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INSTALLATION CRITERIA
ETS-1 TEST STAND ADAPTER

OCTOBER 1966
NERVA PROGRAM CONTRACT SNP-1

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**INSTALLATION CRITERIA
ETS-1 TEST STAND ADAPTER**

NERVA PROGRAM

CONTRACT SNP-1

ROCKET ENGINE OPERATIONS - NUCLEAR

OCTOBER 1966

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INSTALLATION CRITERIA
ETS-1 TEST STAND ADAPTER

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ABSTRACT

These criteria describe the requirement for the installation and check-out of the Test Stand Adapter (TSA) on the facility thrust ring in ETS-1 and along with the referenced documents form the basis from which the detailed procedure may be developed to accomplish these tasks.

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I. SCOPE

A. SCOPE

These criteria describe the requirements for the installation and check-out of the Test Stand Adapter (TSA) on the facility thrust ring in ETS-1.

1. Description

The TSA will be mechanically installed and aligned; fluid lines will be connected and leak checked, and electrical leads will be connected and checked for proper continuity and ground.

II. APPLICABLE DOCUMENTS

A. DEPARTMENT OF DEFENSE DOCUMENTS

Unless otherwise specified, the following documents, listed in the latest issue of the Department of Defense Index of Specifications and Standards, shall form a part of these criteria.

1. Specifications

Military

MIL-S-7742	Screw Threads, Standard, Optimum Selected Series, General Specification for
MIL-P-27401	Propellant Pressurizing Agent Nitrogen
MIL-P-27407	Propellant Pressurizing Agent Helium
MIL-D-70327	Drawings, Engineering and Associated Lists

2. Standards

Military

MIL-STD-130 Identification Marking of U.S. Military Property

MIL-STD-143 Specification and Standards, Order of Precedence for the Selection of

Air Force - Navy Aeronautical Design

AND - 10357 Colors, Fluid Line Identification

3. Publications

Military Handbook

MIL-HDBK-5 Strength of Metal Aircraft Elements

B. OTHER DOCUMENTS

Unless otherwise specified, the following documents, of the latest issue in effect, shall form a part of these criteria.

1. Publications

a. National Aeronautics and Space Administration

NPC 200-2 Quality Assurance Provisions for Space Systems

NPC 200-3 Inspection System Provisions for Suppliers of Space Materials, Parts, Components and Services

b. Marshall Space Flight Center

Engineering Standards Manual (5 volumes)

C. AEROJET-GENERAL CORPORATION DOCUMENTS

Unless otherwise specified, the following documents, of the latest issue in effect, shall form a part of these criteria.

1. Specifications

AGC-46351	Fusion Welding
NTO-6501	ETS-1 Interface System

2. Standards

AGC-STD-1004	Terminology, Symbols and Abbreviations for NERVA Nuclear Rocket Engines
AGC-STD-1151	Inspection, Radiographic, Materials, Procedure for
AGC-STD-3010	Inspection Penetrant
AGC-STD-9007	Cleanliness Levels, Components and Assemblies
ASD-5215	Marking, Methods of
NTO-A-0030	ETS-1 Administrative Document
NTO-SOP-0044	Workmanship Standards Manual
NTO-SOP-0047	Compatible Lubricants, Sealants, Gaskets, Cleaning Fluids, and Materials at ETS-1
NTO-SOP-0050	Color Coding and Line Ident
NTO-SOP-0054	Pressurized Equip and Systems ETS-1
NTO-SOP-0058	Use of Torque Wrenches and Torque Sealant at ETS-1
NTO-SOP-0059	Use or Hold Fire, Caution, Danger-Do-Not-Operate, and Remedial Action TAOS at ETS-1
NTO-SOP-0060	Reporting Hardware Discrepancies at ETS-1
NTO-SOP-0064	ETS-1 Tubing Standards
NTO-SOP-0065	Control and Storage of ETS-1 Valves, Filter Visual Gages and other Facility Hardware Including Spare Parts

3. Drawings

1010058	Interface Control Drawing
1115070	Ring, Adapter
1114010	Structure Assembly - Adapter
1117116	Support, Angle
921E504	ETS-1 Interface System - Thrust Ring Plan, Elevations
921E505	ETS-1 Interface System - Thrust Ring Sections and Details
921E506	ETS-1 Interface System - Thrust Ring Sections and Details
1117088	Test Stand Adapter Assembly
1114920	Pneumatic System Installation TSA

4. Aerojet Reports

2275	Material Properties Data Book
2487	NERVA Reliability and Quality Assurance Program Plan

III. GENERAL REQUIREMENTS

A. STRUCTURAL ALUMINUM

The current rules and practices set forth in the American Society of Civil Engineers (ASCE), "Specification for Structures of Aluminum Alloy, 6061-T6" and supplements, and the "Aluminum Construction Manual" shall govern this work, except as otherwise noted on the drawings or as otherwise specified.

B. MATERIALS

Materials shall be as shown on drawings.

C. WORKMANSHIP AND PROCEDURES

All material and equipment shall be fabricated and installed in accordance with the approved procedures and shall conform to the specification, drawings, and other referenced documents.

1. Qualification of Welders and Welding Operators

Before assigning any welders or welder operators to work on structural aluminum fabrication, certification will be obtained that these welders and welding operators have been qualified under the requirements of the Boiler and Pressure Vessel Code and Interpretations, Section IX, "Qualification Standard for Welding and Brazing Procedures, Welders, Brazers, and Welding and Brazing Operators," 1962 with 1962-63-64 Addenda, within the previous 3 months.

2. Connections

Connections shall be as shown on the drawings. Unless otherwise indicated on the drawings, field connections shall be made in accordance with the requirements of the ASCE Specification 6061, Section G through L.

3. Punching, Drilling, and Reaming

Punching, drilling, and reaming shall be in accordance with Section H-4 of ASCE Specification 6061-T6.

D. ERECTION

1. Drift Pins

Drift pins may be used only to bring together the several parts; they shall not be used in such manner as to distort or damage the metal.

2. Gas Cutting

The use of the gas cutting torch in the field for correcting fabrication errors will not be permitted.

3. Bolted (Including Studs) Joints

a. Torqueing Bolts - Bolt torques to be applied in the installation of this assembly shall be as specified on the drawings. Torque shall be measured with calibrated torque wrenches as specified in NTO-SOP-0058. Antiseize compound to Military Specification MIL-A-907C, "Antiseize Compound, High Temperature," or MIL-S-8660B and AM-1 "Silicone Compound", shall be applied to all bolt and stud threads per NTO-SOP-0047.

E. CLEANING

1. System Cleanliness Requirements

The system shall be maintained in as clean a condition as received. In the event of contamination of any of the lines, the installer shall clean the contaminated system or pipe section to the previously existing degree of cleanliness. In addition, exterior surfaces shall be cleaned and maintained free of all loose dirt, rust, slag, and oil, grease or other hydrocarbons. Cleanliness procedures shall be as specified in NTO-A-0030 Section 5 and AGC-STD-9007

IV. INSTALLATION REQUIREMENTS

A. AUXILIARY EQUIPMENT

1. TSA Handling Fixture

The TSA handling fixture, No. 4746 shall be used in the E-MAD Cold Assembly Bay to install the TSA to the Spacer, TSA, No. 490 which shall be mounted

on the Engine Installation Vehicle, (EIV). The EIV will transport the TSA to ETS-1 and position it for installation.

a. At the direction of the ETS-1 Manager, installation of the TSA may be effected by other means if the EIV is not available.

2. Maintenance Platform

The maintenance platform, ETS-1, No. 4059 shall be used at ETS-1 for access to the TSA after installation. Work platforms to be provided by NTO will be utilized during the TSA installation period.

3. Cleanliness Protection

The provisions of Section III,E,1, will be followed during the installation to assure that the cleanliness levels of the TSA and the facility interface are maintained.

B. PREPARATION FOR ATTACHMENT

1. Mechanical

a. Orientation - At the time the TSA is placed on the TSA Spacer No. 490, orient the TSA so that the "Theta-Zero" position marked on the TSA aligns with the ETS-1 "Theta-Zero".

(1) Thrust Ring Stud Placement - The eight 7/8-in. TSA studs (Part No. 1115197-1) at each of the four attachment points on the thrust ring must be placed in the thrust ring prior to bringing the TSA into position.

C. ALIGNMENT

1. Alignment Pins

The TSA will be brought up to mate with the 4, 1-1/2-in. alignment pins on the thrust ring and brought to bear on any three of the four mounting pads of the facility thrust ring. The clearance at the fourth pad shall not exceed 0.060-in. The shims required to maintain this tolerance shall be taken into account during the leveling and alignment checks in Para IV,D,1, below.

a. The TSA will be delivered to NTO with all lines and harnesses installed. With the TSA in this assembled condition, extreme care must be taken during the mating of the TSA to the thrust ring to avoid damage to the interface surface of all lines and seals.

b. An alternate installation approach would be to remove all or part of the fluid lines in the TSA, prior to installation of the TSA, and re-install them after the TSA is located and aligned at the completion of Para IV,D,2,b, below. If the alternate approach is taken the reinstallation of all line must conform to the tolerances specified on drawing No. 1117088.

2. Wiring

Wiring and harnesses will be arranged to avoid interference with fluid lines and mechanical interfaces during the time that the TSA is being attached to the thrust ring, unless it is necessary to thread particular harnesses through the thrust ring during the installation period.

D. ATTACHMENT

1. Four Point

The eight studs at each of the four-point attachment points for the TSA to the thrust ring shall be tightened sufficiently to bring the mating surfaces

to bear. An alignment and leveling check shall be conducted at this time to assure that the TSA is correctly positioned and satisfies the elevation and perpendicular requirements of drawing 1010058 for engine Sta 42.890. Shims provided with the TSA (No. 1117971-1) will be added at the four-point connections to attain proper alignment. After proper alignment has been attained, the eight studs at each of the four attachment points for the TSA to the thrust ring shall be torqued to the value and in the manner specified on drawing No. 1117950. After torqueing is complete, alignment and leveling of the TSA will be re-checked to the engine Sta 42.890 requirements above.

2. Eight Point

a. Bracket Placement

The eight special brackets provided with the TSA (Part No. 1117116-3) shall be placed in position as shown on Drawing No. 1117950.

b. Bracket Attachment

The nine holes in each bracket shall be marked on the TSA and the TSA shall be drilled and tapped and the inserts shall be installed as specified on Drawing No. 1117950. The nine bolts shall be installed in each of the eight brackets and shall be torqued to the value and in the manner specified on Drawing No. 1117950.

c. Bracket Welding

The eight brackets positioned and installed in Paragraphs IV, 2,a and IV,D,2,b above shall be welded to the thrust ring as specified on Drawing No. 1117950. Care shall be taken to provide adequate protection for all components and assemblies in the area to avoid damage and/or contamination during the welding process.

3. Fluid Lines

All fluid, actuation and vent lines shall be connected and torqued to the value and in the manner specified on the Drawings 1117950 and 1114920.

4. Instrumentation and Electrical Connections

All Instrumentation and Electrical harnesses shall be routed through the thrust ring and associated structure and connected to their respective terminal connections at the top shield. All harnesses and cables will be tied and clamped as defined in NTO Spec. 6501 and NTO SOP-0044.

V. TESTING

A. LEAK TEST

After the lines all have been connected per Paragraph IV,D,3, above, the lines shall be pressurized to 10 percent of test pressure with helium, then pressurized to working pressure with dry, free nitrogen. This pressure shall be maintained while all fittings, joints, seals, stem packing, connectors and other locations subject to leakage are leak tested with a mass spectrometer or other leak test device of equal sensitivity. Repair, replacements and adjustments shall be made wherever a leak is detected exceeding 4.0×10^{-8} scc/sec in hydrogen systems or 1.0×10^{-6} in other systems where leakage is found, and after corrections have been completed, the test shall be repeated.

B. ELECTRICAL AND INSTRUMENTATION WIRING

1. Installation Tests

At the completion of the work described in Paragraph IV,D,4 above, each conductor will be tested for continuity through the connectors at the top shield. Incorrect connections or terminations shall be corrected and retested to prove correctness.

The provisions of NTO-SOP-0059 will be followed during all work and testing on electrical and instrumentation wiring.

VI. QUALITY ASSURANCE

A. QUALITY CONTROL

A quality control plan for field installation consistent with the quality control documents referenced herein shall be enacted by NTO.