

AEROSPACE INFORMATION REPORT

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Aerospace Ground Equipment Criteria for a Propellant Transfer Unit

FOREWORD

A group of knowledgeable specialists in the Aerospace Ground Equipment field were called upon to provide a useful guide in preparing a specification for design of a propellant transfer unit used in conjunction with weapon or space vehicle systems. The following information report is based on their experience in the equipment and operations areas. As more data becomes available and state-of-the-art launch operations advance, it is the intention of this committee to continue to pursue this area to update these recommendations.

The committee recognizes that an all-inclusive approach for the entire spectrum of the weapon and space vehicle field is not possible. In preparing this information report, only those variables are included which identify a certain class of vehicles for specific conditions. The recommended performance and system requirements are intended as typical or representative within the scope of this document.

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TABLE OF CONTENTS

1. INTRODUCTION	4
2. GENERAL REQUIREMENTS FOR PROPELLANT TRANSFER UNIT	5
3. PERFORMANCE AND SYSTEM REQUIREMENTS	5
3.1 General Requirements	6
3.1.1 Design Requirements	6
3.1.2 General Procurement Specifications	6
3.1.3 Major Components	6
3.1.4 Purchased Piece Parts	6
3.1.5 Tolerances	6
3.2 Materials and Processes	6
3.2.1 Specifications and Standards	6
3.2.2 Materials	6
3.2.2.1 Standard Parts	6
3.2.2.2 Other Materials	6
3.2.2.3 Protective Treatment	6
3.2.2.4 Welding	7
3.2.3 Qualification Requirements	7
3.2.4 Fluid Compatibility	7
3.2.4.1 Fluid Compatibility - Operation with UDMH	7
3.2.4.2 Fluid Compatibility - Operation with IRFNA	7
3.2.4.3 Fluid Compatibility - Operation with Hydrazine	7
3.2.4.4 Fluid Compatibility - Operation with N_2O_4	8
3.2.5 Electrical Power	8
3.2.6 Bonding	8
3.3 Design Characteristics	8
3.3.1 General Design	8
3.3.2 Detail Design Characteristics	8
3.4 Design Capability	8
3.5 Construction	9
3.5.1 Propellant Transfer Unit	9
3.5.2 Piping System	9
3.5.3 Electrical Systems	9
3.5.4 Pneumatic Control System	9
3.5.5 Controls and Instrumentation	9
3.6 Maintainability and Interchangeability	10
3.7 Performance	10
3.7.1 Fueling and Defueling	10
3.7.2 Flushing and Drying of Lines and Tank	10
3.7.3 Adjustment Provisions	10
3.7.4 Temperature Conditioning	10

TABLE OF CONTENTS (Continued)

3.7.5	Environmental Conditions	10
3.7.5.1	Transportation, Handling and Storage - Nonoperating, Uncontrolled Environments	11
3.7.5.1.1	Temperature	11
3.7.5.1.2	Atmospheric Pressure	11
3.7.5.1.3	Humidity	11
3.7.5.1.4	Salt Fog	11
3.7.5.2	Operation - Sheltered, Uncontrolled, Unexposed to Booster Blast Environments	11
3.7.5.2.1	Sheltered Environments	11
3.7.5.2.1.1	Temperature	11
3.7.5.2.1.2	Atmospheric Pressure	11
3.7.5.2.1.3	Humidity	11
3.7.5.2.1.4	Explosive Atmosphere	11
3.7.5.2.2	Uncontrolled Environments	12
3.8	Component Performance	12
3.8.1	Propellant Transfer and Circulating Pump	12
3.8.2	Fume Scrubber	12
3.8.3	Heat Exchanger	12
3.8.4	Propellant Tank Weigh Scale	12
3.8.5	Propellant Weigh Tank	13
3.8.6	Bubbler Capacity	13
3.9	External Leakage	13
3.10	Dimensions	13
3.11	Weight	13
3.12	Color	13
3.13	Finish	13
3.14	Nameplate and Product Markings	14
3.14.1	Identification of Product	14
3.14.2	Instruction Plates	14
3.14.3	Markings	14
3.14.4	Identification Markings	14
3.14.5	Nomenclature	14
3.15	Workmanship	14
3.16	Deviations	14

1. INTRODUCTION:

The primary purpose of a Propellant Transfer Unit (PTU) is to temperature-condition and weigh a specific amount of propellant, and transfer it to a vehicle propellant tank.

A secondary purpose of a PTU may be to drain propellant from the vehicle tank and return it to the transfer unit when required. The transfer unit may also be used for flushing the vehicle fill lines and transfer unit with appropriate flushing fluids, followed with nitrogen for the purpose of drying the lines and weigh tank. The transfer unit may include provisions for helium purging of the propellant transfer tank and lines, and supplying a blanket of helium pressure to the transfer tank.

Each PTU consists of a piping system with appropriate propellant and pneumatic valves, regulators, relief valves, filters and a propellant pump. Various components such as a scrubber, bubbler, propellant cooler (heat exchanger), propellant weigh tank, weigh scale and a chiller may make up the balance of the assembly. The PTU is an integrated assembly with all components mounted on a common support frame. Protective covers are provided for those units which operate outside of a controlled environment area.

Items to be specified prior to design of the PTU include:

- a. Operational Environment - Temperature limits, atmospheric pressure limits and explosive atmosphere.
- b. Electrical Input -

<u>AC</u> Voltage Amperes Frequency Single or 3-Phase	<u>DC</u> Voltage Amperes
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- c. Liquid Input - e.g., Inhibited red fuming nitric acid (IRFNA), unsymmetrical dimethyl hydrazine (UDMH), hydrazine, nitrogen tetroxide (N_2O_4), water and/or flushing fluids.
- d. Gas Input - Helium, Nitrogen or other.
- e. Control Functions - Local control at unit, local readout functions, remote control from blockhouse, and readout from blockhouse.
- f. Scale System - Transfer accuracy and maximum readable scale loading.

1. (Continued):

- g. Liquid Transfer - Transfer rate, circulation rate, transfer outlet size, filtration and transfer temperature.
- h. Temperature Conditioning - Cooling capacity, heating capacity, refrigerant cooling medium, and propellant heat exchanger cooling capacity.

2. GENERAL REQUIREMENTS FOR PROPELLANT TRANSFER UNIT:

The detail specification for the propellant transfer unit should include Scope, Effectivity (part number, model number and propellant fluid usage), and Purpose.

A section of the specification should be provided for identification and tabulation of documents which shall include applicable Military Specifications, Federal Standards, Military Standards, Publications, Contractor Specifications and Drawings, and other Publications.

Typical Performance and System Requirements are provided in an expanded section 3. which follows.

A Product Assurance section should be included in the specification. The general Quality Assurance Provisions should include instructions for the Requirement of Inspection and Rejection of PTU Components. Additional instructions, identified as Test Equipment, Examination of Product, and Adjustments and Repairs During Test should become a part of the specification. A subsection entitled "Acceptance Tests" should be included and provide for such items as Test Methods (Examination of Product, Electrical Continuity and Functional Tests), Test Conditions, Tolerances (Temperature, Barometric Pressure and Relative Humidity) and Electrical Continuity. Requirements for "First Article" tests should be identified for those tests which are not to be repeated on subsequent items. In addition, Functional Tests should form a subsection of Electrical Tests and Mechanical Tests (External Leakage Check, Pneumatic Control System and Operational Tests).

A Preparation for Delivery subsection should include instructions for Packaging for Shipment and Storage, Marking for Shipment and Tank Loading.

The last section of the general specification should identify Intended Use and Test Reports.

3. PERFORMANCE AND SYSTEM REQUIREMENTS:

Within the general specification the performance and systems requirements should be identified as Requirements. A typical section is detailed herein to expand on the specific functions for a typical Propellant Transfer Unit.