

1. SCOPE:

This drawing covers the design, fabrication and testing of vacuum jacketed flexible hose assemblies.

DESIGN REQUIREMENTS

2. APPLICABLE PUBLICATIONS:

ASME, Boiler and Pressure Vessel Code

Section VIII
Section IX

Rules for Unfired Pressure Vessels
Welding

3. GENERAL:

The vacuum jacketed flexible hose assembly shall be designed, fabricated and tested with the requirements specified herein. The manufacturer shall provide any additional measures necessary to produce equipment which will satisfactorily pass the tests specified herein. This SSC drawing shall govern and take preference where it may depart or conflict with provisions of referenced document.

Inner Hose. The inner hose shall be designed, fabricated, inspected and tested for a design internal pressure and temperature range as specified with full vacuum in the annular space.

Outer Jacket. Outer jacket shall be designed for an external atmospheric pressure and internal vacuum of 10 Microns of mercury absolute with the outer flex hose at ambient temperature.

4. MATERIALS:

All materials shall be free from all defects impairing strength, durability and appearance and of the best commercial quality for the purpose specified. All materials shall be new and shall have structural properties to sustain safety and stresses to which they are subjected at the design conditions.

5. VACUUM JACKET DESIGN:

Each vacuum jacketed hose assembly shall be provided with at least one combination device which shall contain a vacuum thermocouple probe and which also shall be used for annular space evacuation and as a protection against over pressurization of the outer hose. Rupture discs are prohibited. The combination protective device shall be a vacuum valve with a lift disc, thermocouple port, and welded connection. Protective device shall be similar and equal to Control Components, Inc., Valve No. VV216 and Actuator VV216A for each hose. A shield shall be fabricated and installed to prevent damage to the protective device.

6. HEAT GAIN:

Maximum allowable over-all heat gain for the hose when filled with liquid nitrogen and at an outside ambient temperature of 100 degrees F shall be as shown below:

Hose Size	Heat Gain
2 Inch	4 BTU/Linear Foot/Hr.
3 Inch	6 BTU/Linear Foot/Hr.
6 Inch	12 BTU/Linear Foot/Hr.

△	CHANGED "GENERAL ELECTRIC CO." TO "GOVERNMENT REPRESENTATIVE" ITEM NO. ISSUED/CEP		1/3/89	JAN 4 1989
	CHANGED FROM "...HOSE SHALL HAVE STAMPED INTO ITS METAL..." TO "...HOSE SHALL BE IDENTIFIED WITH..." ITEM 27, SHT. 4. CHANGED CLEANING REQUIREMENTS FROM LEVEL 1 TO COMMERCIAL CLEAN. PER 90HC7601, MR 11/1/88			
THIS DWG SUPERSEDES MTF STD FH-VJ				
SYM	ZONE	DESCRIPTION	DATE	APPROVED
REVISIONS				
SIGNATURES		DATE	NATIONAL AERONAUTICS GEORGE C. MARSHALL SPACE FLIGHT CENTER	
DRAWN			SPACE ADMINISTRATION MISSISSIPPI TEST FACILITY BAY ST. LOUIS, MISSISSIPPI	
CHECKED			MTSD GENERAL ELECTRIC	
ENGINEER				
ISSUED		MAR 15 1968	FLEX HOSES, VACUUM JACKETED, GENERAL	
SUBMITTED				
APPROVED			SIZE B	DWG. NO. 54B00-GF01
USED ON		54B00-D001	AUTHORITY NASAw-410 Mod MSFC-1	REV. 1
			SHEET	1 of 4

7. INSULATION:

Radiant shield insulation, as required, shall be provided in the annular space of the hose to meet heat leak requirements.

8. EVACUATION:

The jacket of each section shall be evacuated to an absolute pressure less than 10 Microns, in the manufacturer's shop. The pressure in the vacuum jacket shall not exceed 200 Microns absolute in the ambient condition throughout the first year after acceptance by the purchaser.

9. DRAWINGS & DATA:

Prior to start of fabrication, the manufacturer shall submit shop drawings and data to the Purchaser for approval. Approval of drawings and data is required prior to start of fabrication. The drawings and data shall include design of inner hose and outer hose, suspension system, heat gain, stiffening rings, connections, design calculations, and other details of design and construction. Fabrication drawings shall indicate all dimensions of the hose assemblies, including the method of supporting inner flex hose. Installation, assembly, and sectional drawings shall be complete in all details. The manufacturer shall furnish two reproducible copies of approved drawings as part of the order. This applies on initial procurement only. The manufacturer therefore will not be required to comply with this specification when he can show that the drawings and data required herein has been previously furnished to the purchaser.

10. PROPRIETARY NOTICES:

Such notices on drawings or data submitted that would restrict the Government Representative from reproducing or using copies of these drawings and data as required for maintenance and operation of the subject components will be a basis for deeming the manufacturer's bid proposal non-responsive. The purchase of standard shelf-item soft goods will not necessarily be restricted to the manufacturer and therefore must not be covered by such proprietary restrictions.

11. APPROVAL OF DEPARTURES:

Any departures from these specifications deemed necessary by the manufacturer, shall be submitted for approval with the shop drawings. Approved departures shall be incorporated in the work at no additional cost.

12. RESPONSIBILITY:

Approval of shop drawings and data will not relieve the manufacturer from responsibility for deviations from these specifications and the codes referenced

herein, or for any error or omission which may exist, and the manufacturer shall be responsible for adequate design, details, fabrication and construction of all work.

13. FABRICATION:

Flexible hose shall be made so that inspection and cleaning can be accomplished. Approved welding procedures shall be followed using materials compatible with and recommended for use with the base metal. All protrusions and weld spatter shall be chipped or ground smooth to a sufficient degree to permit radiographic inspection. Care shall be taken that no voids, scale, blowholes, and/or other defects are present that would be detrimental to the performance or appearance of the flexible hose. In no case shall defective or unsatisfactory conditions exceed limitations specified by ASME requirements. All welds shall have 100 percent penetration. All mating parts shall be gaged to insure proper mating and interchangeability of like standard parts. Care shall be taken during construction to insure a high standard of cleanliness of all parts.

14. WELDING:

Stainless steel welding shall be the Gas Tungsten Arc Process. An inert gas purge shall be maintained during the root pass and all subsequent passes. All welding shall be performed and inspected in accordance with the ASME, Boiler and Pressure Vessel Code, Section VIII and IX for Unfired Pressure Vessels. Manufacturer shall certify that the welds are within required specifications.

		REFER TO SHEET NO. 1			
SYM	ZONE	DESCRIPTION		DATE	APPROVED
REVISIONS					
SIGNATURES		DATE	NATIONAL AERONAUTICS GEORGE C. MARSHALL SPACE FLIGHT CENTER		
DRAWN		12/67	MTSD GENERAL ELECTRIC		
CHECKED		2-7-68			
ENGINEER		2/26	FLEX HOSES, VACUUM JACKETED, GENERAL		
ISSUED		5-1-68			
SUBMITTED			SIZE DWG. NO. 54B00-GF01 REV. 1		
APPROVED		5-1-68			
USED ON		54B00-D001	AUTHORITY NASAw-410 Mod MSFC-1		SHEET 2 of 4

15. RADIOGRAPHY:

Inner Hose: All inner hose welds shall be 100 percent radiographed.

Outer Jacket: Outer jacket welds shall be spot radiographed.

Radiographing shall be in accordance with ASME, Boiler and Pressure Vessel Code, Section VIII, paragraph UW 51, for Unfired, Pressure Vessels.

16. ANNEALING:

All stainless steel shall be in the fully annealed condition before starting fabrication. Parts that are severely cold worked during fabrication shall be annealed before any welding is performed. Annealing or other approved heat treatment shall be compatible with, and shall not detract from, the maximum corrosion resistance characteristics of the material.

17. TOLERANCE:

On lineal dimensions the tolerance shall be plus or minus one and one half (1-1/2) Inches.

18. WITNESS OF TEST:

Prior to purchaser's acceptance, the flexible hoses shall be subjected to the following tests in the sequence listed herein. The purchaser's authorized representative shall witness all tests unless specifically waived in writing. The manufacturer shall notify the purchaser a minimum of 72 hours prior to a scheduled test sequence. Certified results of the tests shall be transmitted with the hoses.

19. PROOF TEST:

Inner Hose: Each hose shall be hydrostatically tested at 1.5 times the design pressure with the ends unrestrained and free to move. The hydrostatic test shall be performed using water filtered to remove particles that will not pass through a 400 mesh screen. Each section shall be proven tight by showing no decrease in test pressure for 5 minutes, with the pressure sources disconnected. Relief valves and other appurtenances shall be isolated and/or removed before testing and replaced following the test.

Outer Hose: The outer hose shall be pneumatically tested with dry air or nitrogen at 22 PSIG.

20. COLD SHOCK TEST:

Each cryogenic flexible hose shall be cold shock tested with liquid nitrogen. This test condition shall be maintained for a minimum of 10 minutes. There shall be no visible leakage.

21. VACUUM TEST:

The annular space shall be subject to a static vacuum test while the inner hose is pressurized with 10-90 helium-nitrogen mixture to the design pressure as indicated on the individual flexible hose drawings. The vacuum shutoff valve shall be closed for a period of at least 48 hours after the inner space has been evacuated to 10 Microns of mercury or less. The internal pressure shall be maintained on the inner pipe during this period of time. After 48 hours, the total pressure increase in the annular space shall be determined and evaluated. There shall be no indication of leakage into the annular space when checked with a mass spectrometer set to a sensitivity of 1 x 10⁻⁸ atmospheric CC's per second of helium.

22. HEAT GAIN:

A heat gain test shall be performed on one typical hose of each size, using liquid nitrogen. Ends shall be capped and insulated. The annular space shall be evacuated to 10 Microns of mercury absolute pressure of non-condensable gases at ambient temperature, and the inner line maintained full of liquid nitrogen by the use of a liquid nitrogen reservoir for a period of not less than 8 hours after temperature stabilization. During this 8 hour period, the vented gas shall be measured by an integrating type flowmeter and the results corrected for temperature, pressure, and the heat gain in the liquid reservoir used to maintain the liquid level in the pipe section. The average heat gain in the hose segment shall not exceed the value specified herein before. Manufacturer will certify the average heat gain through end connections and test equipment and the average heat gain of the hose assembly. The manufacturer shall submit, for approval, descriptions of the equipment to be used for the test, sketch of test loop, as well as test procedures.

		REFER TO SHEET NO. 1			
SYM	ZONE	DESCRIPTION	DATE	APPROVED	
REVISIONS					
SIGNATURES		DATE	NATIONAL AERONAUTICS GEORGE C. MARSHALL SPACE FLIGHT CENTER		
DRAWN		12/4/67	SPACE ADMINISTRATION MISSISSIPPI TEST FACILITY BAY ST. LOUIS, MISSISSIPPI		
CHECKED		2-2-68	MTSD GENERAL ELECTRIC		
ENGINEER		2-2-68	FLEX HOSES, VACUUM JACKETED, GENERAL		
ISSUED					
SUBMITTED					
APPROVED		MAR 15 1968	SIZE	DWG. NO.	REV.
USED ON			B	54B00-GF01	1
54B00-D001 NASAw-410 Mod. MSFC-1			AUTHORITY		SHEET
					3 of 4

23. REJECTION:

Failure to meet any of the above specified tests' requirements shall result in rejection of the equipment under test.

24. CERTIFICATION & REPORTS:

The manufacturer shall furnish three (3) copies of all certification and test reports to the purchaser within one week after completion of the work.

25. CLEANING:

Commercial clean. Flexible hose assemblies shall be cleaned in accordance with MSFC 164 (Level 1).

26. SHIPPING:

Hose assemblies shall have end connection covers, plugs or caps suitable to prevent moisture and/or contaminants entrance, with double polyethylene bags properly sealed prior to shipping or storage. Coiling and restraining with a non-metallic material is permitted as long as the coil tightness does not exceed the natural lay of the hose materials. When more than one assembly is shipped in one container, assemblies shall be packed to prevent chafing. Containers shall be legibly marked with minimum of 1/2 Inch letters as to contents by nomenclature, size and quantity each.

27. IDENTIFICATION:

Each hose shall be identified with the following information:

- Hose Type
- Design Temperature
- Design Pressure
- Proof Pressure
- Service
- Date of Proof Test
- Serial No.

		REFER TO SHEET NO. 1			
SYM	ZONE	DESCRIPTION		DATE	APPROVED
REVISIONS					
SIGNATURES		DATE	NATIONAL AERONAUTICS GEORGE C. MARSHALL SPACE FLIGHT CENTER		
DRAWN		2/6/68	SPACE ADMINISTRATION MISSISSIPPI TEST FACILITY BAY ST. LOUIS, MISSISSIPPI		
CHECKED		2/6/68			
ENGINEER		2/26	MTSD GENERAL ELECTRIC		
ISSUED		MAR 15 1968		FLEX HOSES, VACUUM JACKETED, GENERAL	
SUBMITTED					
APPROVED		5-1-68			
USED ON		54B00-D001	SIZE B DWG. NO. 54B00-GF01	REV. 1	
			AUTHORITY NASAw-410 Mod MSFC-1 Amend. 90	SHEET 4 of 4	