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**PRELIMINARY SERVICE SYSTEMS REQUIREMENTS
FOR THE NRDS VEHICLE TEST STANDS**

Prepared Under Contract No. NAS 8-5600

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TID/SNA -- 1634

NSP-62-18-REV 1 • 1 DEC 1962

NSP-62-18-REV 1

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FOREWORD

This document defines preliminary Service Systems requirements for the NRDS Vehicle Test Stands. It includes preliminary cooling-water requirements, preliminary propellant- and pressurization-systems design requirements, and preliminary data for electrical power and other related-systems requirements.

These systems, in part, shall constitute the Central Service Area and, except for the process-water storage tank, will be located generally in the area between and as close to the Vehicle Test Stands as is compatible with quantity-distance criteria selected by NASA and/or other applicable documents and the topography of the test site.

In this document, the words listed below are used with the following connotation:

- SHALL - Wherever "shall" is used in the sections of this document, a definite binding requirement is expressed.
- WILL - "Will" is used to express expected operation.
- SHOULD - "Should" or "would" when used expresses a recommendation or method of accomplishment.
- MAY - "May" or "can" express a suggested method of accomplishment.

NSP-62-18 was initially submitted on 24 September 1962 in accordance with the requirement of Item 5 of Report 253 in the RIFT Data Submittal Document, NSP-62-22, dated 22 September 1962. This revision is in accordance with the updating requirements of Report 253.

This document constitutes Part II of NRDS Stage Static Test Facility requirements. Part I will be published subsequently as document NSP-62-20.

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NOMENCLATURE

A-E	Architect-Engineering
AMR	Atlantic Missile Range
GH ₂	Gaseous Hydrogen
GN ₂	Gaseous Nitrogen
LH ₂	Liquid Hydrogen
LMSC	Lockheed Missiles & Space Company
LN ₂	Liquid Nitrogen
NASA	National Aeronautics and Space Administration
NPSH	Net Positive Suction Head
NRDS	Nuclear Rocket Development Station
SNPO	Space Nuclear Propulsion Office
TCC	Test Control Center
VTs	Vehicle Test Stand

Section 1
WATER SYSTEMS

1.1 GENERAL

The following water systems are the minimum required to serve the Vehicle Test Stands:

1. Process-Water Make-Up and Storage System
2. Exhaust-Structure Cooling-Water System
3. Radiation-Shield Water System
4. Deluge and Fire-Protection Systems

The method used to control the disposal of the nuclear-engine exhaust has not been decided at this time. The water systems required (if any) to be used in conjunction with the method selected may vary widely from the concepts presented below. For example, an open Exhaust-Structure Cooling-Water System with little likelihood of reusing the water for other test runs may be used. The discharge may be through open channels to a disposal pond rather than through piping systems as presented herein.

All water systems shall be monitored for radioactivity by the Stage Contractor. Sampling connections shall be provided in the systems for this purpose. Their number and location will be provided when the systems are designed.

In addition to the preliminary requirements described for each of the above systems, the following requirements shall be met:

- Heat exchangers, storage tanks, pumps, pipelines, etc.
throughout the area shall be sized to meet the individual service requirements.
- Standby capacity for all equipment shall be provided only as necessary to preclude the interruption or delay of tests or test schedules. This does not include redundant systems or back-up equipment used to facilitate maintenance operations (if and when installed).
- Necessary provisions shall be made to prevent freezing of all equipment and piping.
- All equipment and piping shall be constructed of materials resistant to corrosive elements contained within and environmental conditions without.
- Isolating valves, air-relief valves, check valves, pressure-relief valves, and other instrumentation controls shall be provided as required.

1.2 PROCESS-WATER MAKE-UP AND STORAGE SYSTEM

1.2.1 Purpose

Process Water will be used to cool the exhaust structure and radiation shield at the Vehicle Test Stands during startup, test, and cooldown periods of an engine test run as well as for the deluge and fire-protection requirements

described in Section 1.5.1 A suggested scheme for providing this Process Water is shown in Fig. 1.

Since the Process Water used at the test stands is subject to high radiation flux from the test-engine reactor, it may be necessary to remove most of the dissolved minerals in the water prior to its use to preclude the possibility of generating large quantities of radioactive liquids that would exceed the maximum permissible limits of activation as established at NRDS. In addition, as the formation of mineral deposits within the cooling-water passages of the exhaust structure could create hot spots and cause the subsequent failure of the structure walls, some water treatment is indicated.

1.2.2 Requirements

The total process-water storage requirement for any one test run is a function of the exhaust-structure and radiation-shield designs. These design data are not presently available. Therefore, any capacities or rates of cooling water used herein are order-of-magnitude only and subject to revision.

The capacity of any water-treating plant specified by the A-E shall be based on recharging the storage tank to full capacity in seven calendar days. In addition, the plant shall be capable of producing treated water with the maximum solid content specified from the raw water supplied to the RIFT Stage Facility at NRDS.

1-4

Fig. 1 Process-Water Make-Up and Storage System

The storage tank shall be a welded cylindrical steel tank with conical roof. All internal surfaces, including the underside of the roof, and all surfaces in contact with the process water shall be given a corrosion-resistant coating.

1.3 EXHAUST-STRUCTURE COOLING-WATER SYSTEM

1.3.1 Purpose

The exhaust structure, which handles hot gaseous hydrogen discharged by the nuclear-rocket engine, will require cooling to maintain structure temperatures at reasonable levels for structural strength.

1.3.2 Requirements

The requirements for this system shall be as shown in Fig. 2.

At the present time, due to lack of development of design information on the exhaust structure, no firm estimate of the exhaust-structure cooling-water requirements can be made.

Figure 2 presents two methods of disposing of cooling water from the exhaust structure. A study has been made by SNPO-Nevada of the water-supply system at NRDS-Nevada in relation to presently planned and future water requirements for NRDS facilities including the RIFT Stage Facilities. The A-E shall use the results of this study, plus the confirmed flow rates of cooling water to the structure and other pertinent data, to decide on which method shall be

1-6

Fig. 2 Exhaust-Structure Cooling-Water System

used. Decision shall be based on providing a highly reliable cooling-water source in line with good economic practices. If the water supply at NRDS is limited as determined by the above-mentioned study, the A-E shall propose additional alternates.

1.4 RADIATION-SHIELD WATER SYSTEMS

1.4.1 Purpose

Since the nuclear engine must be shielded at the test stand and since this shield will absorb heat generated by absorption of nuclear radiation, a cooling-water system or systems may be required. If the shield has a tank-type configuration, it may contain borated water for the attenuation of reactor neutron flux and subsequent gamma radiation. This borated water would be exchanged with process water from the storage tank to remove the heat picked up by the borated water in the radiation shield. Other shield configurations may involve a series of cooling coils to control shield temperatures. In this case, the water would be exchanged with process water as above, and again, the water may require borating.

1.4.2 Requirements

Requirements for the above two systems shall be generally as shown in Fig. 3. As in the case of the exhaust structure, cooling is required primarily to maintain structural integrity of the surfaces of the shield. The system shall provide for a limited bulk temperature rise of the borated water to keep this

1-8

Fig. 3 Radiation-Shield Water System

water below boiling temperatures. Process water must be kept on the high-pressure side of the exchangers to prevent leakage of radioactive water into the process-water system.

1.5 SURFACE DECONTAMINATION AND FIRE-PROTECTION SYSTEMS

1.5.1 Purpose

Fire protection shall be provided for the Vehicle Test Stands and shall be designed for automatic actuation by fire signals at all times other than when the RIFT Stage is in the vicinity or mounted in a Vehicle Test Stand.

Fire prevention shall be accomplished for the RIFT Stage itself with the Equipment and Interstage Purge subsystem described in Section 2, paragraph 2.2.5.5, this document.

Decontamination of the Vehicle Test Stands shall be required after a test firing and after the RIFT Stage has been removed from the test area.

1.5.2 Requirements

The Surface Decontamination and Fire-protection Systems using water shall be as arranged in Fig. 4. Attention is called to the fact that water must not at any time come in contact with the nuclear engine. All valves in the system and subsystems shall have positive interlocks to preclude the actuation of the systems, while the RIFT Stage is in position or in the vicinity of the Vehicle Test Stand. With the RIFT Stage removed from the Vehicle Test Stand

1-10

Fig. 4 Surface Decontamination Deluge and Fire-Protection System

area, the surface decontamination portion of the system may be operated manually and the fire protection portion of the system shall be operated automatically by fire signals.

The term fire protection as used herein is to be interpreted literally; i.e., it is a system designed to protect the installation and equipment from hydrogen and/or other fire damage insofar as practicable. It is not intended to be used for fire extinguishing beyond the system's inherent ability to do so to a limited extent. The capacity of the system, therefore, shall be sufficient to keep all fire-exposed supporting structures and equipment cool enough to preserve their structural integrity. The surface decontamination deluge feature of the system is intended to satisfy the surface-decontamination requirement and as such shall be considered separately insofar as flow rates, types of nozzles, system layout, and valving are concerned. It is expected nonetheless that most of the system will be designed to serve a dual purpose as stated above.

Section 2

NRDS VEHICLE-TEST-STAND CRYOGENIC AND PNEUMATIC SYSTEMS

2.1 GENERAL

This section defines tentative design requirements for cryogenic and pneumatic service systems necessary to support the Vehicle Test Stand operations for the RIFT Program at the Nuclear Rocket Development Station in Nevada. These service systems shall be compatible with the requirements of the AMR launch operations.

2.1.1 Ground-Service Units

The Cryogenic Flow and Pressurization Systems (see Fig. 5) will include the following ground-service units, which will receive facility fluids and control and transmit them to the RIFT Stage:

- Engine After-Cooling System
- Propellant-Transfer System
- Pneumatic-Pressurization System

Control-Pressure and Umbilical Purge Subsystem

Attitude-Control Pressurization Subsystem

Engine-Accumulator Charge Subsystem

Equipment and Interstage Purge Subsystem

Stage-Accumulator Purge and Charge Subsystem

Propellant-Tank Purge and Drain Subsystem

Fig. 5 Block Diagram, Cryogenic Pressurization Facility, GSE, CFF

2.1.2 Facility Items

The Cryogenic Flow and Pressurization Systems will include the following facility items:

- Liquid-Hydrogen Supply Dewar
- LH_2/GH_2 Recharger
- Gaseous-Hydrogen Supply Battery
- Liquid-Nitrogen Supply Dewar
- LN_2/GN_2 Recharger
- Gaseous-Nitrogen Supply Battery
- Helium Compressor
- High-Pressure Helium Supply Battery
- Demineralized Water Supply
- GH_2 Disposal System
- Vacuum Pumps
- Attendant Valving, Piping, and Their Installation

2.1.3 General Requirements

The facility shall provide all necessary controls and instrumentation for the purging and cooldown of liquid-hydrogen lines up to the Stage Contractor-furnished ground-service units (see Section 2.2).

Local and remote pressure indicators for all facility systems shall be provided, as required, for safe operation of the facility.

Appropriate relief valves, rupture-disc and drain or vent valves, shall be provided on all facility systems.

The controls and instrumentation of the facility system shall be compatible with the Stage Contractor-furnished computer-controlled checkout systems.

2.2 GROUND SERVICE UNITS

2.2.1 General (See Fig. 6, LMSC 6995023)

Operational equipment as described in this report is to be regarded as typical of the final equipment which will subsequently be developed.

2.2.2 Propellant-Transfer System

2.2.2.1 Purpose. This stage-contractor furnished system is required (1) to furnish four flow rates to the stage: line chilldown, rapid load, fine load, and topping; (2) to control draining in the event of an abort; and (3) to provide for controlling the flare with helium. To accomplish liquid flow, two pressure schedules will be used in the LH_2 supply tank and two liquid-flow control valves will be used. Chilldown flow will be obtained by opening the smaller of the two liquid valves and starting pressurization to high transfer pressures. This will start flow to the system and gradually build it to a fine-load rate. Upon sensing liquid in the stage propellant tank, the second larger valve will open and rapid load will begin. Rapid load will continue until reaching the 95-percent liquid level, when the larger valve will close. The chilldown (fine load) valve will remain open. Upon reaching 99.5 percent,

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the transfer pressure will begin to vent, thereby slowing the flow of liquid hydrogen. Venting of the supply tank to topping pressures will take approximately 600 seconds. Upon reaching 100 percent, the fine-load valve will close and thereafter will modulate between 99.8 percent and 100.2 percent probes.

For drain, a separate valve will be provided in order not to back-flow the supply-line filter.

2.2.2.2 Interface requirements. The propellant-transfer system is to be located at ground level at the base of the umbilical tower. Inputs to it of high-pressure nitrogen, helium, and hydrogen gas are required from facility supply sources. In addition, it will receive and control liquid hydrogen flow to the stage. Launch logic will be required to actuate the system on a planned program; responses from the unit are to be in the form of valve-position switches, pressure-transducer signals, and pressure-switch signals.

2.2.3 Electronic Package Cooling System

2.2.3.1 Purpose. The MSFC-furnished instrumentation unit and the RIFT Stage electronics package will require cooling from a ground cooling unit. Details of the unit are not available at this time; however, it is anticipated that this cooling unit shall require make-up water and power. Actual requirements will be furnished when available. The unit shall be located in the umbilical tower.

2.2.4 Engine After-Cooling Module

2.2.4.1 Purpose. After each static test of the nuclear engine, the reactor core must be cooled, using various gases. Present planning provides for using hydrogen, helium, nitrogen, and air. Initial cooling with hydrogen will be required for a short period of time, using the hydrogen available in the stage tank. Helium gas piped to the engine through an aft stage umbilical connection will then be used for approximately 30 minutes, followed by nitrogen for approximately 48 hours. Subcooling of the engine to 0°F with nitrogen gas, while the stage is at the test stand, shall be required.

If a method can be developed for using hydrogen gas instead of helium for the second cooling cycle, without creating a fire hazard at the test stand, then the helium requirements listed in Section 2.4.3 may be greatly reduced. The cooling time, or the total scf of gas required if GH_2 were used, would necessarily increase because of the difference in heat-transfer characteristics of the two gases. The GH_2 storage requirement listed in Section 2.4.1 does not account for this alternate method of engine cooling.

A reactor-cooling module will be provided at the Vehicle Test Stands and will control the flow of cooling gases to the reactor.

2.2.4.2 Interface requirements. The engine-cooling system is to be located at ground level at the base of the umbilical tower. Inputs to it of high-pressure nitrogen, helium, and hydrogen gas shall be supplied from facility supply sources. Shut-down logic will be required to actuate the system on a planned program; responses from the unit are to be in the form of valve-position switches, pressure-transducer signals, and pressure-switch signals.

2.2.5 Pneumatic Pressurization System

2.2.5.1 Interface requirements. The pneumatic-pressurization system will service both RIFT Stage umbilicals. Location of the RIFT umbilical connections are shown in Fig. 7. Inputs to the pneumatic-pressurization system of high-pressure nitrogen, helium, and hydrogen gas shall be supplied from facility supply sources. The system shall be designed to compensate for varying inlet pressures because of supply decay as well as normal pressure drops. Launch logic will be required to actuate the system on a planned program. Responses from the units are to be in the form of valve-position switches, pressure-transducer signals, and pressure-switch signals.

2-10

Fig. 7 RIFT Umbilical Connection Locations

2.2.5.2 Control pressure and umbilical purge subsystem. Instrument-control pressure is required for pressure control and valve operation for this and the following subsystems and will be supplied at all times when the stage is in the stand. The umbilical-purge and ejection pressure may be shut off manually during standby conditions. A failure in any portion of the automatic system will be sensed by pressure switches provided, and a signal will close the normal supply valves and open an emergency supply valve, thereby insuring continued operation of the launch sequence.

2.2.5.3 Attitude-control pressurization subsystem. The stage bi-propellant attitude-control system will require an airborne supply of gaseous nitrogen at approximately 3,000 psig. In the event of an abort, the attitude-control accumulator will be vented through the exhaust valve.

2.2.5.4 Engine-accumulator charge subsystem. To function properly, the engine requires gaseous hydrogen and gaseous nitrogen in two separate systems. These will be provided through the engine-accumulator charge subsystem. The nitrogen accumulator(s) will be supplied at approximately 1,000 psig. In the event of an abort, the accumulator(s) will be vented through the exhaust valve. The hydrogen accumulator(s) will be supplied by a similar system at approximately 650 psig.

2.2.5.5 Test-stand substructure and equipment section purge subsystem. In order to preclude the possibility of a fire in the test-stand substructure and equipment section of the stage as a result of a possible hydrogen leak, it is necessary to purge those sections of all oxygen. Nitrogen will be supplied to the sections through an umbilical prior to countdown start. Inasmuch as an orifice will relieve pressure in the event of an abort, no dump valve is necessary on the ground.

2.2.5.6 Stage-accumulator purge and charge. Inflight propellant-tank pressures are supplied by an airborne accumulator and GH_2 pneumatic system. Since contamination by oxygen creates a fire hazard and contamination by nitrogen an engine failure hazard, it is necessary to first purge the accumulator of oxygen by cyclic pressurization with nitrogen. This will be accomplished prior to propellant-tank purge. Secondly, the accumulator will be purged of nitrogen in a similar manner, using GH_2 . Upon completion of the purge operation, the system will be brought to flight pressures and held there until test or abort. In the event of an abort, inflight pressure will be vented to the GH_2 exhaust disposal system.

2.2.5.7 Propellant-tank purge and drain subsystem. The stage propellant tank must be purged of air prior to propellant loading in order to eliminate the possibility of a fire, and then be purged of the inerting gas in order to eliminate propellant contamination. To insure elimination of essentially all air and all inerting gas, it will be necessary to reverse the flow of the purging gas to the tank. This subsystem accomplishes this end through several

pneumatically operated, electrically actuated valves which may be controlled manually from the TCC or through the logic. Programming of nitrogen or hydrogen to either the forward vent line or the aft fill line will be possible. Readout of the pressures in the propellant tank will be provided to the operator from a pressure transducer, and in the event of a failure in the automatic pressure system, pressure switches will close all inlet and outlet valves. The operator may then assume control through the emergency system. The emergency system is restricted to pressurizing through the upper vent lines and venting through the lower fill line; however, the operator may supply either nitrogen or hydrogen, depending on which was being used at the time of failure in the automatic system.

This same subsystem is to be used for the propellant-drain sequence, and at that time launch logic will prohibit use of nitrogen gas.

This system may be used for a third purpose if required: for purging the vent line to the flare stack and the fill-line drain prior to test.

Purge of the liquid-hydrogen fill line concurrent with propellant-tank purge somewhat complicates the programming of this operation, and care must be exercised to design the entire system to eliminate all air and finally all gaseous nitrogen prior to chillover and load.

2.3 FACILITY ITEMS

2.3.1 Cryogenic Storage

2.3.1.1 LH₂ storage dewar. The supply demand for LH₂ shall require a storage capacity of about 460,000 lb (780,000 gal) as tabulated below:

1. Propellant Loading	210K lb [*]
2. GH ₂ Purge Gas Supply	25K lb
3. Cooldown and Loading Losses	40K lb
4. Abort Loading and Reloading Contingency	50K lb
5. Replenishment (12 hrs at 150 gpm)	63K lb
6. Engine Shutdown Cooling	5K lb
7. Minimum Liquid Level Allowance	7K lb
8. Resupply Logistics Contingency, Including Bcilloff Losses	<u>60K lb</u> 460 K lb

For storage tank sizing purposes, the required ullage space shall be added to the above to arrive at the equivalent water volume of the storage dewar required.

This storage tank shall be a vacuum, perlite-insulated, double-walled, spherical dewar designed for 100-psig maximum working pressure and a maximum normal evaporation rate of 0.06 percent per day. The inside shell shall be constructed of aluminum or austenitic stainless steel, but the outer shell can be low-carbon steel.

* The initial stage design loading is 176 K lb. Facility design is based on an initial growth estimate of 206 K lb.

2.3.1.2 LN₂ storage dewar. The supply demand for LN₂ shall require a storage capacity of approximately 50,000 gal at about 50 psig working pressure. The dewar heat leak shall not exceed 1 percent per day.

Where the distance from storage to the LN₂/GN₂ rechargers is appreciable, adequate NPSH to the rechargers shall be provided.

2.3.2 High-Pressure Gas Storage

2.3.2.1 GH₂ storage. A GH₂ high-pressure gas-storage battery of 3,000,000 standard cubic feet (scf) capacity at 3,500 to 4,500 psig shall be required.

2.3.2.2 GN₂ storage. A GN₂ high-pressure gas-storage battery of 2,000,000 scf capacity at 5,000 to 6,000 psig shall be required.

2.3.2.3 GHe storage. A GHe gas-storage battery of approximately 1,500,000 scf capacity at 5,000 to 6,000 psig shall be required.

2.3.3 Equipment

2.3.3.1 Purge-gas and boiloff-gas venting system requirement. The purge-gas and boiloff venting system shall provide the propellant-transfer system with immediate disposal of the propellant-tank efflux. The purge venting at other sections of the transfer system, the initial purge venting of the storage dewar and its fill line at each charging, and the regular venting of the storage boiloff shall also have adequate disposal provisions. A maximum of 2-psig vent-system back pressure will be tolerated under maximum flow conditions. This vent shall have sufficient capacity to handle all stage efflux

and for the evacuation of the propellant loading and pressurization umbilicals. It shall be disposed of by atmospheric dispersion, either with or without burning, based on safety, reliability, and cost aspects.

2.3.3.2 Vacuum equipment (vacuum subsystem). If required by the transfer piping, the vacuum subsystem shall utilize vacuum forepumps, holding pumps (where static vacuum is not maintained), and diffusion units designed for safe use, on a high order, in hydrogen atmospheres.

Vacuum levels shall be maintained at about 10-micron mercury pressure at ambient temperature.

2.3.3.3 LH₂/GH₂ recharger. LH₂/GH₂ rechargers, capable of a maximum of 400,000 scfh at 3,500 to 4,500 psig delivery on 12-hour continuous duty, shall supply the GH₂ high-pressure gas storage battery.

2.3.3.4 LN₂/GN₂ recharger. LN₂/GN₂ rechargers, capable of 200,000 scfh at 6,000 psig delivery on 12-hour continuous duty, shall supply the GN₂ high-pressure gas storage battery.

2.3.3.5 GHe compressors. GHe compressors, capable of 100,000 scfh at 5,000 to 6,000 psig delivery on 10-hour continuous duty, shall be required to supply a high-purity GHe high-pressure gas storage battery.

2.3.3.6 LH₂ and LN₂ filter separators. LH₂ and LN₂ filters shall be provided to filter out all impurities larger than 40 microns at minimum pressure drop. They shall have minimum heat leak and cooldown characteristics.

2.3.4 Cryogenic Piping and Valves

2.3.4.1 General. All cryogenic piping systems shall be of economical construction and have high leak-tightness reliability. They shall have minimum susceptibility to cooldown loss, heat leak, and maintenance. They shall contain no pockets or traps for gaseous contaminants. The A-E contractor shall specify piping up to Stage Contractor-furnished ground-service units, and the Stage Contractor will specify the piping from these units to the stage umbilicals. Requirements for an electrostatic-suppression system shall be developed by the A-E and used on all piping systems to prevent the spontaneous ignition of hydrogen leakage.

2.3.4.2 LH₂ piping. Superinsulated vacuum-jacketed piping shall be provided for LH₂ service from the main LH₂ storage dewar to the interface connection.

2.3.4.3 LN₂ piping. All piping in LN₂ service shall be insulated with foam glass insulation, except the main supply line to the LN₂/GN₂ rechargers, which shall be vacuum-jacketed.

2.3.4.4 valves. All valves shall be vacuum-jacketed, packless (bellows-sealed stems) and of low-cooldown-mass design. Flow-control valve selection shall be based on low pressure-drop ratings, positive shutoff performance, reliability, rapid-response, and remote-control with dry-nitrogen actuation. Position indication for remote display shall be provided.

2.4 SITING REQUIREMENTS

It is anticipated that in meeting the requirements for siting of the equipment used in the cryogenic and pneumatic systems as specified in Section 1 of the RIFT Site Development and Utilities Requirements document, NSP-62-3 Rev. 1 dated 10 December 1962, the above-described equipment will be generally located between Vehicle Test Stands E-VTS-3 and VTS-4. This initial installation will not provide sufficient redundant capacity as back-up to allow for maintenance operations on the systems. Future installations of similar systems between VTS-4 and VTS-5 will provide the required redundancy. Valved connections shall be provided on the headers that are installed initially to allow for tie-in to the future systems without major alteration.

Section 3

ELECTRICAL REQUIREMENT

3.1 SYSTEMS OPERATIONS REQUIREMENTS

The utility system shall normally furnish all power to electrical loads in the Central Service Area. If at any time utility power fails, sufficient emergency power shall be available from an engine-generator to bring all test activities to a safe condition. If power fails during a propellant loading, for instance, emergency power shall be adequate for emptying the stage tank, returning the liquid hydrogen to storage and purging the stage tank and the propellant-transfer system. The noncritical loads shall be without electrical power until the restoration of utility power. For a description of the engine-generator and the modes under which it shall operate, see NSP-62-3, Preliminary RIFT Site Development and Utility Requirements, Section 6.2, System Operation Requirements.

3.2 CLASSIFICATION OF ELECTRICAL LOADS

Loads are divided into three classes: critical loads, essential loads, and noncritical loads.

Critical loads are those loads which, if interrupted, would cause a hazard to life or property.

Essential loads are those loads which, if interrupted, would cause the shut-down of a test in progress with a subsequent costly loss of test data and objectives.

Noncritical loads are those loads which, if interrupted, would not endanger life or property or cause the shutdown of a test.

The following abbreviations are used for the three classes of loads:

Critical Load	- C
Essential Load	- E
Noncritical Load	- NC

3.3 CENTRAL SERVICE AREA ELECTRICAL LOADS

The following listing of electrical loads is preliminary. It will be modified as new information becomes available.

<u>Load</u>	<u>kva</u>	<u>Class</u>
PROCESS WATER SYSTEM		
Make-up Pump 1	60	NC
Make-up Pump 2	60	NC
Cooling-Tower Fan (If required)	30	NC
Return Pump (If required)	40	NC
Demineralizer (If required)	2	NC
Area Lighting	2	NC
Controls	10	E
Air-Navigation-Obstruction Lighting	1	NC
Electronics-Cooling Control Module	20	E

<u>Load</u>	<u>kva</u>	<u>Class</u>
Radiation-Shield Water System Circulating Pump 1	100	C
Radiation-Shield Water System Circulating Pump 2	100	C
Radiation-Shield Water System Circulating Pump 3	100	C
Radiation-Shield Water System Circulating Pump 4	100	C
Radiation-Shield Water System Circulating Pump 5	100	C
Radiation-Shield Water System Circulating Pump 6	100	C

CRYOGENIC SYSTEMS

Filling Station Lighting	2	NC
Pipeline Lighting	15	NC
LH ₂ /GH ₂ Recharger 1	200	NC
LH ₂ /GH ₂ Recharger 2	200	NC
LH ₂ /GH ₂ Recharger 3	200	NC
LH ₂ /GH ₂ Recharger 4	200	NC
LN ₂ /GN ₂ Recharger 1	200	NC
LN ₂ /GN ₂ Recharger 2	200	NC
LN ₂ /GN ₂ Recharger 3	200	NC
LN ₂ /GN ₂ Recharger 4	200	NC
Area Lighting	7	NC
Helium Compressors	300	NC
Vacuum Roughing Pump	25	NC
Diffusion Pump	3	NC
Hydrogen-Monitoring Alarm System	5	C

Summary of Central Service Area Electrical Loads (Connected)

<u>Critical (kva)</u>	<u>Essential (kva)</u>	<u>Noncritical (kva)</u>
605	30	2152