Attachment J-02

APPLICATION	
NEXT ASSY	USED ON

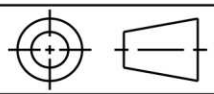
REVISION HISTORY

PART NO.	ZONE	REV	DESCRIPTION	DATE	APPROVAL

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES. INTERPRET DIMENSIONS AND TOLERANCES PER ASME Y14.5M-1994. TOLERANCES NO:

FRACTIONS DECIMALS ANGLES

THIRD ANGLE PROJECTION



EAR 99 –NO LICENSE REQUIRED

The information contained in the document is technical in content, but not technical data as defined by the International Traffic in Arms Regulations (ITAR) or the Export Administration Regulations (EAR), and therefore is EAR 99 NLR, no export license required, suitable for public release. [General Prohibition Six (Embargo) applies to all items subject to the EAR, i.e. items on the CCL and within EAR 99 NLR. You may not make an export or re-export contrary to the provisions of part 746 (Embargos and Other Special Controls) of the EAR and 22 CFR part 126.1 of the ITAR].

EDDR #1310063 NASA KSC Export Control Office (321-867-9209)

CAD MAINTAINED. CHANGES SHALL BE INCORPORATED ONLY BY THE DESIGN ACTIVITY

SOFTWARE

FILENAME K0000143202-SPC

MATERIAL

HEAT TREATMENT

FINAL PROTECTIVE FINISH

ORIGINAL DATE OF DRAWING (YY/MM/DD)

DRAFTSMAN	CHECKER
ENGINEER	CHECKER
ENGINEER	STRESS
ENGINEER	

SUBMITTED

APPROVED

JOHN F. KENNEDY SPACE CENTER, NASA
KENNEDY SPACE CENTER, FLORIDA

MANIFOLD BLOCK ASSEMBLIES FOR SWING ARM HYDRAULIC CONTROL SYSTEM, SPECIFICATION FOR

SIZE	CAGE CODE	DWG NO	REV
A	22264	K0000143202-SPC	A
SCALE None	UNIT WEIGHT	SHEET 1 OF 19	

REVISION HISTORY					
PART NO.	ZONE	REV	DESCRIPTION	DATE	APPROVAL

CONTENTS

REVISION HISTORY					
PART NO.	ZONE	REV	DESCRIPTION	DATE	APPROVAL

List of Tables

List of Figures

REVISION HISTORY					
PART NO.	ZONE	REV	DESCRIPTION	DATE	APPROVAL

ABBREVIATIONS, ACRONYMS, AND SYMBOLS

ASME	American Society of Mechanical Engineers
ASNT	American Society of Non-destructive Testing
ASTM	American Society of Testing and Materials
BPVC	Boiler and Pressure Vessel Code
CO	Contracting Officer
COTR	Contracting Office Technical Representative
DIN	German Institute for Standardization
°F	Degree Fahrenheit
g	Acceleration due to gravity
GRMS	Gravity Root Mean Squared
ISO	International Organization for Standardization
IT	Information Technology
ITAR	International Traffic in Arms Regulations
KSC	John F. Kennedy Space Center
MIL	Military
NAS	National Aerospace Standard
NASA	National Aeronautics and Space Administration
NDE	Non Destructive Evaluation
PPM	Parts per Million
PSD	Power Spectral Density
SAE	Society of Automotive Engineer
SOW	Statement of Work

REVISION HISTORY					
PART NO.	ZONE	REV	DESCRIPTION	DATE	APPROVAL

1. SCOPE

This specification establishes the requirements for the design, fabrication, qualification and acceptance testing of Manifold Block Assemblies for the Swing Arm Hydraulic Control System.

2. APPLICABLE DOCUMENTS

The following documents form a part of this document to the extent specified herein. The latest revision applies unless a specific revision is indicated.

Copies of government specifications, standards, drawings, and publications required by the contractor in connection with specified procurement functions, are obtained from the procuring activity or as directed by the NASA Contracting Officer.

2.1 Governmental

National Aeronautics and Space Administration (NASA)

KSC-STD-164B	Standard For Environmental Test Methods For Ground Support Equipment
NASA NPR 6000.1 Rev H	Requirements for Packaging, Handling and Transportation for Aeronautical and Space Systems, Equipment, and Associated Components
KSC-C-123 Rev J	Specification for Surface Cleanliness of Ground Support Equipment
K0000067808	Swing Arm Hydraulic Speed Control Manifold Schematic
K0000068674	Swing Arm Hydraulic Pressure Reduction Manifold Schematic
K0000132092-ANA	SLS Mobile Launcher Rocket Exhaust Plume Induced Environment, Volume 1 of 2, Acoustic and Vibration

Military (MIL)

MIL-A-8625	Anodic Coatings for Aluminum and Aluminum Alloys

2.2 Non-Governmental

American Society of Mechanical Engineers (ASME)

ASME B31.3 (2012)	Process Piping Design Code

REVISION HISTORY					
PART NO.	ZONE	REV	DESCRIPTION	DATE	APPROVAL

American Society of Testing and Materials (ASTM)

ASTM B209 (2010)	Aluminum Alloy 6061-T6
ASTM B580 (2009)	Specification for Anodic Oxide Coatings on Aluminum
ASTM D4174 – 89 (2010)	Standard Practice for Cleaning, Flushing, and Purification of Petroleum Fluid Hydraulic Systems

Society of Automotive Engineers (SAE)

SAE AS9132 A (2005)	Data Matrix Quality Requirement for Parts Marking
SAE AS5202 A (2005)	Port Fitting End, Straight Thread

German Institute for Standardization (DIN) - International Standard Organization (ISO)

DIN ISO 7368 (1994)	Hydraulic Fluid Power, Cavities for Two Port Slip In Cartridge Valves
ISO 4406 (1999)	Hydraulic Fluid Power, Fluids, Method for Coding the Level of Contamination by Solid Particles

3. REQUIREMENTS

3.1 Description

The manifold block assembly is the physical combination of the internal flow passages to interconnect components contained within or mounted upon that are required to form a complete hydraulic control system.

3.2 Interchangeability

Hardware assemblies, components, and parts with the same part number shall be physically and functionally interchangeable.

3.3 Performance Characteristics

3.3.1 The service media shall be Mobil DTE-25 Hydraulic Fluid.

3.3.2 Design Pressure is 3000 psig.

3.3.3 Test Pressure: 1.5 x Design Pressure x Allowable Stress @ Test Temperature / Allowable Stress @ Maximum Design Temperature

REVISION HISTORY					
PART NO.	ZONE	REV	DESCRIPTION	DATE	APPROVAL

3.3.3 Design hydraulic fluid flow rates for the following conditions:

Table 1 Flow Test Matrix

K0000067808, Speed Control Manifold Schematic, Column 1	**Valve(s) in Open Position during test** **All other valves shall be in the closed position, Column 2**	**Flow to be maintained for a minimum of 5 seconds under test, Column 3**	**Maximum Allowable Pressure Drop, Column 4**
Port A to Port D	Primary Extend Supply Valve	170 gpm at 2000 psig	125 psig
Port A to Port D	Secondary Extend Supply Valve	170 gpm at 2000 psig	125 psig
Port A to Port E	Primary Retract Supply Valve	170 gpm at 2000 psig	125 psig
Port A to Port E	Secondary Retract Supply Valve	170 gpm at 2000 psig	125 psig
Port D to Port E	Primary Retract Return Valve Primary Speed Control Valve	170 gpm at 2000 psig	400 psig
Port D to Port E	Secondary Retract Return Valve Secondary Speed Control Valve	170 gpm at 2000 psig	400 psig
Port E to Port D	Primary Extend Return Valve Primary Speed Control Valve	170 gpm at 2000 psig	400 psig
Port E to Port D	Secondary Extend Return Valve Secondary Speed Control Valve	170 gpm at 2000 psig	400 psig
Port D to Port C	Primary Retract Return Valve Primary Speed Control Valve	170 gpm at 2000 psig	450 psig
Port D to Port C	Secondary Retract Return Valve Secondary Speed Control Valve	170 gpm at 2000 psig	450 psig
Port E to Port C	Primary Extend Return Valve Primary Speed Control Valve	170 gpm at 2000 psig	450 psig
Port E to Port C	Secondary Extend Return Valve Secondary Speed Control Valve	170 gpm at 2000 psig	450 psig
Port F to Port C	None	170 gpm at 2000 psig	15 psig

REVISION HISTORY					
PART NO.	ZONE	REV	DESCRIPTION	DATE	APPROVAL

K0000068674, Pressure Reduction Manifold Schematic	**Valve(s) in Open Position during test** **All other valves shall be in the closed position**	**Flow to be maintained for a minimum of 5 seconds under test**	
Port G to Port H	HP Circuit Supply Manual Isolation Valve Regulator set to 2000 psi HP Regulated Pressure Isolation Valve	20 gpm at 2000 psig	20 psig
Port G to Port J	LP Circuit Supply Isolation Manual Valve Regulator set to 90 psig LP Regulated Pressure Manual Isolation Valve	20 gpm at 90 psig	20 psig

REVISION HISTORY					
PART NO.	ZONE	REV	DESCRIPTION	DATE	APPROVAL

3.3.4 Speed Control Manifold KT00335 shall be designed to:

a) Flow from port to port as identified in column 1 of Table 1, and shown on Speed Control Manifold Schematic K0000067808,

b) Flow with valves positioned as indicated in column 2 of Table 1

c) Flow with the rates and pressures shown as indicated in column 3 of Table 1

d) Flow with pressure drops not to exceed the values shown in column 4 of Table 1.

3.3.5 Pressure Reduction Manifold KT00336 shall be designed to:

a) Flow from port to port as identified in column 1 of Table 1, and shown on Pressure Reduction Manifold Schematic K0000068674,

b) Flow with valves positioned as indicated in column 2 of Table 1

c) Flow with the rates and pressures shown as indicated in column 3 of Table 1

d) Flow with pressure drops not to exceed the values shown in column 4 of Table 1.

3.3.6 Design temperature range for Hydraulic Fluid is 40 to 200 degrees Fahrenheit.

REVISION HISTORY					
PART NO.	ZONE	REV	DESCRIPTION	DATE	APPROVAL

3.4 Physical Characteristics

3.4.1 The manifold assemblies shall have fluid inlet and outlet ports as per SAE AS5202 for 1 inch (1 5/16-12 UN 3A/3B threads) or 2 inch (2 1/2-12 UN 3A/3B threads) 37 degree flare fittings, as shown on: Speed Control Manifold Schematic K000067808 and Pressure Reduction Manifold Schematic K0000068674.

3.4.2 The manifold assemblies shall have sensor ports as per SAE AS5202 for 1/4 inch (7/16-20 UNF 3A/3B threads) 37 degree flare fittings, as shown: Speed Control Manifold Schematic K000067808 and Pressure Reduction Manifold Schematic K0000068674.

3.4.3 The manifold assemblies shall have internal flow passages of the sizes specified on: Speed Control Manifold Schematic K000067808 and Pressure Reduction Manifold Schematic K0000068674.

3.4.4 Component and port locations on the Manifold Block Assemblies:

a) Components may be located upon the manifold's top, front or rear surfaces.

b) The 1 inch and 2 inch inlet and outlet ports shall be located on the manifold's ends (either or both).

c) The 1/4 inch sensor ports may be located upon the manifold's top, front or rear surfaces.

d) Reference Figure 1.

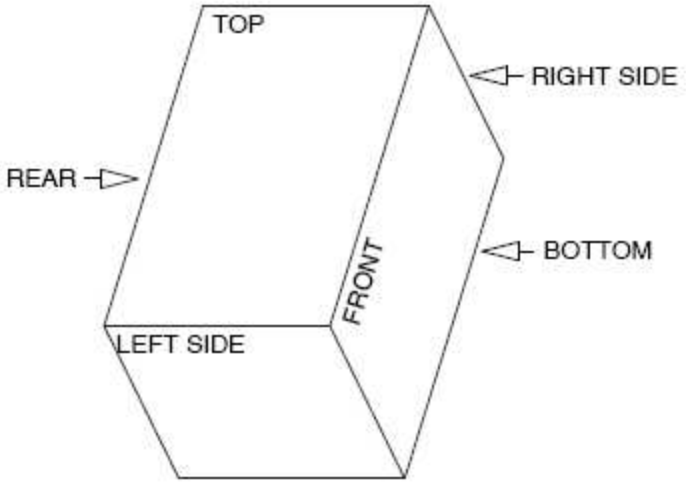


Figure 1 – Manifold Configuration

REVISION HISTORY					
PART NO.	ZONE	REV	DESCRIPTION	DATE	APPROVAL

3.4.5 The manifold blocks shall be made of Aluminum Alloy 6061-T6, as per ASTM B209.

3.4.6 The Manifold Blocks shall utilize material compatible thread inserts for all ports and threaded holes used for mounting and lifting. Threaded insert type and material information shall be provided to the NASA Contracting Officer for approval prior to use and fabrication.

3.4.7 Critical components (isolation valves, throttle valves and check valves) shall be able to withstand operational vibration loads induced by the Launch Vehicle's Exhaust Plume. Any critical component that has not been factory tested and certified for operation under the specified vibrational environment, shall be qualified as part of this procurement.

Critical components (as defined above) that do not have Manufacturer's certifications shall be qualified individually. Reference section 4.1 for vibration testing requirements.

3.4.8 Maximum dimensional envelope for the manifold blocks shall be:

Speed Control Manifold, KT00335 - 18 inches High x 18 inches Wide x 30 inches Long.

Pressure Reduction Manifold, KT00336 - 8 inches High x 12 inches Wide x 18 inches Long.

3.4.9 Maximum weight of manifold blocks with components installed shall not exceed:

Speed Control Manifold, KT00335 - 1000 pounds.

Pressure Reduction Manifold, KT00336 - 250 pounds.

3.4.10 Manifold blocks shall be Black Hard Anodize Coated as per ASTM B580 or Mil-A-8625.

3.4.11 The manifold blocks shall have provisions for mounting to a support frame by 1/2 – 13 UN bolts located on the bottom surface of the manifold block, in at least four locations (one at each corner of the manifold block). Mounting bolt hole locations and dimensions shall be provided for approval to the NASA Contracting Officer prior to fabrication, and said mounting bolt hole locations shall be part of the deliverable Manifold Block Drawings.

Reference to Figure 1.

REVISION HISTORY					
PART NO.	ZONE	REV	DESCRIPTION	DATE	APPROVAL

3.4.12 Provisions for 1/2 – 13 UN lifting eye bolts shall be provided for at each corner on the upper surface of the manifold block. Lifting eye bolt hole locations and dimensions shall be provided to the NASA Contracting Officer prior to fabrication, and said lifting eye bolt hole locations shall be part of the deliverable Manifold Block Drawings.

Reference to Figure 1.

3.4.13 One complete set (4 pieces) of lifting eye bolts shall be provided as a deliverable to this contract.

3.5 Design and Fabrication

3.5.1 The Manifold shall be designed, fabricated, inspected and tested per ASME B31.3 requirements.

3.5.2 Weld repairs to correct machining errors on the manifold blocks shall not be permitted.

3.5.3 Associated components that are not designed per ASME B31.3 requirements, but are designed to some other standard, require approval from the NASA Contracting Officer, prior to the use of said components.

3.6 Recommended List of Components:

3.6.1 For KT00335, Speed Control Manifold

Component Description	**Manufacturer**	**Part Number**
Isolation Valve with Valve Position Indication, via Inductive Proximity Sensor	ATOS	LIDASH-32433/FV/ERX-28DC with BKS-S20-4-PU-5 Connector
Proportional Throttle Valve	ATOS	LIQZO-LE-252L4/I with SP-ZM-7P Connector
Check Valve, Main Flow	ATOS	LIDA-3 Cover & SCLI-32421 Cartridge
Relief Valve, Low Pressure	ATOS	LIMM-3/50/V Cover & SCLI-32312 Cartridge (90 psi set pressure)
Relief Valve, High Pressure	ATOS	LIMM-3/350/V Cover & SCLI-32312 Cartridge (3000 psi set pressure)
Check Valve, Pilot Pressure	SUN	CXAA-XBN
Manual Bypass Needle Valve	SUN	NFDC-LAN

REVISION HISTORY					
PART NO.	ZONE	REV	DESCRIPTION	DATE	APPROVAL

3.6.2 For KT00336, Pressure Reduction Manifold		
Component Description	**Manufacturer**	**Part Number**
Isolation Valve with Valve Position Indication, via Inductive Proximity Sensor	ATOS	LIDASH-16433/FV/ERX-28DC with BKS-S20-4-PU-5 Connector
Regulator, High Pressure	ATOS	LIRA-1/210 Cover & SCLI-16374 Cartridge
Regulator, Low Pressure	ATOS	LIRA-1/50 Cover & SCLI-16374 Cartridge
Check Valve	ATOS	LIDA-1 Cover & SCLI-16421 Cartridge
Manual Isolation Ball Valve	DMIC	BVMM-1000-2211-PZZZ

NOTES Concerning Components:

1) All components shall meet the dimensional requirements of DIN ISO 7368 to ensure inter compatibility.

2) Components from other manufactures will be considered, but approval by the NASA Contracting Officer shall be required prior to the substitution of any component.

3) All components shall comply with ASME B31.3 Paragraph 304.7.2. Refer to ASME B31.3 Paragraph 326 for further details on Listed and Unlisted Components.

3.7 Cleaning and Drying

3.7.1 The manifold block shall be cleaned to KSC-C-123 level 300. ISO 4406 clean level 17/15/12 may be used in place of KSC-C-123 Level 300.

3.7.2 Fresh Mobil DTE-25 hydraulic fluid shall be used as the hydrostat test media.

3.7.3 Prior to assembly, the manifold block and all sub components shall be verified to be visually clean with absence of all particulate and non-particulate matter visible to the normal unaided eye or corrected-vision eye, and visibly clean when inspected with an ultraviolet light wavelength of 320 nm to 380 nm.

REVISION HISTORY					
PART NO.	ZONE	REV	DESCRIPTION	DATE	APPROVAL

3.8 Transportation

The hydraulic control manifold assemblies shall be packaged for shipment via standard commercial practice. The packed manifold assemblies shall be mounted upon a pallet that is suitably sized and configured to allow the package to be lifted and moved by a forklift. Packaging shall offer protection against loads induced on the manifold assemblies during transportation, so that the manifold assemblies are not damaged during shipment.

3.9 Name Plates and Product Marking

The hydraulic control manifold assembly shall be permanently and legibly marked as per SAE AS9132-A for identification on an outer surface (Top, Front, Rear, Left Side or Right Side) to include the information listed below:

- Manufacturing Contractor's name
- Part or model number
- Serial number
- Fabrication date
- Design pressure rating
- Service media
- Acceptance test pressure and date
- All ports shall be marked with identifications as indicated on: Speed Control Manifold Schematic, K0000067808 and Pressure Reduction Manifold Schematic, K0000068674.
- All component locations on the manifold blocks shall be identified using the designations as shown on: Speed Control Manifold Schematic, K0000067808 and Pressure Reduction Manifold Schematic, K0000068674.

3.10 Government-Furnished Property

Not Applicable.

3.11 Documentation

Documentation shall be furnished per the requirements of the SOW.

3.12 Personnel and Training

Not Applicable

REVISION HISTORY					
PART NO.	ZONE	REV	DESCRIPTION	DATE	APPROVAL

3.13 Precedence

The technical requirements of this specification take precedence, in the case of conflict, over the technical requirements cited in the listed applicable documents or referenced guidance documents. The contractor shall notify the NASA Contracting Officer of each instance of conflicting or apparently conflicting requirements.

4. QUALIFICATION TESTS

The following tests shall be performed on critical components (isolation valves, throttle valves and check valves):

4.1 Vibration Testing

4.1.1 Testing shall be done as per KSC-STD-164B, section 3.3.6 – Vibration.

4.1.2 Functional Test Verification, as per section 5.1.5, as called out in KSC-STD-164B, section 3.3.6.5.6 – Test Performance, shall be performed prior to vibration testing, to ensure correct operation of all components before the vibration testing is conducted.

4.1.3 Each component shall be tested to the three specified Power Spectral Density (PSD) curves (one for each axis). One test for each axis shall be performed. The PSDs were developed as per KSC-STD-164B, section 3.3.6.4.3.2 - Standard Test Specification.

The following PSDs found within K000132092-ANA shall be used:

PSD found on page B-66 for Z axis, 2 to 1000 Hz.

PSD found on page B-73 for X axis, 2 to 1000 Hz

PSD found on page B-83 for Y axis, 2 to 1000 Hz

4.1.4 Duration of the vibration test shall be 60 seconds. This test duration was determined as per KSC-STD-164B, section 3.3.6.4.4 - Test Duration, for a ten launch life.

4.1.5 Vibration Test components while under flow at 3000 psig pressure and cycle each component a minimum of 10 times.

4.1.6 After vibration testing is completed, repeat Functional Test Verification, as per section 5.1.5, as called out in KSC-STD-164B, section 3.3.6.5.6 – Test Performance, to ensure components are still functional.

REVISION HISTORY					
PART NO.	ZONE	REV	DESCRIPTION	DATE	APPROVAL

4.2 Tests to qualify Manifold or Associated Components to ASME B31.3 Requirements

The Contractor shall document and provide the Test Procedures and Results when qualifying the manifold or components.

5. ACCEPTANCE TESTS

The purpose of the acceptance testing is to verify the manifold assembly meets the design specification requirements necessary to ensure operational suitability.

Acceptance testing is required for each manifold assembly designed and fabricated in accordance with this specification.

After successful acceptance testing, any changes to the manifold assembly design, material changes, or sub component changes will result in invalidating the acceptance testing certification for this purchase. Such changes would drive the contractor to re-perform the acceptance testing unless the change is approved by the NASA Contracting Officer.

5.1 Manifold Assembly Acceptance Testing Requirements Test Matrix

5.1.1 Test Matrix

The following Table 1 presents the required tests to be performed as part of the manifold assembly acceptance criteria, unless otherwise approved by the NASA Contracting Officer. Alternate test methods shall be approved by the NASA Contracting Officer before implementation.

Table 2 Acceptance Test Matrix

Requirement	Section
Hydrostatic Test	5.1.3
Assembly Weight	5.1.4
Functional Test	5.1.5
Flow Rate Verification	5.1.6

NOTE:
The acceptance testing of the manifold assembly procured under this specification shall be conducted as an assembly unless otherwise specified in the performance specifications or SOW. Testing as shown may be combined for maximum efficiency/cost effectiveness.

REVISION HISTORY					
PART NO.	ZONE	REV	DESCRIPTION	DATE	APPROVAL

5.1.2 Testing Medium

5.1.2.1 Clean, fresh Mobil DTE-25 hydraulic fluid shall be used for hydrostatic testing.

5.1.2.2 All functional testing shall be conducted using clean, fresh Mobil DTE-25 hydraulic fluid.

5.1.3 Hydrostatic and Leak Testing

5.1.3.1 The manifold block shall be hydrostatically tested per ASME B31.3 Section 345.4. The test shall include all internal passages.

5.1.4 Assembly Weight Verification

5.1.4.1 The manifold assembly shall be weighed after assembly. Weight to nearest pound shall be recorded and reported.

5.1.5 Functional Test Verification

5.1.5.1 Each component shall be cycled a minimum of five times to verify operation.

5.1.5.2 Manifold assembly functionality shall be verified by recording the following parameters: flow rate (gpm), supply pressure (psig) and return pressure (psig).

5.1.5.3 Record the test date and technician’s name and signature.

5.1.6 Flow Rate Verification

5.1.6.1 It shall be demonstrated by actual flow test that each circuit is capable of flowing per section 3.3.4 (Table 1).

5.1.6.2 Identify each circuit and record flow rate, pressure and pressure drop.

5.1.6.3 Record these parameters and report test results for each circuit, per section 3.3.4 (Table 1).

5.1.7 Test data submittal

5.1.7.1 All test data shall be delivered via agreed upon electronic format.

5.1.8 Test cable harness

5.1.8.1 All cable harness required to perform testing, shall be provided by the contractor.

REVISION HISTORY					
PART NO.	ZONE	REV	DESCRIPTION	DATE	APPROVAL

6. PREPARATION FOR DELIVERY

6.1 Preservation

Packaging procedures and materials shall be adequate to preserve the cleanliness level of the manifold assembly during shipping and handling.

6.2 Protection of Manifold Assembly

All ports on the manifold assemblies shall be sealed with 37 degree flare fittings with caps.

7. Packaging for Shipment

Safe delivery in packaging is defined as delivery of a shipment to its destination shall ensure there is no damage to the package and the contents.

7.1 Packaging Procedure

The packaging shall be to common commercial practice. The packaging shall be upon or integral to a pallet suitable for lifting and movement by a forklift. Packaging shall be approved by NASA Contracting Officer prior to shipment of any unit.

7.2 Marking for Shipment

The vendor shall provide markings on the outside of the package to identify the item(s) contained within the package. These marking shall contain at a minimum: complete shipping address, list of package contents, package weight and procurement contract number.

8. NOTES

8.1 Intended Use

This document is intended to establish the requirements for fabrication and testing of hydraulic manifold assemblies, to be used within the Swing Arm Hydraulic Control System, as part of Ground Support Equipment.

8.2 Definitions

For the purpose of this document, the following definitions shall apply.

1) **Acceptance Tests** - A test (or series of tests) conducted on each fabricated manifold block and/or manifold assembly, to verify that it performs in accordance with expectations and requirements. To ensure it is designed and produced with adequate workman-

REVISION HISTORY					
PART NO.	ZONE	REV	DESCRIPTION	DATE	APPROVAL

ship and quality, that it is acceptable for delivery to the customer. Acceptance testing often includes testing for certification and to detect latent manufacturing and workmanship problems.

2) **Design Pressure** – Reference to B31.3. The maximum pressure which the manifold assembly is expected to experience during its service life, in association with its applicable operating environment.

3) **Shall** - Used to indicate a requirement which must be implemented and its implementation verified.

Custodian:

NASA - John F. Kennedy Space Center
NE-F Fluids Division
Kennedy Space Center, Florida 32899

Preparing Activity:

John F. Kennedy Space Center