APPLICATION	
NEXT ASSY	USED ON

REVISION HISTORY

PART NO.	ZONE	REV	DESCRIPTION	DATE	APPROVAL

NASA KSC Export Control Office (ECO)
Export/SBU Determination Record

EDDR# 1311559

DOCUMENT INFORMATION: (TITLE, NUMBER, REV, DATE)
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Flexible Hose Specification, Single Wall, LO2 Service

SENSITIVE BUT UNCLASSIFIED (SBU)

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	Yes	No	SBU Reviewer's Signature	Date	Company / Org
Document contains SBU?	☐	☒	Heather White (affiliate) (5/8/2013)	05/08/2013	ESC

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	EXPORT DETERMINATION (Check one box only)	
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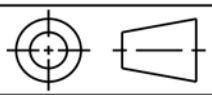
UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES.
INTERPRET DIMENSIONS AND
TOLERANCES PER ASME Y14.5M-1994.
TOLERANCES NO:

FRACTIONS DECIMALS ANGLES

THIRD ANGLE PROJECTION



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

SOFTWARE

FILENAME

MATERIAL

HEAT TREATMENT

FINAL PROTECTIVE FINISH

ORIGINAL DATE OF DRAWING (YY/MM/DD) 06/11/2013

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ICPSU FLEXIBLE HOSE SPECIFICATION, SINGLE WALL, LO2 SERVICE

SIZE	CAGE CODE	DWG NO	REV
A	22264	K0000147036-SPC	-
SCALE None	UNIT WEIGHT —	SHEET 1 OF 25	

KSC FORM 21-2C NS (REV 06/04) PREVIOUS EDITIONS ARE OBSOLETE

REVISION HISTORY					
PART NO.	ZONE	REV	DESCRIPTION	DATE	APPROVAL

TABLE OF CONTENTS

REVISION HISTORY					
PART NO.	ZONE	REV	DESCRIPTION	DATE	APPROVAL

LIST OF TABLES

REVISION HISTORY					
PART NO.	ZONE	REV	DESCRIPTION	DATE	APPROVAL

RECORD OF REVISIONS/CHANGES

REV LTR	CHANGE NO.	DESCRIPTION	DATE
Basic		**Initial Release**	

REVISION HISTORY					
PART NO.	ZONE	REV	DESCRIPTION	DATE	APPROVAL

Abbreviations, acronyms, and symbols

ASME	American Society of Mechanical Engineers
GN_2	Gaseous Nitrogen
GO_2	Gaseous Oxygen
GSE	Ground Support Equipment
KSC	Kennedy Space Center
LH_2	Liquid Hydrogen
LO_2	Liquid Oxygen
LN_2	Liquid Nitrogen
KSC	John F. Kennedy Space Center
MDP	Maximum Design Pressure
NASA	National Aeronautics and Space Administration
NDE	Non-Destructive Evaluation

REVISION HISTORY					
PART NO.	ZONE	REV	DESCRIPTION	DATE	APPROVAL

1. SCOPE

This specification provides technical information for the design, fabrication, and testing of flexible hose assemblies used in the transfer of liquid oxygen (LO2) and liquid nitrogen (LN2).

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. However, when this document is used for procurement, including solicitations, or is added to an existing contract, the specific revision levels, amendments, and approval dates of said documents shall be specified in an attachment to the Solicitation/Statement of Work/Contract.

In case of conflict between referenced document and this specification, this specification shall take precedence

2.1 Governmental

National Aeronautics and Space Administration (NASA)

NASA-SPEC-5004	Welding of Aerospace Ground Support Equipment and Related Nonconventional Facilities
NASA-STD-5005	Standard For the Design and Fabrication of Ground Support Equipment
NASA-STD-5008	Protective Coating of Carbon Steel, Stainless Steel, and Aluminum on Launch Structures, Facilities, and Ground Support Equipment

NASA/Kennedy Space Center

KSC-C-123	Surface Cleanliness of Fluid Systems, Specification For
KSC-GP-425	Fluid Fitting Engineering Standards
KSC-STD-E-0015	Marking of Ground Support Equipment, Standard For
KSC-STD-SF-0004	Safety Standard for Ground Piping Systems Color Coding and Identification

REVISION HISTORY					
PART NO.	ZONE	REV	DESCRIPTION	DATE	APPROVAL

KSC-STD-G-0003	Qualification of Launch Support and Facility Components Standard For
KSC-STD-Z-0009	Design of Cryogenic Ground Support Equipment Standard For
MSFC 20M02540	Assessment of Flexible Lines For Flow Induced Vibration

KSC Drawings

TBD	TBD
TBD	TBD
TBD	LO2 Isometric Drawing

2.2 STANDARDS

Copies of specifications, standards, drawings, and publications required by vendors in connection with specified procurement functions should be obtained from the procuring activity or as directed by the Contracting Officer.

2.3 Non-Governmental

The American Society of Mechanical Engineers

ASME B31.3	Process Piping
ASME B16.5	Pipe Flanges and Flanged Fittings
ASME B16.9	Factory-Made Wrought Buttwelding Fittings

American Society of Nondestructive Testing (ASNT)

ASNT-TC-1A	Recommended Practice, Personnel Qualification and Certification in Nondestructive Testing

REVISION HISTORY					
PART NO.	ZONE	REV	DESCRIPTION	DATE	APPROVAL

American Society of Testing and Materials

ASTM A182	Standard Specification for Forged or Rolled Alloy and Stainless Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High Temperature Service
ASTM A312	Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes
ASTM A403	Standard Specification for Wrought Austenitic Stainless Steel Piping Fittings
ASTM A380	Practice for Cleaning, Descaling, and Passivation of Stainless Steel parts, Equipment, and Systems
ASTM B575	Standard Specification for Low-Carbon Nickel-Chromium-Molybdenum, Low-Carbon Nickel-Chromium-Molybdenum-Copper, Low-Carbon Nickel-Chromium-Molybdenum-Tantalum, and Low-Carbon Nickel-Chromium-Molybdenum-Tungsten Alloy Plate, Sheet, and Strip
ASTM A580	Standard Specification for Stainless Steel Wire
ASTM A967	Standard Specification for Chemical Passivation Treatments for Stainless Steel Parts

International Organization for Standardization

ISO 10380	Pipework - Corrugated Metal Hoses and Hose Assemblies

International Code Council

IBC	International Building Code

REVISION HISTORY					
PART NO.	ZONE	REV	DESCRIPTION	DATE	APPROVAL

3. REQUIREMENTS

3.1 Definition

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

a. **Field Monitor** – Pressure monitoring performed by individual from a dial indicator gage without electronic transmission.

b. **shall:** - Used to indicate a requirement which must be implemented and its implementation verified;

c. **should:** Used to indicate a goal which must be addressed by the design but is not formally verified;

d. **Will:** Used to indicate a statement of fact and is not verified.

e. **TBR –** to be resolved / reviewed, involves data / processes to be designed / developed by contractor and provided to NASA at 45 percent and 90 percent design reviews for approval.

f. **TBD –** to be determined, involves data / processes in work at present by NASA, to be updated by NASA and incorporated to specification prior to contract award.

g. **TBS –** to be supplied, involves data / process to be supplied by the contractor to NASA as part of deliverables of this specification, but are not required for approval by NASA.

REVISION HISTORY					
PART NO.	ZONE	REV	DESCRIPTION	DATE	APPROVAL

3.2 General

3.2.1 Fluid Service

3.2.1.1 The service shall be for Liquid Oxygen (LO_2), Gaseous Oxygen (GO_2), Gaseous Helium (GHe), Liquid Nitrogen (LN_2) or Gaseous Nitrogen (GN_2)

3.2.1.2 All flexible hose assembly components shall be designed and fabricated as normal fluid service in accordance with ASME B31.3.

3.2.1.3 Examination processes and Pass/Fail criteria shall be in accordance with severe cyclic service requirements in ASM E B31.3.

3.2.2 Temperature and Pressure

3.2.2.1 The assembled flexible hose shall be designed for -321 degrees F to +158 degrees F at 3000 psig.

3.2.2.2 The lowest ambient temperature expected in service shall be 20F.

3.2.2.3 The nominal ambient temperature for ground operations shall be 80 degrees F

3.2.2.4 The Maximum Design Pressure (MDP) for the flexible hose shall be 300 PSIG with atmospheric pressure applied to external surface of inner pipe.

3.2.2.5 A pressure cycle for the assembled flexible hose shall be 0 psig to 300 psig and back to 0 psig.

3.2.2.6 The flexible hose burst pressure shall be 4 times the design pressure for each hose assembly

3.2.3 Material Properties

3.2.3.1 All materials used as pressure components shall meet the requirements of ASME 31.3.

3.2.3.2 Thermal properties of materials at cryogenic temperatures shall be as described from the National Bureau of Standards - Thermal Expansion of Technical Solids at Low Temperatures. A Compilation from the literature, NBS Monograph 29

3.2.4 Flexible hose Assembly

3.2.4.1 Flexible hose assembly shall meet requirements in Table 1: Flexible Hose Sizes.

REVISION HISTORY					
PART NO.	ZONE	REV	DESCRIPTION	DATE	APPROVAL

3.2.4.2 The convolutions shall be covered with braided wire reinforcement per ASTM A580 316/316L (dual grade) stainless steel.

3.2.4.3 Any hard pipes shall be ASTM TP312 316/316L (dual grade) stainless steel Schedule 10.

3.2.4.4 Compression length shall be designed to include braid tension required for full engagement of convolutes.

3.2.4.5 The flexible hose convolute section manufactured length is the live length plus compression length.

3.2.4.6 Flexible hose pipe butt welds and the longitudinal seam weld on the convoluted section shall accommodate 100% radiography. Fillet welds needed to assemble the convoluted sections together shall accommodate 100% Dye Penetrant examination (no radiography).

3.2.4.7 Elbows shall be long radius per ASME/ANSI B16.9. Mitered tee and elbows are not permitted.

3.2.5 Bend Radius

3.2.5.1 The bend radius shall be as specified in **Table 1**.

Minimum Center-Line Bend Radius		
Flex Hose Size	**Dynamic Flexing (inches)**	**Static Bend (inches)**
1.5”	28	12.8

Table 1: Minimum Flexible Hose Center-Line Bend Radius

SIZE	CAGE CODE	DWG NO	REV
A	22264	K0000147036-SPC	-
SCALE None	UNIT WEIGHT —	SHEET 11 OF 25	

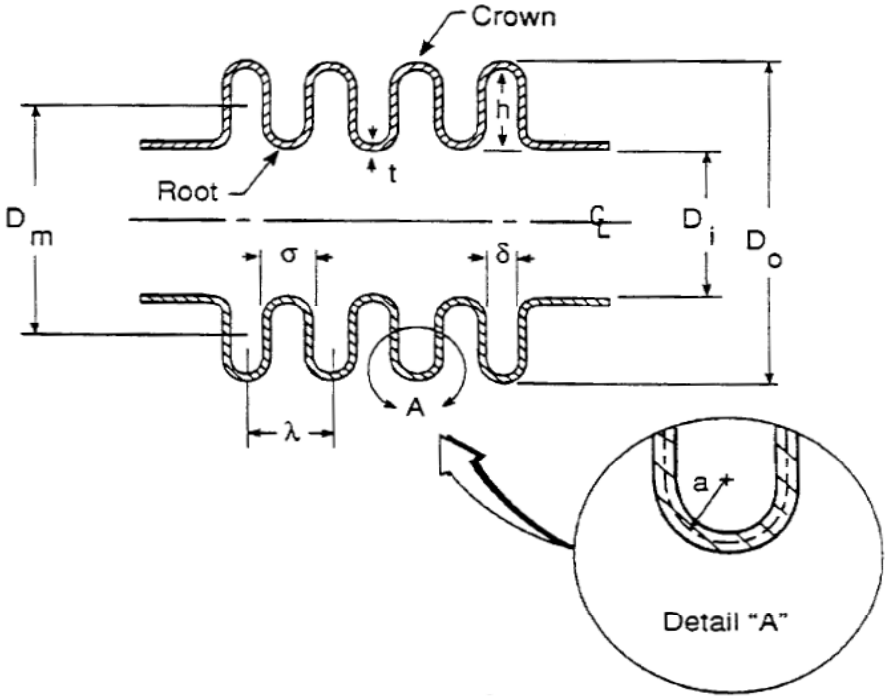
REVISION HISTORY					
PART NO.	ZONE	REV	DESCRIPTION	DATE	APPROVAL

3.2.6 Convolutes

3.2.6.1 Reference **Figure 1** for values listed

3.2.6.2 Convolutes shall meet dimensions shown in **Table 2**.

Figure 1: Convolutes Diagram



Inside Convolute (δ) $\delta = \lambda - \sigma$
Inside Convolute Spacing (λ) $\lambda = 1 / (Nc/12)$
Root Convolute Inside Width (σ) $\sigma = \lambda/2 + t\ Np$

Bellows Inner Diameter, Di (inches)	Wall Thickness, t (inches)	Number of Plys Np	Mean Inside Convolute Height h (inches)	Number of Convolutions Nc
1.5	0.02-0.024	1	0.306-0.51	24-48

Table 2: Convolute dimensional information

REVISION HISTORY					
PART NO.	ZONE	REV	DESCRIPTION	DATE	APPROVAL

3.2.7 Joint Connections

3.2.7.1 Joints in the flexible hose system shall be of the flanged design.

3.2.7.2 Flanges shall be per ANSI/ASME B16.5 and shall be ASTM A182 F316/F316L (dual graded) stainless steel. Flange styles and pressure classes are as indicated on KSC drawings. All serrations on raised face flanges shall be concentric and per ASME B16.5 paragraph 6.4.5.3.

3.2.7.3 All flanged joints shall be either weld neck or lap-joint design in accordance with ANSI/ASME B16.5. Stainless steel flange material shall be in accordance with ASTM A182 and shall be of the same grade as the piping material to which it is attached. The bolt, washer and nut materials shall be in accordance with ASTM A193, A194, or A320, as applicable. A weld neck flange bolted to a lap joint flange should be used where necessary to allow correct bolt alignment between the two flanges.

3.2.7.4 Gasket material shall be glass-filled Teflon TFE 2.4 mm (3/32 in) thick. Dimensions for flat ring gaskets shall be per KSC drawing 76K04886 or ASME B16.5 for cryogenic piping.

3.2.7.5 Socket weld joints shall not be used.

3.2.7.6 Slip flanges shall not be used.

3.2.7.7 Butt welded joint designs shall meet the requirements of ASME B16.9.

3.2.7.8 Butt welded end designs shall meet the requirements of ASME B16.25

3.2.8 Weld Fittings

3.2.8.1 Fittings shall be as per ASME B16.9 and ASTM A403 class WP-S (seamless) or WP-WX (welded with 100% x-ray) and shall be WP316/WP316L (dual graded) and shall be of schedule to match flexible hose segment.

3.2.9 Thermal Life Cycle

3.2.9.1 The flexible hose assemblies shall have a designed thermal cycle life of a minimum of 3,000 cycles. A thermal cycle is defined as the flexible hose assembly starting at ambient temperature, then being taken down to minus 321 degrees F, held at that temperature for a minimum of 15 minutes, and then allowed to return to ambient temperature.

3.2.10 Environmental Conditions

REVISION HISTORY					
PART NO.	ZONE	REV	DESCRIPTION	DATE	APPROVAL

3.2.10.1 Flexible hose, joints, components and seals exposed to the atmosphere shall be made of corrosion resistant materials to be corrosion resistant to marine environment and saltwater spray.

3.2.11 Listed Components Usage

3.2.11.1 Flexible Hose components shall use listed components in accordance with ASME B31.3.

3.2.12 Unqualified Components

3.2.12.1 Unlisted components shall be qualified in accordance to ASME B31.3 paragraph 302.2.3.

REVISION HISTORY					
PART NO.	ZONE	REV	DESCRIPTION	DATE	APPROVAL

3.3 Construction

3.3.1 Welder Qualification

3.3.1.1 All welding shall be performed by qualified welders per weld procedure specifications for each weld in accordance with NASA-SPEC-5004 and ASME B31.3. Weld traceability maps of welder and procedure number at each joint are required for each flexible hose.

3.3.2 Non Destructive Evaluation (NDE) Examiners

3.3.2.1 Weld examiners shall be qualified in accordance with NASA-SPEC-5004, ASME B31.3 paragraph 342 and ASNT-TC-1A Level III.

3.3.3 Non Destructive Evaluation (NDE)

3.3.3.1 All welding inspections shall be performed by certified weld examiners in accordance with NASA-SPEC-5004, ASME B31.3 and ASNT-TC-1A

3.3.3.2 NDE for severe cyclic welds shall be performed per ASME B31.3 severe cyclic service.

3.3.3.3 All welds shall be 100% visually examined by certified welding examiner per ASME B31.3. Pass/fail criteria shall be per ASME B31.3.

3.3.3.4 All pipe butt welds and longitudinal seam weld of convoluted section (prior to forming) shall be 100% radiograph examined per NASA-SPEC-5004 and ASME B31.3. Pass/Fail criteria shall be per ASME B31.3. All inner line fillet welds on the convoluted section shall be 100% dye penetrant examined per NASA-SPEC-5004.

3.3.3.5 If welds located on flexible hose cannot be radiographed due to the inherent design of the flexible hose, all welds shall be 100% dye penetrant tested. Pass/Fail criteria shall be per ASME B31.3 for severe cyclic service.

3.3.4 Welding

3.3.4.1 All welds shall be full penetration welds for severe cyclic conditions in accordance with NASA-SPEC-5004 and ASME B31.3 Chapter V. Backing rings are not permitted.

3.3.4.2 Attachments shall be in accordance with ASTM A240 with a full-seal weld to prevent moisture intrusion

3.3.4.3 Remove scale, burrs and break sharp edges

3.3.4.4 Pull braids tight to ensure contact with all convolutes after bellows compression and prior to welding braid in ferrule.

REVISION HISTORY					
PART NO.	ZONE	REV	DESCRIPTION	DATE	APPROVAL

3.3.5 Low Temperature Toughness

3.3.5.1 All welds shall meet the requirements for low temperature toughness (impact test) in accordance with ASME B31.3, paragraph 323.2.2.

3.3.6 Passivation

3.3.6.1 Weld heat affected areas shall be passivated per ASTM A380 and ASTM A967.

3.3.7 Paint

3.3.7.1 Coat all exterior surfaces of jacket using an inhibited polyamide epoxy primer and aliphatic polyurethane topcoat per NASA-STD-5008B. Other coatings such as polysiloxane and silicone ablative may be substituted as top coats.

3.3.7.2 Coating shall be applied after completion of all acceptance testing and before final marking/labeling.

3.3.8 Cleaning

3.3.8.1 The inner surfaces of all flexible hose assemblies and components shall be cleaned to KSC-C-123, level 300A. All cleaning processes and cleanliness level inspections shall be as specified in KSC-C-123.

3.3.9 Name Plates and Product Marking

Electrochemical Etch (Type II), Engrave (Type VII), or Laser Engrave (Type VIII) flexible hose/part using 0.125 inch minimum characters per provisions in MIL-STD-792 and the General Requirements (Paragraph 3.1) and Quality Assurance provisions (Paragraph 4) of KSC-STD-E-0015.

At a minimum, the data indicated below shall be included:

- manufacturing vendor’s name
- Contract Number
- KSC Drawing Number
- KSC Spool number
- Design Pressure
- Test pressure
- Service
- Year Built
- Temperature Range
- Serial Number

REVISION HISTORY					
PART NO.	ZONE	REV	DESCRIPTION	DATE	APPROVAL

3.3.10 Workmanship

Hardware shall be fabricated and finished so appearance, fit, and adherence to specified dimensions and tolerances are observed and in a manner that ensures reliable operations in accordance with the requirements specified herein. Particular attention shall be given to the neatness and thoroughness of construction and to the freedom of parts from burrs and sharp edges that might damage associated equipment or cause injury to personnel. Any item exceeding the acceptance criteria shall be repaired or replaced and reexamined by the same acceptance criteria as required for the original work.

3.3.11 Interchangeability

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

3.3.12 Safety

N/A

3.3.13 Human-Factors Engineering

N/A

3.3.14 Security

N/A

3.3.15 Government-Furnished Property

N/A

3.4 Documentation

N/A

3.5 Logistics

N/A

3.6 Personnel and Training

N/A

REVISION HISTORY					
PART NO.	ZONE	REV	DESCRIPTION	DATE	APPROVAL

3.7 Major-Component Characteristics

N/A

3.8 Precedence

In case of conflict between referenced document and this specification, this specification shall take precedence. Isometric drawing "tbd" shall take precedence over individual flex hose drawings.

REVISION HISTORY					
PART NO.	ZONE	REV	DESCRIPTION	DATE	APPROVAL

4. VERIFICATION

4.1 Responsibility for Inspection

Unless otherwise specified in the contract or order, the vendor shall be responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified, the vendor may use his own facilities or any commercial laboratory acceptable to the Government. The Government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to ensure supplies and services conform to prescribed requirements.

4.2 Special Tests and Inspections

4.2.1.1 Flexible Hose Measurements

4.2.1.1.1 Measure the length of the flexible hose under the following conditions:

4.2.1.1.2 Ambient pressure and temperature with the annulus evacuated below 50 um Hg

4.2.1.1.3 Measure the length of the hose in the straight position

4.2.1.1.4 The specified length tolerance for all hoses is +/- ½ inch

4.2.1.1.5 Convolute dimensions.

4.2.1.2 Live Lengths Flexible Hose Measurements

4.2.1.2.1 Determine normal and retracted flexible hose live lengths and worst case shape of each flexible hose using arc lengths and radii for mated and retracted positions

4.2.1.3 Mated Assembly Test

4.2.1.3.1 Physically demonstrate individual flex hoses and pipe can be successfully mated without damage and pass helium leak test of the mated flanges. Mated assembly leak test may be performed during mass spectrometer leak test and MAWP using gaseous helium.

4.3 Verification Inspections

Testing commodities shall conform to specifications as follows:

- Gaseous helium to MIL-PRF-27407C, Type I, Grade A
- Gaseous nitrogen to MIL-PRF-27401F, Type I, Grade B
- Liquid nitrogen to MIL-PRF-27401F, Type II, Grade B

REVISION HISTORY					
PART NO.	ZONE	REV	DESCRIPTION	DATE	APPROVAL

- Liquid Oxygen to MIL-PRF-25508G, Type II, Grade A

4.3.1 Required Testing Chronology

The testing in sections 4.3.2 to 4.3.6 shall be performed sequentially.

4.3.2 Cold Shock

4.3.2.1 The flexible hose assembly shall undergo cold shock testing after the leak testing is completed.

4.3.2.2 The assembly shall be cold shocked with LN_2 by tilting the line at least 15 degrees and introducing the LN_2 into the assembly at the low end, allowing the boil off gas to vent from the high end. The chilldown and tilting of the assembly shall continue until a steady stream of LN_2 is forced out the high end. The LN_2 supply shall then be maintained to keep LN_2 within 6 inches, at the farthest point, from the end of the spool, and allowing the assembly to cold-soak for 1 hour

REVISION HISTORY					
PART NO.	ZONE	REV	DESCRIPTION	DATE	APPROVAL

4.3.3 Pressure/Leak Testing

4.3.3.1 The leak pressure test shall be conducted via hydrostatic testing at a minimum of 150% of the design pressure.

4.3.3.2 The pressure shall be maintained for a minimum of 10 minutes. The flexible hose undergoing test shall exhibit no leakage while undergoing leak testing and show no permanent deformation or damage as result of the leak testing.

4.3.3.3 Leak testing shall be performed at ambient temperature.

4.3.4 Mass Spectrometer Leak Testing

4.3.4.1 The flexible hose shall undergo leak testing after the cold shock testing is completed and prior to the application of any coatings on the outer jacket.

4.3.4.2 One of the following two testing procedures shall be used.

4.3.4.2.1 With inner line pressurized to MDP with 100% helium and holding at MDP for 1 minute minimum, the mass spectrometer leakage indication shall be below 10^{-7} std-cc/sec. To accomplish this test, a mass spectrometer set capable of sensitivity to 10^{-9} std-cc/sec shall be used.

4.3.4.2.2 As an option with inner line pressurized to MDP with 10% helium/90% nitrogen and holding at MDP for 1 minute minimum, the mass spectrometer leakage indication shall be below 10^{-9} std-cc/sec. To accomplish this test, a mass spectrometer set capable of sensitivity to 10^{-10} std-cc/sec shall be used.

4.3.4.3 For installations where leak testing of flanged joints is performed use the following leak criteria;

4.3.4.3.1 With joint pressurized to MDP with 100% helium, the helium leakage indication shall be below $1x\ 10^{-4}$ std-cc/sec. To accomplish this test, a helium leak detector set capable of sensitivity to $1x10^{-6}$ std-cc/sec shall be used.

4.3.4.3.2 As an option with joint pressurized to MDP with 10% helium/90% nitrogen, the helium leakage indication shall be below $1x\ 10^{-5}$ std-cc/sec. To accomplish this test, a helium leak detector set capable of sensitivity to $1x10^{-7}$ std-cc/sec shall be used.

4.3.5 Dimensional Verification

4.3.5.1 Flexible hose assemblies shall be dimensionally verified to be in accordance with the vendor's fabrication drawings prior to packaging for shipment.

REVISION HISTORY					
PART NO.	ZONE	REV	DESCRIPTION	DATE	APPROVAL

4.3.6 Responsibility For Verification / Inspection

4.3.6.1 The vendor shall be responsible for the performance of all verification (~~analysis~~, test, demo or inspection) requirements as specified herein. Except as otherwise specified, the vendor may use his own facilities or any commercial laboratory acceptable to NASA. NASA reserves the right to witness or perform any of the inspections set forth in the specification where such inspections are deemed necessary to ensure supplies and services conform to prescribed requirements.

4.3.6.2 The Vendor shall formulate acceptance test procedures for all components and will provide the facility and instrumentation to perform all relevant tests to ensure compliance with this specification. The acceptance test procedures shall include but not be limited to all of the testing procedures specifically outlined in this document.

4.3.6.3 All items purchased or manufactured by a subcontractor used in the Vendor's work shall be clearly identified and tabulated.

4.3.6.4 All material and components shall be traceable to original vendor via material certification records.

4.3.6.5 NASA reserves the right to have access to the Vendor's facility at any time during the design, fabrication and code testing. NASA shall have the right to witness any manufacturing or testing procedures upon request. When requested, the Vendor shall provide a minimum of 7 days' notice in advance of any test date to allow for NASA (or its designated contractor representative) to make the necessary travel arrangements.

4.3.6.6 Review of analysis data and procedures by NASA shall not release the Vendor from its responsibility to correct errors, oversights and omissions to ensure conformance to the requirements in this document and ASME code requirements.

REVISION HISTORY					
PART NO.	ZONE	REV	DESCRIPTION	DATE	APPROVAL

5. PREPARATION FOR DELIVERY

5.1 Preservation

5.1.1 Protective covers

5.1.1.1 The flexible hoses shall be furnished with schedule 40 stainless steel protective end covers to prevent damage or contamination during storage, transportation and handling.

5.1.2 Packaged per KSC-C-123

5.1.2.1 All flexible hose assemblies shall be packaged per KSC-C-123. Packing design shall be approved by NASA prior to use.

5.1.3 Pressure

5.1.3.1 Cleanliness shall be maintained.

5.1.3.2 Seal inner pipe ends and ports with pressure retaining flanges equipped with pressure gage and gas charging tee (1 set per pipe assembly). All flanges shall meet the component requirements in Section 3.

5.1.3.3 Establish a minimum dew point of minus 65F (24 ppm) using 2 micron filtered MIL-PRF-27401F, Type II, Grade B GN_2 in accordance with Test Method III (A.3.3) of KSC-C-123 then establish a 5 +/-2 psig GN2 blanket pressure

5.1.3.4 Capability shall be provided to field monitor blanket pressure, isolate pressure gage and re-establish any lost blanket pressure. All components and fittings shall be cleaned to fabricated component level or better

5.1.3.5 Leak check shall be performed on pressure ports using MSFC-SPEC-384 Type 1 or 2 leak check fluid. Verify no bubble formation for one minute minimum.

5.1.4 Recordings

5.1.4.1 All flexible hose assembly GN2 blanket pressures shall be checked and recorded prior to shipment for validation at KSC receiving site prior to acceptance.

5.2 Packing

The vendor shall package each flexible hose section within a hard sided container (at a minimum wood construction) using standard commercial practice, ensuring each flexible hose section is protected against damage during shipment. Entire flexible hose section length must also be protected against damage using isolation / separation means between segments during shipment. Boxes shall be strong enough to support being picked up using a forklift and/or using lifting straps. The boxes should be

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PART NO.	ZONE	REV	DESCRIPTION	DATE	APPROVAL

capable of being stacked. Flexible hoses can be shipped on saddle supports with hold-downs, or equivalent means. More than one flexible hose may be contained in a box. The boxes do not need to be weatherproof. Shipping containers shall conform to freight classification rules and applicable container specifications. These shipping containers shall be capable of being picked-up by fork lift or lifting straps.

6. NOTES

6.1 Intended Use

This document is intended to establish the requirements for fabrication and testing of LO_2 flexible hose.

Custodian:

NASA – John F. Kennedy Space Center
Kennedy Space Center, Florida 32899

Preparing Activity:

John F. Kennedy Space Center

REVISION HISTORY					
PART NO.	ZONE	REV	DESCRIPTION	DATE	APPROVAL

APPENDIX A – FLEXIBLE HOSE ASSEMBLY PART SPECIFICATIONS

Table 3: Flexible Hose Sizes

QTY (Units)	Fluid	Spool Number	Function	Type	Size	Location	Drawing Number
3	LO2	5160	Liquid Oxygen Bleed	Flexible Hose	1-1/2”	ICPSU	K0000065267