SPECIFICATIONS

DETAIL SPECIFICATION

FOR

TRANSPORTATION OF

SCOUT VEHICLE SOLID

PROPELLANT ROCKET MOTORS

Scout Vehicle Program
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SPECIFICATION FOR TRANSPORTATION OF SCOUT VEHICLE SOLID PROPELLANT ROCKET MOTORS

1. SCOPE: This specification defines the requirements for transportation of the Scout vehicle mainstage solid rocket motors via highway van. Included are requirements for:

(1) Handling, supporting, and securing the rocket motor-dolly assembly (Algol IIB only) and rocket motor-shipping container assemblies (Castor I-E5, Castor IIA, Antares II (X259), Altair II (X258), and Altair III (FW-4S)),

(2) Transportation system load restraint capability,

(3) Temperature control,

(4) Transportation safety precautions,

(5) Monitoring and reporting the condition of the load during transit, and

(6) Documentation and final reporting.

Also included are responsibilities of the carrier and shipper during loading and unloading operations.

Two dolly configurations (SPACE and REGENT JACK) will be used to transport the Algol rocket motor necessitating differences in the support and tie-down provisions. These differences are noted within this specification.

2. APPLICABLE DOCUMENTS

2.1 Drawings

2.1.1 Space Corporation (Algol handling dolly)

23-10-1 Dolly-Handling for Algol Rocket Motor

23-10-2 Cradle-Fwd and Aft Lower Assemblies

23-10-5 Rear Axle and Brake Assembly

2.1.2 Regent Jack Mfg. Co. (Algol handling dolly)

5468 Trailer-Handling

5468-B Trailer-Handling

5468-D Assembly Instruction Drawing

2.1.3 United Technology Center (FW4-S Shipping Container) DWG. 5G0048 Rev. C

2.1.4 Thiokol Chemical Corporation (Castor I-E5 and Castor IIA Shipping container) DWG. FR 41927 Rev. B

2.1.5 Champion Co., Springfield, Ohio (X259 Shipping Container) DWG. 08730 Rev. B-4

2.1.6 Hercules Powder Co. Allegany Ballistics Laboratory (X258 Shipping Container) DWG. 258E10-1-01-0001-No Revision

3. REQUIREMENTS

3.1 General - The construction of solid propellant rocket motors renders these units susceptible to damage during transportation when exposed to adverse temperature and shock environments. It is therefore essential that the requirements of this specification be adhered to in order to maintain component reliability and minimize material losses.

3.2 Supports - (Applicable to the Algol rocket motor only)

3.2.1 Primary - The Algol rocket motor-dolly assembly is to be fully supported by sturdy wooden blocks during transportation. These supports shall be located at each of the four points where the dolly longitudinal I-beams cross the dolly axles (see drawings reference in paragraph 2.1.1 and 2.1.2). Wood supports shall be recessed as required to facilitate total load transmission through longitudinal I-beams only, and each support shall provide bearing support for a minimum of two (2) feet of I-beam length. No support loads shall be transmitted to the dolly through either axle during shipment. When resting on the wooden supports the dolly tires shall clear the van floor by a minimum of 1/2 inch.

NOTE: The longitudinal axis is fore and aft along the rocket motor center line; the transverse axis runs horizontally through the rocket motor's center of gravity and perpendicular to the longitudinal axis.

CAUTION: When lifting the rocket motor-dolly assembly to insert the wooden supports, two (2) wheels shall be jacked simultaneously to prevent twisting the I-beam frame and possible motor damage.

3.2.2 Secondary - Each of the two dolly longitudinal I-beams shall be supported by wooden blocks at three locations equidistant between the fore and aft axles. A minimum of 12 inches length of the I-beam shall be supported by each secondary support. If necessary, shims shall be added to bring the secondary supports flush with the I-beam.

NOTE: The function of secondary supports and tie-downs is to prevent the longitudinal I-beams from flexing during transit, not to assist the primary supports in carrying the load.

3.3 Dolly Tie-Downs (Applicable to the Algol rocket motor only)

3.3.1 Primary Tie-Downs - Tie-downs between the van and rocket motor-dolly assembly shall be attached at the four principal dolly tie-down points. The attach points are the two (2) inch diameter holes located outboard on the cradle transverse webs. The uppoer holes in the SPACE dolly shall be used for securing the tie-downs. The above tie-downs shall be capable of restraining without failure the rocket motor-dolly assembly when subjected to the ultimate vertical and transverse forces applied independently (see paragraph 3.5).

A rigid tie-down shall be provided between the dolly rear axle (non-steerable end) and the van. The rear axle interface for this rigid member is shown on SPACE Corporation drawing 23-10-5. This rigid member shall be capable of restraining, without failure, the rocket motor-dolly assembly when subjected to the ultimate longitudinal force (see paragraph 3.5).

3.3.2 Secondary Tie-Downs - Each of the dolly longitudinal I-beams shall be restrained by secondary tie-downs secured to the van floor and located immediately adjacent to the secondary supports. The secondary tie-down shall

insure that the I-beam is held against the secondary support at all times during transportation of the rocket motor-dolly assembly and shall have a minimum pull test strength of 10,000 pounds. These tie-downs shall be of nylon construction.

3.4 Carrier's Van

3.4.1 Flooring - (Applicable to Algol rocket motor only) The van floor surface on which the dolly tires roll during loading and unloading shall be continuous and provide 100 percent bearing surface for the dolly tires.

3.4.2 Suspension System - The rear tandem wheels of the carrier's van shall have a pneumatic shock absorbing and suspension system.

3.4.3 Size - The van shall be of lawful size to safely carry the required load. Dimensions of all Scout motor shipping containers can be obtained from attached drawings. (See paragraph 2.1 above.)

3.5 Design and Ultimate Loads - The tie-downs and supports described above shall restrain the Algol rocket motor-dolly assembly without failure when subjected to the ultimate forces for the conditions shwon in table I (independent application of forces is assumed). The shipping container assemblies for all other Scout motors shall also be secured in place so as to successfully withstand the ultimate loads specified in table I (applied independently):

NOTE: Weights defining lg (weight due to gravitational force only) conditions for each motor shipping assembly to be used in conjunction with table I are as follows.

Motor	Shipping Assy Weight (lg)
Algol IIB	27,000 lbs
Castor I-E5	13,000 lbs
Castor IIA	14,000 lbs
Antares II	5,000 lbs

Altair II	1,100 lbs
Altair III	1,100 lbs

TABLE I - TRANSPORTATION SYSTEM DESIGN LOAD RESTRAINT CRITERIA

Load Condition	Design Limit	Design Ultimate
Vertical down	3g	4.5g
Vertical up	1g	1.5g
Longitudinal	±2g	±3g
Transverse	1g	1.5g

NOTE: The center of gravity of the Algol rocket motor-dolly assembly is approximately 157.3 inches aft of the forward face of the forward dolly cradle.

Center of gravity for the other rocket motor-shipping container assemblies is shown in the drawings referenced in paragraph 2.1.3 through 2.1.6.

3.6 Orientation - The Algol rocket motor-dolly assembly shall be oriented in the van such that the steerable end of the dolly is in the aft end of the van.

3.7 Carrier Responsibilities - The carrier shall have the responsibility for:

(a) determining the proper position of the load within the van;

(b) proper weight distribution of the loaded van;

(c) blocking and tie-down of the Algol rocket motor-dolly assembly in position prior to shipment;

(d) securing each motor shipping assembly to meet requirements of paragraph 3.5 above;

(e) furnishing all equipment required for supporting and restraining the Algol dolly and shipping containers for the other Scout motors as required by this specification.

NOTE: The above applies to each motor unit in the case of milti-motor shipments.

3.8 Shipper Responsibilities - The shipping activity shall provide all material, services, and personnel required to transfer the rocket motor-shipping assembly (motor-dolly assembly in case of the Algol) from the loading dock into the carrier's van. The loading dock required for loading and unloading shall also be provided by the shipper. The above requirements shall also apply to unloading.

3.9 Temperature Control and Monitoring

3.9.1 Internal Van Temperature - All shipments shall be made in a temperature controlled van capable of maintaining an internal temperature of 50 degrees F to 90 degrees F. Continuous temperature control monitoring will be provided utilizing a carrier furnished calibrated mechanical recording device. The tachigraph charts of van internal temperature shall be retained by the launch site or agency to which the motor is delivered.

3.9.2 Ambient Temperature Records - The local ambient temperature will be recorded by drivers a minimum of once every four (4) hour period during transit. Information to be recorded is date, time, location, mileage, and ambient temperature. A copy of this information shall be supplied to the launch site or agency to which the motor is delivered.

3.10 Auxiliary Power Supply Capability - The van shall be equipped to accept an auxiliary power supply to provide heating or cooling in the event of failure of the primary power supply.

3.11 Transportation Safety Precautions

3.11.1 Transportation Safety Precautions - Transportation safety precautions shall be in accordance with ICC motor carrier safety regulations as amended and Tarriff Reg. No. 15, as superseded, published by T. C. George.

3.11.2 ICC Classification - Rocket motor shipping assemblies transported under this specification have the following ICC explosive classification.

Rocket Motors	Classification
Algol IIB	ICC jet thrust unit Class B explosive
Castor I-E5	ICC jet thrust unit Class B explosive
Castor IIA	ICC jet thrust unit Class B explosive
Altair III (FW-4S)	ICC jet thrust unit Class B explosive
Antares II (X-259)	ICC jet thrust unit Class A explosive
Altair II (X-258)	ICC jet thrust unit Class A explosive

3.12 Delivery- The scheduled delivery time to the governmental receiving activity designated on the GBL shall be within the time period specified below for transit between governmental activities.

Aerojet-General Corporation Nimbus, California	to or from (130 hours)	National Aero & Space Adm. Wallops Station Wallops Island, Va.
Aerojet-General Corporation Nimbus, California	to or from (24 hours)	51st Munitions & Maintenance Squadron, Vandenberg AFB, California
Aerojet-General Corporation Nimbus, California	to or from (12 hours)	Naval Ammunition Depot Hawthorne, Nevada
Thiokol Chemical Corporation Huntsville, Alabama	to or from (36 hours)	NASA-Wallops Station Wallops Island, Va.
NASA Wallops Station Wallops Island, Va.	to or from (130 hours)	51st Munitions & Maintenance Squadron, Vandenberg AFB, California
Allegany Ballistics Lab. Cumberland, Maryland	to or from (10 hours)	NASA-Wallops Station Wallops Island, Va.
Allegany Ballistics Lab. Cumberland, Maryland	to or from (125 hours)	51st Munitions & Maintenance Squadron, Vandenberg AFB California

NOTE: Acceptance of the delivery will be withheld by the governmental receiving activity if the carrier's van has been subjected to detrimental impact loads (carrier's van hitting or being hit by another vehicle or abrupt stops caused by hitting fixed objects) during transit. In the case of damage to the load, a request for approval or disapproval for acceptance shall be referred to the National Aeronautics and Space Administration, Langley Research Center Contracting Officer by the receiving governmental activity.

3.13 Documentation and Reporting

3.13.1 Certification - The carrier shall certify in writing prior to the initial shipment that the structural integrity of all of the tie-down components and van attach points meet the requirements of this specification (see paragraph 3.5). In addition, the load capability of the van attach points for the four principal vertical and transverse tie-downs for the Algol motor shall have been demonstrated by actual test. Results of this test shall also be reported in writing to NASA-LRC Scout Project Office, Langley Station, Virginia. Finally the carrier shall certify his ability to comply with all other requirements of this specification in writing prior to the initial shipment.

3.13.2 Procedures - The carrier will provide written procedures to the drivers to insure compliance with all the applicable requirements of this specification. They shall include but not be limited to:

(a) Procedures for securing the Algol rocket motor-dolly assembly and other rocket motor-shipping container assemblies to the van.

(b) Instructions defining the enroute inspection and reporting requirements, and

(c) Instructions in the use of auxiliary power for the temperature control equipment

These written procedures shall be submitted to NASA-LRC-SPO for review.

3.13.3 Reports

3.13.3.1 Enroute Reports - Telephone reports to the carrier's central traffic control center while enroute to the carrier's destination and shall include: Location, weather conditions, external temperatures, and other information that may affect the shipment.

3.13.3.2 Delays - Anticipated delays of twelve (12) hour duration or more will be reported by the carrier to both the consignee and consignor. The reason(s) for the delay plus its effect on the delivery schedule will be reported using the most expedient method of communications available.

3.13.3.3 Final Report - A letter report covering complete history of each shipment will be forwarded by the carrier to the receiving governmental activity within ten (10) days of delivery.

4. LIMITED CAPABILITIES - Carrier's not capable of complying with the requirements for transportation of all Scout vehicle rocket motors may submit certification of their qualifications to transport one or more of the rocket motors. The carrier must clearly state all the reasons which necessitated the submission of a limited certification.

5. DEFINITION OF TERMS

5.1 Carrier - Transporter of the rocket motor(s) authorized by the Shipping Government Activity.

5.2 Shipper - The Shipping Government Activity which initiates the Government Bill of Lading (GBL) authorizing a shipment.