 to 51.7°C (-225 to +125°F)
5. ELECTRICAL CHARACTERISTICS:
   a. Output voltage: 56.0 ± 4.0 Vdc
   b. Insulation resistance: 1.0 MΩ min
   c. Reference designation: 404A11
6. REMARKS: This page reflects information on DAC drawing 1A83471 rev C AEO's through F

DC-TO-DC CONVERTER, PART NO. 50M60040-17

This converter (K816) supplies isolated, regulated power to the single sideband telemetry assembly (K866) and isolation amplifier (K867).

1. VENDOR: GFE (part no. 50M60040-17)
2. LOCATION: Forward skirt panel position 1
3. SERVICE: Electrical
4. TEMPERATURE (operating): +20 to +85°C (+68 to +185°F)
5. ELECTRICAL CHARACTERISTICS:
   a. Input voltage: +23.8 to +30.8 Vdc
   b. Output voltage: +28.0 $\pm$0.56 Vdc
   c. Input current (max): 1.1 A
   d. Output current (load): 430 mA
   e. Reference designation: 411A95A206
6. REMARKS: This page reflects information on MSFC drawing 50M60040 rev C.

MOTOR-DRIVEN POWER TRANSFER 300-A SWITCH, PART NO. 1A68085-505

This switch (K804-1, K805-1, K806-1, and K818) consists of four sets of single-pole, double-throw contacts which open and close by means of a motor driven switching mechanism. The switch, when actuated, transfers S-IVB Stage primary power from external to internal and vice versa.

1. VENDOR: Kinetics Corp. (part no. M947-7 and M947-9)
2. LOCATION:
   a. K804-1: On fwd power distribution assembly, at fwd skirt panel position 16.
   b. K805-1: On 28 Vdc aft power distribution assembly, at aft skirt panel position 19.
   c. K806-1: On 56 Vdc aft power distribution assembly, at aft skirt panel position 17.
   d. K818: On fwd skirt panel position 4.
3. SERVICE: Electrical
4. TEMPERATURE (operating): -54 to +71°C (-65 to +160°F)
5. ELECTRICAL CHARACTERISTICS:
   a. Actuation voltage: 24 to 30 Vdc
   b. Actuation current: 11 A
   c. Insulation resistance: 100 MΩ at 500 Vdc
   d. Dielectric strength: 1000 V rms, 60 Hz for 1 minute
   e. Reference designation:
      (1) K804-1: 411A99A10A1
      (2) K805-1: 404A2A1
      (3) K806-1: 404A45A1
      (4) K818: 411A87A2
6. REMARKS: This page reflects information DAC drawing 1A68085 rev G and AEC's through J.

HYDRAULIC POWER UNIT STARTER SWITCH, PART NO. 1B32647-501

This motor-driven three-position switch module (K806-3) with two sets of contacts applies 56-Vdc starting power to the auxiliary hydraulic pump motor. Three switch monitoring circuits, containing one resistor per circuit, indicate the switch position.

1. VENDOR: Mason Electronics (part no. 989-0905)
2. LOCATION: On 56 Vdc aft power distribution assembly at aft skirt panel position 17
3. SERVICE: Electrical
4. TEMPERATURE (operating): -54 to +71°C (-65 to +160°F)
5. ELECTRICAL CHARACTERISTICS:
   a. Input voltage: 26 to 32 Vdc
   b. Insulation resistance: 100 MΩ at 500 Vdc
   c. Dielectric strength: 1000 Vrms, 60 Hz
   d. Reference designation: 404A45A3
6. REMARKS: This page reflects information on DAC drawing 1B32647 rev K.

TIME DELAY VALVE ACTUATION MODULE, PART NO. 1B54351-1

The time delay valve actuation module (K812-40) delays the EDS signal that closes chilldown shutoff valves K8 and K14, and prevalves K9 and K13.

1. VENDOR: Douglas Aircraft Company, Inc. (part no. 1B54351-1)
2. LOCATION: On the sequencer mounting assembly at aft skirt panel position 1
3. SERVICE: Electrical
4. TEMPERATURE (operating): -65 to +175°C (-85 to +347°F)
5. ELECTRICAL CHARACTERISTICS:
   a. Voltage: 28 Vdc
   b. Reference designation: 404A3A40
6. REMARKS: This page reflects information on DAC drawing 1B54351 rev F and AEO's through G.

Section III

DIODE MODULE, PART NO. 1B39975-1

The diode module contains six JAN-IN1206 diodes and two electrical connectors: J1, part no. MS3102R-20-27P and J2, part no. PT03A-12-85. Six identical diode circuits lie between the two electrical connectors with the cathode end of each diode connected to J2. The module also contains electrical connections between J1 and the cathode end of each diode. The electrical connectors are installed on a sheet of fiber glass board with the electrical wiring and diodes encapsulated in potting compound.

1. VENDOR: Douglas Aircraft Company, Inc. (part no. 1B39975-1)
2. LOCATION:
   a. Aft skirt panel position 1: K812-1, K812-3, K812-5, K812-37, and K812-39
   b. Aft skirt panel position 19: K805-17
3. SERVICE: Electrical
4. TEMPERATURE: -143 to +57°C (-225 to +135°F)
5. ELECTRICAL CHARACTERISTICS:
   a. Reference designations:
      (1) K805-17: 404A2A17
      (2) K812-1: 404A3A1
      (3) K812-3: 404A3A3
      (4) K812-5: 404A3A5
      (5) K812-37: 404A3A37
      (6) K812-39: 404A3A39
   b. Voltage: 28 Vdc
   c. Average current (each diode): 12 Adc max
   d. Voltage drop at 12A (each diode): 1.2 V
6. REMARKS: This page reflects information on following DAC drawings:
   a. 1B39975 rev C and AEO D
   b. 1A88564 rev B

DIODE MODULE, PART NO. 1B40604-1

This diode module contains nine JAN1N649 semiconductors independently wired between two connectors (Bendix PT03A12-10S and PT03A14-19P). The diodes isolate portions of the sequencing circuits that perform a common operation.

1. VENDOR: Douglas Aircraft Company, Inc. (part no. 1B40604-1)
2. LOCATION: Sequencer mounting assembly at aft skirt panel position 1
3. SERVICE: Electrical
4. TEMPERATURE: -143 to +57°C (-225 to +135°F)
5. ELECTRICAL CHARACTERISTICS:
   a. Operating voltage: 28 Vdc
   b. Average current (each diode): 0.4 Adc max
   c. Voltage drop at 0.4 A (each diode): 1.0 V
   d. Reference designation:
      (1) K812-7: 404A3A7
      (2) K812-42: 404A3A42
6. REMARKS: This page reflects information on the following:
   a. 1B40604 rev D
   b. 1A88564 rev B

RESISTOR MODULE, PART NO. 1B40464-1

This resistor module contains four independently wired 250 Ω resistors. A PT03A-14-19P Bendix connector provides the electrical interface. Module K804-35 provides the excitation bridge for fuel tank pressure transducers no. 1 and 2. Module K805-18 provides the excitation bridge for oxidizer tank pressure transducers no. 1 and 2.

1. VENDOR: Douglas Aircraft Company, Inc. (part no. 1B40464-1)
2. LOCATION:
   a. K804-35: Fwd skirt panel position 16
   b. K805-18: Aft skirt panel position 19
3. SERVICE: Electrical
4. TEMPERATURE: -143 to +57°C (-225 to +135°F)
5. ELECTRICAL CHARACTERISTICS:
   a. Voltage: 5 Vdc
   b. Power: 0.5 W (each resistor)
   c. Reference designation:
      (1) K804-35: 411A99A10A35
      (2) K805-18: 404A2A18
6. REMARKS: This page reflects information on the following DAC drawings:
   a. 1A88564 rev B
   b. 1B40464 rev A

RESISTOR MODULE, PART NO. 1B43810-1

This resistor module contains twelve 10K ± 1%, 1/2 W resistors and an electrical connector, part no. P714-14-19P. One end of each resistor attaches to separate pins in the connector, the other end attaches to a common bus that also attaches to two pins of the connector. The resistors, wiring, and electrical connector are encapsulated in potting compound. The resistor module reduces a 28 Vdc input, which is applied to the common bus, to a lower voltage level for telemetry system inputs. The module applies power to position switches in valves of the fuel tank vent system. These switches provide valve position inputs to the telemetry system.

1. VENDOR: Douglas Aircraft Company, Inc. (part no. 1B43810-1)
2. LOCATION:
   a. Fwd skirt panel position 16: K804-30
   b. Aft skirt panel position 17: K806-30
   c. Aft skirt panel position 19: K805-30, K805-31, K805-32, and K805-33
3. SERVICE: Electrical
4. TEMPERATURE: -143 to +57°C (-225 to +135°F)
5. ELECTRICAL CHARACTERISTICS:
   a. Reference designations:
      (1) K804-30: 411A99A10A30
      (2) K806-30: 404A45A30
      (3) K805-30: 404A2A30
      (4) K805-31: 404A2A31
      (5) K805-32: 404A2A32
      (6) K805-33: 404A2A33
   b. Input voltage: 28 Vdc
6. REMARKS: This page reflects information on the following DAC drawings:
   a. 1B43810 new
   b. 1A88564 rev B

2-A RELAY MODULE, PART NO. 1A74211-503

This relay module contains four DPDT relays with a 100 Ω resistor-diode circuit around the relay coil for transient pulse suppression. A 10K resistor circuit connected to the common terminal of each contact set permits the data acquisition system to sample the circuit function. Input, output, and control signals to the module route through three electrical connectors: J1, part no. PT03A-18-32P; J2, part no. PT03A-12-10S; and J3, part no. PT03A-12-10S. The module components are encapsulated with 9709466 type 1 potting compound.

1. VENDOR: Douglas Aircraft Company, Inc. (part no. 1A74211-503)
2. LOCATION:
   a. Fwd skirt panel position 16: K804-11 and K804-12
   b. Aft skirt panel position 1: K812-15, K812-17, and K812-19
   c. Aft skirt panel position 17: K806-7, K806-8, K806-9, and K806-10
   d. Aft skirt panel position 19: K805-6 and K805-8
3. SERVICE: Electrical
4. TEMPERATURE: -143 to +57°C (-225 to +135°F)
5. ELECTRICAL CHARACTERISTICS:
   a. Reference designation:
      (1) K804-11: 411A99A10A11
      (2) K804-12: 411A99A10A12
      (3) K805-6: 404A2A6
      (4) K805-8: 404A2A8
      (5) K806-7: 404A45A7
      (6) K806-8: 404A45A8
      (7) K806-9: 404A45A9
      (8) K806-10: 404A45A10
      (9) K812-15: 404A3A15
      (10) K812-17: 404A3A17
      (11) K812-19: 404A3A19
   b. Voltage: 28 Vdc
   c. Relay contact rating:
      (1) Resistive load: 2A
      (2) Inductive load: 0.5A
6. REMARKS: This page reflects information on the following DAC drawings:
   a. 1A74211 rev W
   b. 1A88564 rev B

10-A MAGNETIC LATCH RELAY MODULE, PART NO. 1B40887-501

This module contains four DPDT magnetic latch relays and four networks modules. Each networks module contains four diodes, which provide relay coil transient suppression, and one 10K Ω resistor, which couples the common side of the contact set to the data acquisition system.

1. VENDOR: Douglas Aircraft Company, Inc. (part no. 1B40887-501)
2. LOCATION:
   a. Fwd skirt panel position 16: K804-4 and K804-5
   b. Aft skirt panel position 17: K806-6
   c. Aft skirt panel position 1: K812-2, K812-4, K812-6, K812-8, K812-10, K812-16, and K812-18
3. SERVICE: Electrical
4. TEMPERATURE: -143 to +57°C (-225 to +135°F)
5. ELECTRICAL CHARACTERISTICS:
   a. Operating voltage: 28 Vdc
   b. Contact current rating:
      (1) Resistive load: 10A
      (2) Inductive load: 6A
      (3) Motor load: 4A
      (4) Lamp load: 2A
   c. Reference designation:
      (1) K804-4: 411A99A10A4
      (2) K804-5: 411A99A10A5
      (3) K806-6: 404A45A6
      (4) K812-2: 404A3A2
      (5) K812-4: 404A3A4
      (6) K812-6: 404A3A6
      (7) K812-8: 404A3A8
      (8) K812-10: 404A3A10
      (9) K812-16: 404A3A16
      (10) K812-18: 404A3A18
6. REMARKS: This page reflects information on the following DAC drawings:
   a. 1B40887 rev C and AEO's through G
   b. 1B58777 rev B and AEO's C and D
   c. 1B42529 rev B and AEO C
   d. 1B32526 rev A
   e. 1A88564 rev B

10-A RELAY MODULE, PART NO. 1A74218-503

This module contains four DPDT relays. A diode and 100 Ω resistor provide transient suppression for each relay coil. A 10K Ω resistor couples the common side of each contact set to the data acquisition system.

1. VENDOR: Douglas Aircraft Company, Inc. (part no. 1A74218-503)
2. LOCATION:
   a. K804-10: Fwd skirt panel position 16
   b. K805-2: Aft skirt panel position 19
   c. K806-11: Aft skirt panel position 17
   d. K812-12: Aft skirt panel position 1
   e. K812-14: Aft skirt panel position 1
   f. K812-20: Aft skirt panel position 1
   g. K821: Fwd skirt panel position 4
3. SERVICE: Electrical
4. TEMPERATURE: -143 to +57°C (-225 to +135°F)
5. ELECTRICAL CHARACTERISTICS:
   a. Operating voltage: 28 Vdc
   b. Contact current rating:
      (1) Resistive load: 10A
      (2) Inductive load: 6A
      (3) Motor load: 4A
      (4) Lamp load: 2A
   c. Reference designation:
      (1) K804-10: 411A99A10A10
      (2) K805-2: 404A2A2
      (3) K806-11: 404A45A11
      (4) K812-12: 404A3A12
      (5) K812-14: 404A3A14
      (6) K812-20: 404A3A20
      (7) K821: 411A87A4
6. REMARKS: This page reflects information on the following DAC drawings:
   a. 1A74218 rev S and AEO's T and U
   b. 1A88564 rev B

50-A RELAY MODULE, PART NO. 1A74890-501

This module contains two 1A88061-1 motor driven switches, a 1A88589-1 isolation module, a 1A97061-519 receptacle, and a PT03A-12-10S connector. Each switch has one 50A contact set and two 5A contact sets. The isolation module contains six 10K Ω resistors, which provide data acquisition system connection to the common side of each switch contact set.

1. VENDOR: Douglas Aircraft Company, Inc. (part no. 1A74890-501)
2. LOCATION:
   a. Fwd skirt panel position 16: K804-2 and K804-3
   b. Aft skirt panel position 19: K805-7, K805-9, and K805-10
   c. Aft skirt panel position 17: K806-2
   d. Fwd skirt panel position 6: K819
   e. Fwd skirt panel position 4: K820
3. SERVICE: Electrical
4. TEMPERATURE: -143 to +57°C (-225 to +135°F)
5. ELECTRICAL CHARACTERISTICS:
   a. Switch motor operating voltage: $28\ ^{+2}_{-4}$ Vdc
   b. Switch actuation current: 10A max
   c. Reference designation:
      (1) K804-2: 411A99A10A2
      (2) K804-3: 411A99A10A3
      (3) K805-7: 404A2A7
      (4) K805-9: 404A2A9
      (5) K805-10: 404A2A10
      (6) K806-2: 404A45A2
      (7) K819: 411A89A70A4
      (8) K820: 411A87A3
6. REMARKS: This page reflects information on the following DAC drawings:
   a. 1A74890 rev J and AEO's through M
   b. 1A88589 rev F
   c. 1A88061 rev G
   d. 1A97061 rev K
   e. 1A88564 rev B

Section III

MAGNETIC LATCH RELAY MODULE, PART NO. 1A74216-503

This module contains four DPDT magnetic latching relays. A diode and a 100 Ω resistor provide transient suppression for each relay coil. The common terminal of each contact set couples to the data acquisition system through a 10K Ω resistor. Input, output, and control signals route through three electrical connectors: J1, part no. PT03A-20-41P; J2, PT03A-12-10S; and J3, part no. PT03A-12-10S. The module components are encapsulated in 9709466 Type 1 potting compound.

1. VENDOR: Douglas Aircraft Company, Inc. (part no. 1A74216-503)
2. LOCATION:
   a. Fwd skirt panel position 16: K804-6
   b. Aft power distribution assembly, 56 Vdc: K806-4 and K806-5
   c. Aft skirt panel position 1: K812-9, K812-11, K812-13, K812-21, and K812-23.
3. SERVICE: Electrical
4. TEMPERATURE: -143 to +57°C (-225 to +135°F)
5. ELECTRICAL CHARACTERISTICS:
   a. Reference designations:
      (1) K804-6: 411A99A10A6
      (2) K806-4: 404A45A4
      (3) K806-5: 404A45A5
      (4) K812-9: 404A3A9
      (5) K812-11: 404A3A11
      (6) K812-13: 404A3A13
      (7) K812-21: 404A3A21
      (8) K812-23: 404A3A23
   b. Voltage: 28 Vdc
   c. Relay contact rating:
      (1) Resistive load: 2A
      (2) Inductive load: 0.5A
6. REMARKS: This page reflects information on the following DAC drawings:
   a. 1A74216 rev V
   b. 1A88564 rev B

STATIC INVERTER-CONVERTER ELECTRONIC ASSEMBLY, PART NO. 1A66212-503

This assembly (K813) consists of modules enclosed in an air-tight housing. The assembly functions with the propellant utilization (PU) system providing regulated ac and dc voltages to the PU electronics assembly and to the PU valve motor. Outputs from the assembly also are provided for telemetry purposes. The assembly is connected into the PU system through four electrical receptacles externally mounted on the housing.

1. VENDOR: Douglas Aircraft Company, Inc. (part no. 1A66212-503)
2. LOCATION: Fwd skirt panel position 9
3. SERVICE: Electrical
4. TEMPERATURE: -143 to +57°C (-225 to +135°F)
5. ELECTRICAL CHARACTERISTICS:
   a. Electrical reference: 411A92A7
   b. Input voltage: 28 Vdc
   c. Output voltage:
      (1) 21 Vdc: Measurement input to the data acquisition system and B+ to the following PU electronic assembly modules: LOX bridge module, LH_2 bridge module, Quadrature reject trigger module, and proportional electronics circuit.
      (2) 44.2 Vdc: Excitation voltage for the servomotor feedback potentiometer
      (3) 2.5 Vpp, 400 Hz square wave: Input to valve modulation in PU electronic assembly
      (4) 115 Vrms: To servomotor in valve positioner assembly and to +4A bus in PU electronic assembly
      (5) 117.5 Vdc: To pot assembly in PU electronic assembly
      (6) 5 Vdc: Measurement input to data acquisition system
      (7) 12 Vpp 400 Hz: Measurement input to data acquisition system
6. INTERNAL PRESSURE: After pressurization with 12 psig GN_2, assembly pressure must be 5 psig min after 24 hours.
7. REMARKS: This page reflects information on the following DAC drawings:
   a. 1A66212 rev AA
   b. 1B40073 rev A
   c. 1B51462 rev C
   d. 1B59236 new

Section III

CHILLDOWN INVERTER ELECTRONIC ASSEMBLY, PART NO. 1A74039-507

This pressurized assembly contains a filter module, an oscillator transformer, an oscillator pre-regulator, a telemetry and test module, three driver modules, and associated solid-state circuitry.

Connector J1 provides input voltage to the filter module from bus +4D41 on 56 Vdc power distribution assembly (K806). Connector J2 supplies voltage measurement readouts to multiplexer (K860) in the data acquisition system. Connector J3 is assembly output.

Two identical inverter assemblies are used, one (K814) to power up LOX chilldown pump (K7), another (K815) for fuel chilldown pump (K15). Switch selector (K811) commands on-off power to both assemblies via sequencer assembly (K812).

1. VENDOR: Douglas Aircraft Company, Inc. (part no. 1A74039-507)
2. LOCATION: Aft skirt panel position no. 15
3. SERVICE: Electrical
4. TEMPERATURE: -143 to +57°C (-225 to +135°F)
5. ELECTRICAL CHARACTERISTICS:
   a. Input voltage: 56 Vdc
   b. Output voltage: 56 V at 400 Hz
   c. Insulation resistance: 200 MΩ min
   d. Reference designation:
      (1) K814: 404A74A1
      (2) K815: 404A74A2
6. REMARKS: This page reflects information on the following DAC drawings:
   a. 1A74039 rev W and AEO's through AC
   b. 1B40062 rev E
   c. 1B51462 rev C
   d. 1B62971 new

N. DATA ACQUISITION SYSTEM

Measuring instrumentation and telemetry components provide current data on stage status during prelaunch checkout and flight. Since measurement signals originate in various forms, many require conditioning in the signal conditioning racks before transmission. Use of the multiplexers allows increased data transmission capability through the telemetry links.

Five separate telemetry links transmit data during flight through a multiplexed four-antenna system.

Section III

DATA ACQUISITION SYSTEM INFORMATION ILLUSTRATION

DATA ACQUISITION SYSTEM CALLOUT LIST

FIND NO.	COMPONENT	PART NO.	PAGE
K850	Multiplexer Assembly, Mod. 270	1B55251-507	
K851	Oscillator Assembly, TM	1B33187-535	
K852	Transmitter, FM	1A58842-501	N-15
K853	Amplifier, Power, Transmitter, FM	1A77080-501	N-13
K854	Coupler Assembly, Bi-directional	1A69214-505	
K855	Multiplexer Assembly, Mod. 270	1B29741-539	
K856	Oscillator Assembly, TM	1B33187-539	
K857	Transmitter, FM	1A58842-1	N-15
K858	Amplifier, Power, Transmitter, FM	1A77080-1	N-13
K859	Coupler Assembly, Bi-directional	1A69214-505	
K860	Multiplexer Assembly, Mod. 270	1B29741-537	
K861	Oscillator Assembly, TM	1B33187-537	
K862	Transmitter, FM	1A58842-505	N-15
K863	Amplifier, Power, Transmitter, FM	1A77080-505	N-13
K864	Coupler Assembly, Bi-directional	1A69214-505	
K865	Vibration Multiplexer Assembly, Mod. 245	1B32686-503	
K866	TM Assembly, SS	1B55252-1	
K867	Amplifier, SS Isolation	1B39886-1	
K868	Transmitter, FM	1A58842-507	N-15
K869	Amplifier, Power Transmitter, FM	1A77080-507	N-13
K870	Coupler Assembly, Bi-directional	1B69214-505	
K871	PCM/DDAS Assembly	1A74049-505	
K872	Switching Assembly, Transmitter, DDAS	1B29476-1	N-11
K873	Transmitter, FM	1A58842-503	N-15
K874	Amplifier, Power, Transmitter, FM	1A77080-503	N-13
K875	Coupler Assembly, Bi-directional	1A69214-505	
K876	Checkout Multiplexer Assembly, Mod. 270	1B55251-509	
K877	Multiplexer Assembly, TM/RF	1A69212-1	N-9
K878	Divider, Power, TM/RF	1A69215-501	
K879	Coupler Assembly, Bi-directional	1A69214-503	
K880	Switch, Coaxial, RF/Checkout	1B69213-1	N-14
K881	Coupler Assembly, Bi-directional	1A69214-503	

DATA ACQUISITION SYSTEM CALLOUT LIST (CONT.)

FIND NO.	COMPONENT	PART NO.	PAGE
K882	Switch, Coaxial, RF/Checkout	1A69213-1	N-14
K883	Multiplexer Assembly, TM/RF	1A69212-501	N-9
K884	Divider, Power, TM/RF	1A69215-501	
K885	Coupler Assembly, Bi-directional	1A69214-503	
K886	Switch, Coaxial, RF/Checkout	1A69213-1	N-14
K887	Coupler Assembly, Bi-directional	1A69214-503	
K888	Switch, Coaxial, RF/Checkout	1A69213-1	N-14
K889	Relay Assembly, FM/DDAS	1A67921-1	
K889-1	Module, Bus Connector	1A93522-1	
K889-2	Module, Inhibitor	1A67929-1	
K889-3	Module, Output Relay	1A88575-1	
K889-4	Module, Output Relay	1A88575-1	
K889-5	Module, Output Relay	1A88575-1	
K889-6	Module, Telemetry and Output Relay	1A88576-1	
K890	TM Calibration Assembly	1B58798-1	
K891	Adapter, Coaxial	1B42212-1	
K892	Tape Recorder Assembly, Flight	1A66884-1	N-12
K893	Decoder Assembly, Central	1A74051-501	N-16
K894	Decoder Assembly, Channel	1A74053-501	
K895	Decoder Assembly, Channel	1A74053-501	
K896	Rack "B", Signal Conditioning, Forward	1B28827-541	
K897	Rack "C", Signal Conditioning, Forward	1B28827-543	
K898	Rack "D", Signal Conditioning, Forward	1B28827-545	
K899	Rack "E", Signal Conditioning, Forward	1B28827-547	
K900	Rack "F", Signal Conditioning, Forward	1B28827-549	
K901	Rack "G", Signal Conditioning, Forward	1B28827-551	
K902	Rack "A", Signal Conditioning, Aft	1B28826-559	
K903	Rack "B", Signal Conditioning, Aft	1B28826-561	
K904	Rack "C", Signal Conditioning, Aft	1B28826-563	
K905	Rack "D", Signal Conditioning, Aft	1B28826-565	
K906	Rack "E", Signal Conditioning, Aft	1B28826-567	
K907	Rack "F", Signal Conditioning, Aft	1B28826-569	
K908	Rack "G", Signal Conditioning, Aft	1B28826-571	
K909	Rack "H", Signal Conditioning, Aft	1B28826-573	
K910	Rack "J", Signal Conditioning, Aft	1B28826-575	
K911	Rack "K", Signal Conditioning, Aft	1B28826-577	

DATA ACQUISITION SYSTEM CALLOUT LIST (CONT.)

FIND NO.	COMPONENT	PART NO.	PAGE
K912	Dummy Load, TM/RF	1A84057-501	N-8
K913	Dummy Load, TM/RF	1A84057-1	N-8
K914	Dummy Load, TM/RF	1A84057-501	N-8
K915	Dummy Load, TM/RF	1A84057-1	N-8
K916	Antenna #1, TM	1A69206-1	
K917	Antenna #2, TM	1A69206-1	
K918	Antenna #3, TM	1A69206-1	
K919	Antenna #4, TM	1A69206-1	
K920	Detector, Power, TM/RF	1A74776-501	N-10
K921	Detector, Power, TM/RF	1A74776-501	N-10
K922	Detector, Power, TM/RF	1A74776-503	N-10
K923	Detector, Power, TM/RF	1A74776-503	N-10
K924	Detector, Power, TM/RF	1A74776-501	N-10
K925	Detector, Power, TM/RF	1A74776-501	N-10
K926	Detector, Power, TM/RF	1A74776-501	N-10
K927	Detector, Power, TM/RF	1A74776-501	N-10
K928	Detector, Power, TM/RF	1A74776-501	N-10
K929	Detector, Power, TM/RF	1A74776-503	N-10
K930	Detector, Power, TM/RF	1A74776-501	N-10
K931	Detector, Power, TM/RF	1A74776-503	N-10
K932	Detector, Power, TM/RF	1A74776-501	N-10
K933	Rack, Signal Conditioning	1B51597-1	
K934	Rack, Signal Conditioning	1B51597-501	
K935	Rack, Signal Conditioning	1B51597-503	
K936	Rack, Signal Conditioning	1B51598-1	
K937	Rack, Signal Conditioning	1B51597-505	
K938	Decoder Assembly, Channel	1B74053-501	
K939	Decoder Assembly, Channel	1B74053-501	

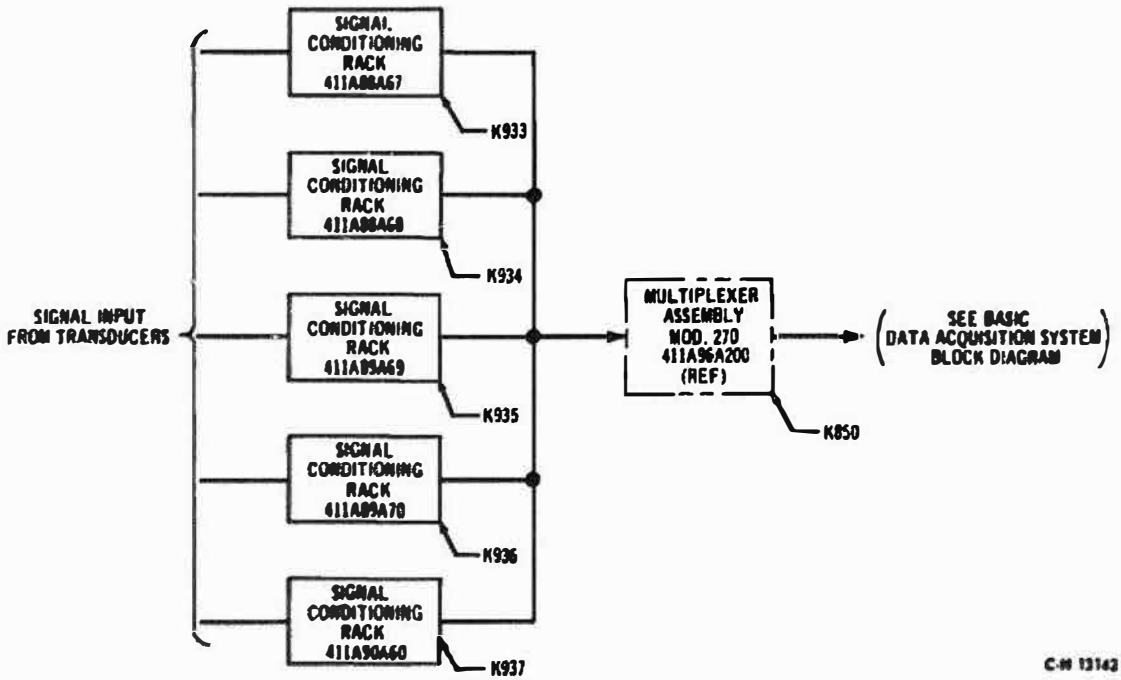

FIGURE N-1 DATA ACQUISITION FOR LH_2 EXPERIMENT

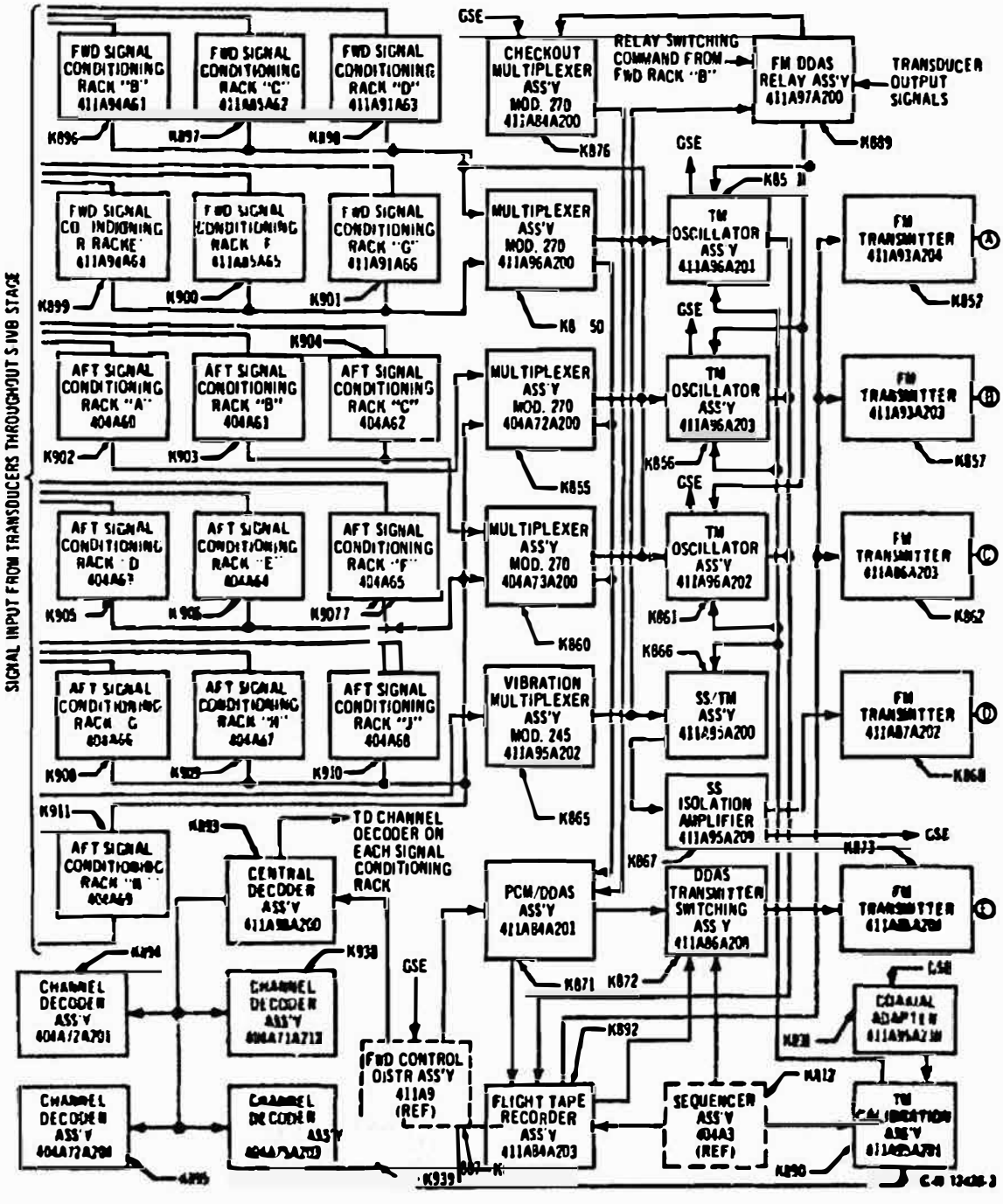

FIGURE N-2 DATA ACQUISITION SYSTEM (Sheet 1 of 2)

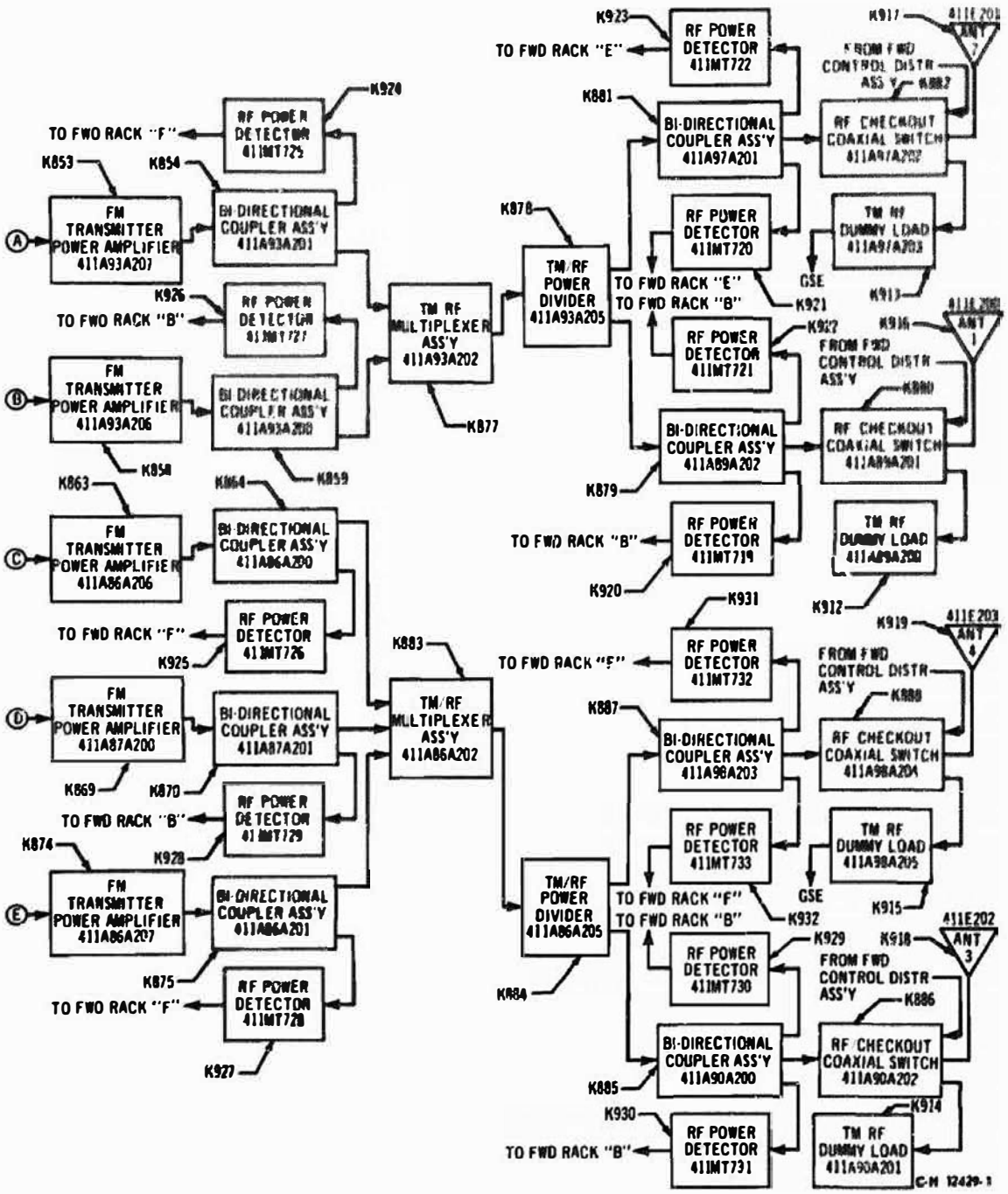

FIGURE N-2 DATA ACQUISITION SYSTEM (Sheet 2 of 2)

TELEMETRY RADIO FREQUENCY DUMMY LOAD, PART NOS. 1A84057-1 AND -501

Four dummy loads, one for each antenna system, terminate 50 Ω coaxial transmission lines in the telemetry system. The -1 configuration (K913 and K915) has an output for GSE sampling, whereas the -501 configuration (K912 and K914) does not.

1. VENDOR: Sierra Electronics
   a. K912 and K914: Part no. 160-50D-2 (-501 configuration)
   b. K913 and K915: Part no. 160-50D-1 (-1 configuration)
2. LOCATION (forward skirt):
   a. K912: Panel position 6
   b. K913: Panel position 7
   c. K914: Panel position 14
   d. K915: Panel position 15
3. SERVICE: Electrical
4. TEMPERATURE: -143 to +57°C (-225 to +135°F)
5. ELECTRICAL CHARACTERISTICS:
   a. Input impedance: 50 ± 2 Ω
   b. VSWR: 1.1:1 max
   c. Reference designation:
      (1) K912: 411A89A200
      (2) K913: 411A97A203
      (3) K914: 411A90A201
      (4) K915: 411A98A205
6. REMARKS: This page reflects information on DAC drawing 1A84057 rev C.

TELEMETRY RADIO FREQUENCY MULTIPLEXER PART NOS. 1A69212-1 AND -501

Two three-channel RF multiplexers (K877 and K883) combine five RF channels into two single outputs for transmitting telemetry signals to GSE. Each RF channel can be tuned to any frequency within the range of the multiplexer.

1. VENDOR: Rantec Corp. (part no. MT-324-1 for -1 configuration and MT-324-501 for -501 configuration)
2. LOCATION (forward skirt):
   a. K877: Panel position 10
   b. K883: Panel position 3
3. SERVICE: Electrical
4. ELECTRICAL CHARACTERISTICS:
   a. Design impedance: 50 ± 2 Ω
   b. Output impedance: 50 Ω load
   c. Input power: 50 W min each channel
   d. Reference designation:
      (1) K877: 411A93A202
      (2) K883: 411A86A202
5. REMARKS: This page reflects information on DAC drawing 1A69212 rev F and AEO G.

Section III

TELEMETRY RF POWER DETECTOR, PART NOS. 1A74776-501 AND -503

This detector monitors transmitted or reflected RF power in the S-IVB telemetry system. The detector operates in conjunction with the RF bi-directional coupler through the RF distribution network.

Find No.	Electrical Designation	Fwd Skirt Panel Position	Part No. 1A74776
K920	411MT719	6	-501
K921	411MT720	14	-501
K922	411MT721	6	-503
K923	411MT722	14	-503
K924	411MT725	10	-501
K925	411MT726	3	-501
K926	411MT727	10	-501
K927	411MT728	3	-501
K928	411MT729	4	-501
K929	411MT730	7	-503
K930	411MT731	7	-501
K931	411MT732	15	-503
K932	411MT733	15	-501

1. VENDOR: Electronic Communications, Inc. (part no. 01-00480-003 for -501 configuration and 01-00480-004 for -503 configuration)
2. LOCATION: See tabulation (fwd skirt panel position).
3. SERVICE: Electrical
4. TEMPERATURE (operating): -26 to +68°C (-15 to +155°F)
5. ELECTRICAL CHARACTERISTICS:
   a. Frequency range: 225 to 260 MHz
   b. Input impedance: 50 ± 2 Ω
   c. Output impedance: 1500 ± 10 pct Ω load
   d. VSWR: 1.2:1 max from 225 to 260 MHz (adjustable on -503 configuration)
   e. Reference designation: See tabulation (electrical designation)
6. REMARKS: This page reflects information on DAC drawing 1A74776 rev L and AEO's through R.

DDAS TRANSMITTER SWITCHING ASSEMBLY, PART NO. 1B29476-1

The transmitter switching assembly (K872) conditions the PCM/DDAS assembly (K871) output and switches either the PCM/DDAS output or the tape recorder (K892) output through an internal filter to FM transmitter (K873). A crystal can, DPDT relay selects either signal for input through the filter; normally closed position connects PCM/DDAS signal conditioning circuitry output to the filter input, normally open position connects the tape recorder mode.

1. VENDOR: United Electrodynamics, Inc. (part no. 22283)
2. LOCATION: Forward skirt panel position 3
3. SERVICE: Electrical
4. TEMPERATURE (operational): -143 to +57°C (-225 to +135°F)
5. ELECTRICAL CHARACTERISTICS:
   a. Input impedance: 200 Ω min
   b. Input current: 80 mA
   c. Input voltage: 26 to 32 Vdc
   d. Reference designation: 411A86A208
6. REMARKS: This page reflects information on DAC drawing 1B29476 rev J.

Section III

FLIGHT TAPE RECORDER ASSEMBLY, PART NO. 1A66884-1

This magnetic, reel-to-reel-type tape recorder (K892) records the three TM oscillator outputs and the PCM/DDAS assembly output for playback through the transmitters, following a transmission blackout or in an emergency.

1. VENDOR: Borg-Warner Controls, Inc. (part no. R-150-9001)
2. LOCATION: Fwd skirt panel position 1
3. SERVICE: Electrical
4. TEMPERATURE: -143 to +57°C (-225 to +135°F)
5. ELECTRICAL CHARACTERISTICS:
   a. Input power: 17.6 to 49.6 W
   b. Input impedance: 20 K Ω with 100 picofarad shunt digital lines, 100 K Ω with 30 picofarad shunt analog lines
   c. Input voltage: 22 to 32 Vdc
   d. Reference designation: 411A84A203
6. REMARKS: This page reflects information on DAC drawing 1A66884 rev D.

FM TRANSMITTER POWER AMPLIFIER, PART NOS. (See tabulation)

This amplifier consists of an amplifier stage and a dc-to-dc voltage converter. One amplifier is used with each of five telemetry system FM transmitters.

Find No.	DAC Part No.	Electrical Designation	Fwd Skirt Panel Position
K858	1A77080-1	411A93A206	10
K853	1A77080-501	411A93A207	10
K874	1A77080-503	411A86A207	3
K863	1A77080-505	411A86A206	3
K869	1A77080-507	411A87A200	4

1. VENDOR: Electro-Mechanical Research (part no. 257)
2. LOCATION: See tabulation (fwd skirt panel position).
3. SERVICE: Electrical
4. ELECTRICAL CHARACTERISTICS:
   a. Input power: 22 to 32 Vdc
   b. Input impedance: 50 Ω
   c. VSWR: 1.5:1 max at 50 Ω impedance
   d. Input signal: PAM/FM/FM, SS/FM or PCM/FM
   e. Insulation resistance: 100 MΩ at +50 Vdc
   f. Reference designation: See tabulation.
5. REMARKS: This page reflects information on DAC drawing 1A77080 rev J.

RF CHECKOUT MODULE COAXIAL SWITCH, PART NO. 1A69213-1

This switch upon command switches an RF transmission line circuit from either of two output terminals to the other.

1. VENDOR: Automatic Metal Products Corp. (part no. 106-8000-2697)
2. LOCATION (forward skirt):
   a. K880: Panel position 6
   b. K882: Panel position 7
   c. K886: Panel position 14
   d. K888: Panel position 15
3. SERVICE: Electrical
4. ELECTRICAL CHARACTERISTICS:
   a. Frequency: 200 to 300 MHz
   b. RF impedance: 50 ± 2 Ω
   c. Input VSWR: 1.2:1 max
   d. Switching voltage: 28.0 ± 4.0 Vdc
   e. Reference designation:
      (1) K880: 411A89A201
      (2) K882: 411A97A202
      (3) K886: 411A90A202
      (4) K888: 411A98A204
5. REMARKS: This page reflects information on DAC drawing 1A69213 rev K.

FM TRANSMITTER, PART NOS. (See tabulation)

This transmitter consists of a crystal-controlled oscillators multipliers, amplifiers, modulators and printed circuit boards. A transmitter operates in conjunction with each of the five separate telemetry links.

Find No.	DAC Part No.	Vendor Part No.	Electrical Designation	Fwd Skirt Panel Position	Freq Range (MHz)
K857	1A58842-1	01-00461-006	411A93A203	10	253.8
K852	1A58842-501	01-00461-007	411A93A204	10	258.5
K862	1A58842-505	01-00461-008	411A86A203	3	232.9
K873	1A58842-503	01-00461-009	411A86A204	3	246.3
K868	1A58842-507	01-00461-010	411A87A202	4	226.2

1. VENDOR: Electronic Communications, Inc. (See tabulation for part no.)
2. LOCATION: See tabulation (fwd skirt panel position).
3. SERVICE: Electrical
4. TEMPERATURE: -143 to +57°C (-225 to +135°F)
5. ELECTRICAL CHARACTERISTICS:
   a. Input voltage: 22 to 32 Vdc
   b. Input current: 1.25 A
   c. Output power: 1.5 to 4.5 W with 50 load and 1.5:1 VSWR
   d. Reference designation: See tabulation (electrical designation).
6. REMARKS: This page reflects information on DAC drawing 1A58842 rev E and AEO's through J.

CALIBRATION COMMAND CENTRAL DECODER ASSEMBLY, PART NO. 1A74051-501

This decoder assembly (K893) buffers and decodes ground calibration and/or checkout commands and provides the proper rack, mode, and channel signals for the channel decoder assemblies.

1. VENDOR: Space Craft, Inc. (part no. 421023, mod 4213)
2. LOCATION: Fwd skirt panel position 15
3. SERVICE: Electrical
4. TEMPERATURE (operating): -26 to +57°C (-15 to +135°F)
5. ELECTRICAL CHARACTERISTICS:
   a. Input signal voltages: 8 V and 27 V
   b. Input voltage: 26 to 32 Vdc
   c. Input current: 1.7 A max at 30 Vdc
   d. Input impedance: 10 KΩ min
   e. Reference designation: 411A98A200
6. REMARKS: This page reflects information on DAC drawing 1A74051 rev F.