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ADA 127908

VOLUME II

DOCUMENT NUMBER

QTR-2191-001

REV. N/C

TITLE

QUALIFICATION TEST REPORT FOR  
450 GALLON CRASHWORTHY FUEL TANK  
FOR  
U.S. AIR FORCE H-53 HELICOPTER

TEST PERFORMED BY

FIBER SCIENCE DIVISION

CONTRACT NUMBER

F09603-79-C-1642-P20002

PREPARED BY

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APRIL 2, 1982

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SALT LAKE CITY, UTAH 84116

PREPARED FOR

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APPENDIX A  
QUALIFICATION TEST PROCEDURES  
QTR-2191  
SECTIONS A-THRU J

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OF

DOCUMENT NUMBER  
QTP-2191 SECTION "A"

TITLE  
QUALIFICATION TEST PROCEDURE  
H-53 TANK  
REQUIREMENTS FOR INDIVIDUAL INSPECTION

REVISIONS

LTR.	DATE	PREPARED	APPROVED	DESCRIPTION

PREPARED BY:                      DATE:  
Richard Lyman                      12/1/80



FIBER SCIENCE, INC.  
SALT LAKE CITY, UTAH

CHECKED BY:                      DATE:  
*Randy Stone*                      12-9-80

NO. QTP-2191 Section "A"

APPROVED BY:                      DATE:  
*C. A. Patrone Jr*                      12-9-80

1.0 SCOPE

This procedure covers the requirements for Individual Inspection of the 450 Gallon Filament Wound External Fuel Tank for the H-53 helicopter.

2.0 APPLICABLE DOCUMENTS

2.1 MILITARY SPECIFICATIONS

MIL-F-8615	General Specification for fuel system components
MIL-C-45664	Calibration System Requirements
MIL-STD-831	Test Reports, Preparation of.

2.2 FEDERAL SPECIFICATION

Fed. Test Method Std.	141 Methods for testing of paints, varnish, lacquer and related materials.
-----------------------	--

2.3 TECHNICAL EXHIBIT

ASD/ENFEA-78	Tank - 450 gallon external fuel, filament wound light-weight explosion proof.
--------------	---

2.4 DRAWINGS

FIBER SCIENCE

2191-001	Tank - Installation, 450 gallon H-53
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SARGENT FLETCHER

27-450-4400	Pylon Assembly - 450 gallon fuel Tank.
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3.0 REQUIREMENTS

3.1 INSPECTION ARTICLE

Four (4) tank assemblies(2191-001) equipped with a Government furnished pylon (27-450-4400) shall be subjected to the individual inspection requirements of Paragraph 4.4.1 as described in Technical Exhibit ASD/ENFEA-78.

3.2 INDIVIDUAL INSPECTION METHOD

The following individual inspections are to be performed during and after the tank fabrication process by the Quality Assurance Department.

3.2.1 INTERNAL CLEANLINESS INSPECTION

Each internal component shall be thoroughly inspected for cleanliness relative to dirt, sand, metal or plastic chips or other foreign matter while being assembled and after final assembly. Each tank shall be judged by a visual examination by wiping all accessible suspect areas with a clean white lint-free cloth. This examination shall be made before the liner receives its final access bond before winding, and again before tank is closed for functional test.

3.2.2 LINER PROOF PRESSURE INSPECTION

Eash liner shall contain without leakage an internal proof pressure of 2.0 psi for five (5) minutes.

3.2.3 LINER DIAMETER INSPECTION

Each tank liner while pressurized to the liner design pressure per Paragraph 3.2.2 shall be measured at four (4) locations as shown in Figure 1 to verify the compliance with the tank liner sub assembly drawing (2191-005).



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3.2.4 COMPOSITE CONSTRUCTION INSPECTION

Each pre production tank shall be inspected during construction and at final assembly for the following requirements to the paragraphs indicated in Technical Exhibit ASD/ENFEA-78 and illustrated in Figure 2.

3.2.4.1 FILAMENT WINDING EQUIPMENT

To have repeatable helical and circumferential capabilities per Paragraph 3.5.3.1.

3.2.4.2 ROVING DEGRADATION

To have tensioned roving path that shall traverse no corner unpolished or less than .25 inch radius per Paragraph 3.5.3.1.1

3.2.4.3 ROVING GAP

Maximum roving gap between adjoining rovings not to exceed .25 inches per Paragraph 3.5.3.1.2.

3.2.4.4 ROVING BRIDGING

Maximum roving bridging not to exceed .50 inch wide by 12 inches long and must be filled per Paragraph 3.5.3.1.3.

3.2.4.5 ROVING SLIPPAGE

Maximum roving slippage to achieve natural geodesic path not to exceed .25 inches per Paragraph 3.5.3.1.4.

3.2.4.6 ROVING KNOTS

Roving knots must be removed and rovings overlapped end to end by 2.0 inches minimum per Paragraph 3.5.3.1.5.

3.2.4.7 ROVING RESIN CONTROL

Roving must be thoroughly impregnated with resin per Paragraph 3.5.3.1.6.



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3.2.4.8 UNIFORM COMPOSITE CONSTRUCTION

Uniform structural composite construction shall be maintained from tank to tank per Paragraph 3.5.3.1.7.

3.2.5 COMPOSITE CONSTRUCTION TESTING

Composite materials testing shall be conducted on samples of the filament wound composite to the following requirements to the paragraphs indicated in Technical Exhibit ASD/ENFEA-78.

3.2.5.1 RESIN CONTENT

Resin content of actual filament wound sample part from each pre-production tank shall not vary more than  $\pm 5\%$  of design value per Paragraph 4.6.7.4.1.

3.2.5.2 LAP SHEAR TESTING

Six (6) samples of actual filament wound materials shall be bonded to actual tank liner scrap material as shown in Figure 3. Each sample shall then be cured and lap shear tested to not less than the design values per paragraph 4.6.7.4.2.

3.2.5.3 COMPOSITE SANDWICH CORE

Composite sandwich core shall be Nomex Honeycomb having a minimum compressive strength of 250 psi per Paragraph 3.3.2.4.1.

3.2.5.4 STRUCTURAL COMPOSITE CURING

Structural composite curing shall be in an automatically controlled oven with continuous temperature recorder data sheet for each tank per Paragraph 4.6.7.6.

3.3 INSPECTION EQUIPMENT

The inspection equipment required to verify compliance of all assemblies, parts, and materials covered by this procedure shall be of good commercial quality in proper working condition, regularly calibrated and under strict equipment control by the Quality Assurance Department.



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3.3.1 INSPECTION EQUIPMENT CALIBRATION

All inspection equipment shall be calibrated and capable of reading or recording data within  $\pm 2\%$  of its full scale value. No inspection equipment shall be used that has not been calibrated within the previous calibration period. Calibration shall be per MIL-C-45662.

3.4 INSPECTION PROCEDURES

The inspection procedures shall be in accordance with Paragraph 4 of this document.

3.5 DOCUMENTATION

At the conclusion of these inspection tests, an inspection test report will be prepared for submission to the contractor.



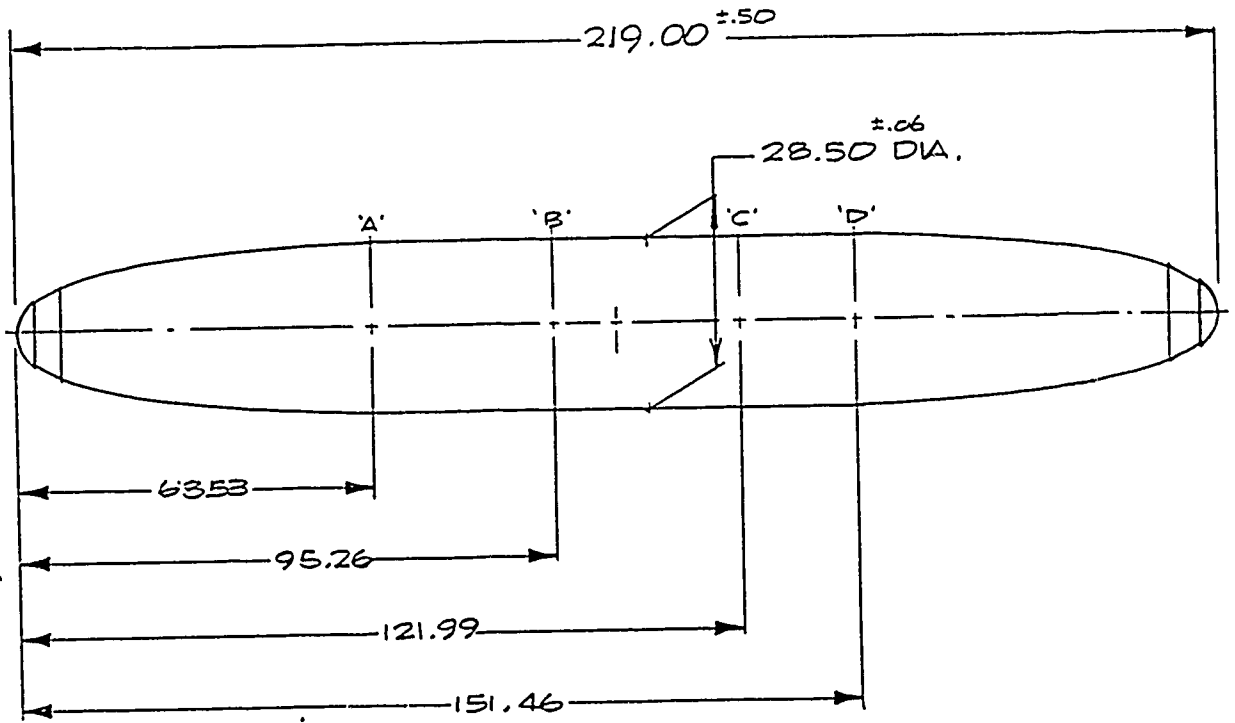
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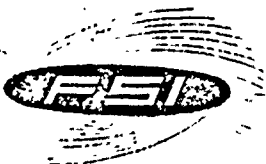
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ASSEMBLED TANK  
LINER WITH POLAR END CAPS

FIGURE 1  
LINER DIAMETER INSPECTION

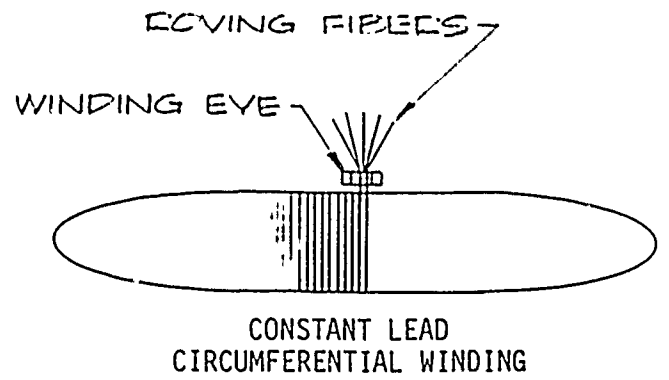
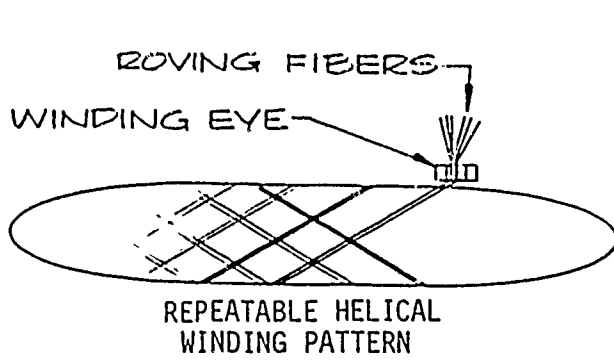


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FILAMENT WINDING EQUIPMENT

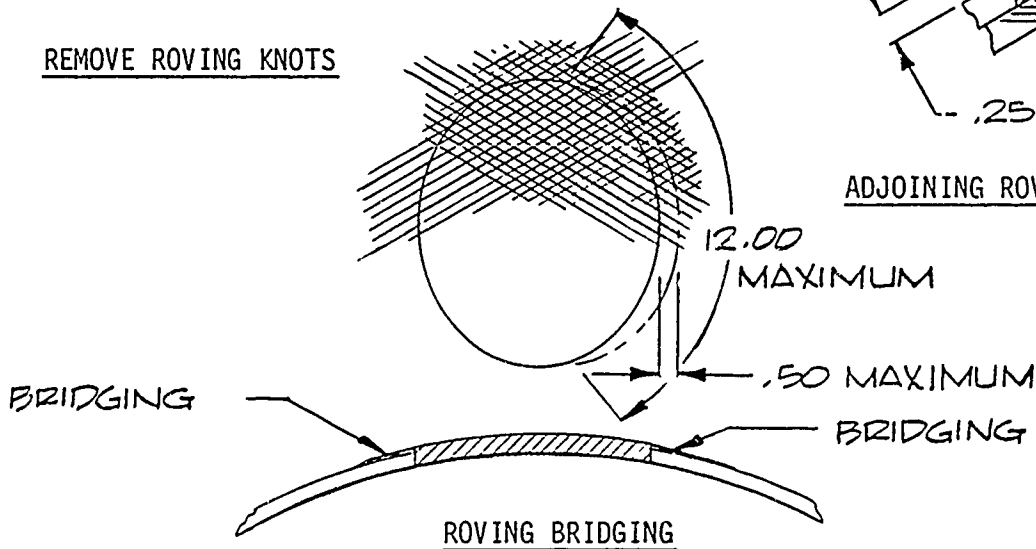
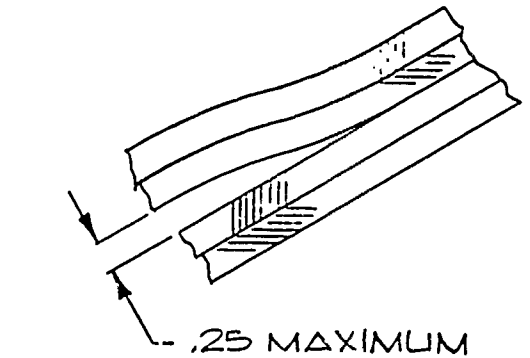
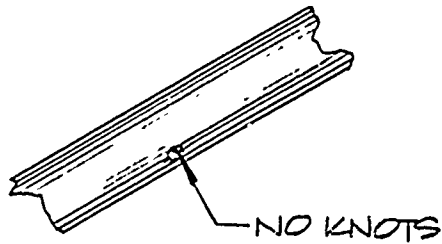
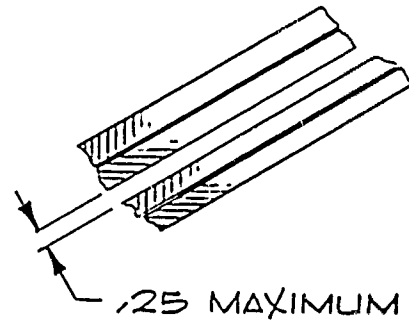
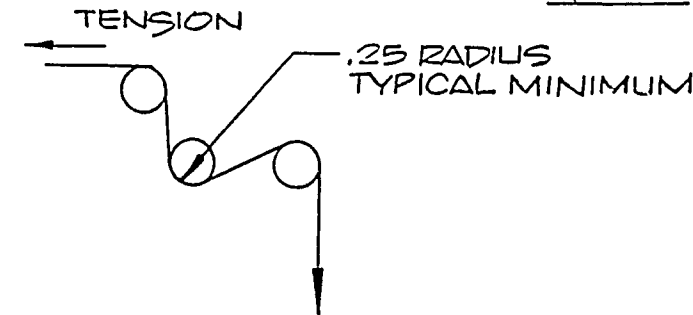
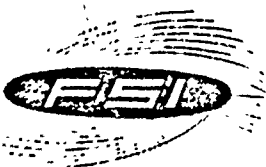


FIGURE 2 - COMPOSITE CONSTRUCTION CRITERIA



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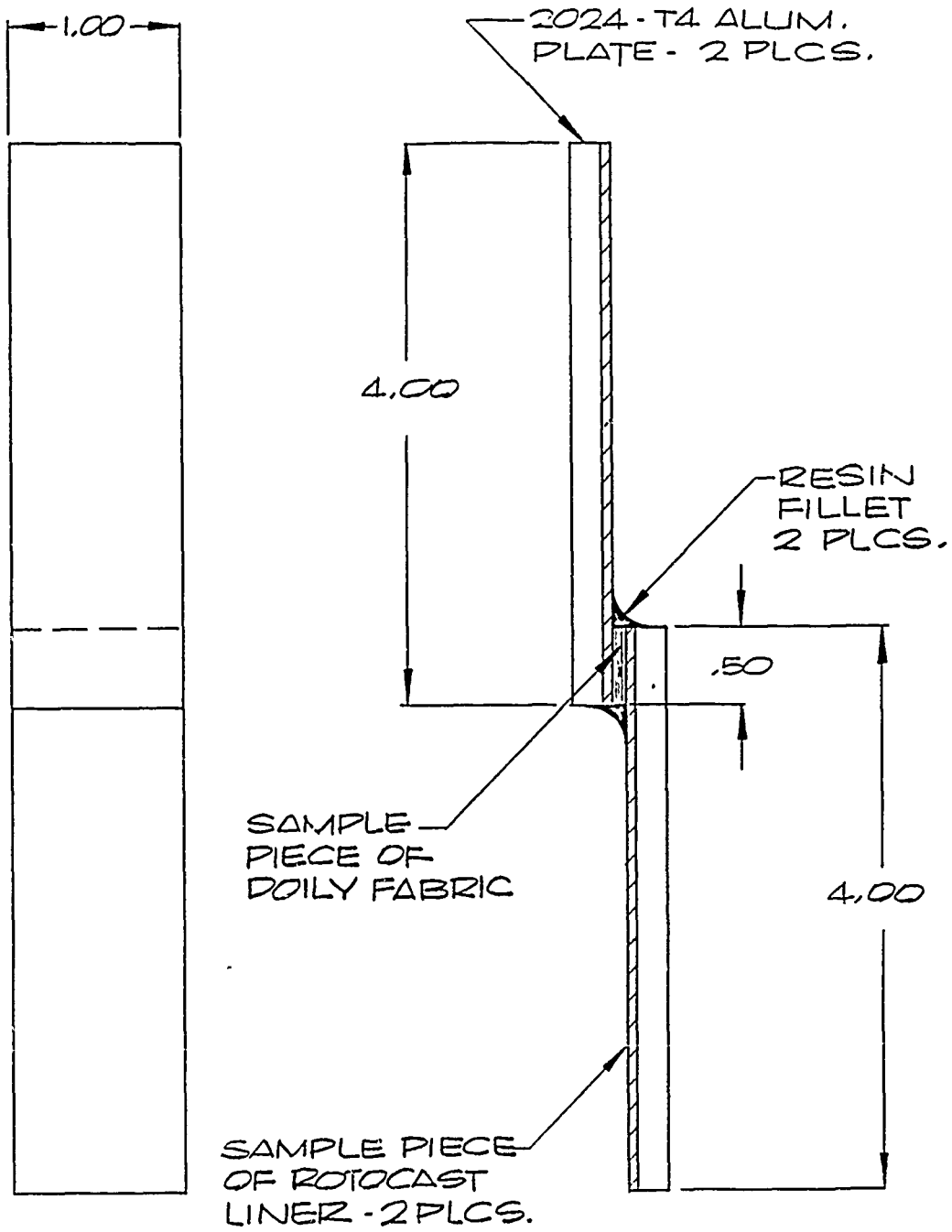


FIGURE 3

LAP SHEAR TEST SAMPLE ARRANGEMENT



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4.0 QUALIFICATION INSPECTION PROCEDURES

4.1 INSPECTION EQUIPMENT REVIEW

All inspection equipment to be used for this procedure shall be examined for accuracy relative to the task assigned, be in good working condition and to possess documentation showing equipment to have been regularly calibrated.

4.1.1 INSPECTION EQUIPMENT CALIBRATION

All inspection equipment shall be inspected to verify that each piece of equipment has had a calibration check within the last calibration period.

4.2 INDIVIDUAL INSPECTION

Perform the following individual inspections during and after the tank fabrication.

4.2.1 INTERNAL CLEANLINESS INSPECTION

Wipe with a lint-free cloth before closing liner assembly and again before closing final assembly the internal surface of tank and all fittings to check for dirt, sand, metallic or plastic chips or other foreign material. The internal surface and fittings of the tank shall be clean.

4.2.2 LINER PROOF PRESSURE

Inflate liner to 2.0 psi and soap bubble check for leakage before winding.

4.2.3 LINER DIAMETER INSPECTION

Inflate liner to the liner design pressure and measure tank at the locations shown in Figure 1. All diameters must meet the requirement of  $28.50 \pm .06$  dia. when measured with a pi tape.



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4.2.4 COMPOSITE CONSTRUCTION INSPECTION

Perform the following inspections relative to the composite construction:

4.2.4.1 FILAMENT WINDING EQUIPMENT

Verify that the filament winding equipment when properly programmed can wind repeatable helical and circumferential winding to the engineering design requirements.

4.2.4.2 ROVING DEGRADATION

Verify that the roving does not pass over any unpolished corner radius less than .25 inches.

4.2.4.3 ROVING GAP

Verify that during the entire winding operation no roving gap between adjoining roving exceeds .25 inches.

4.2.4.4 ROVING BRIDGING

Verify that no bridging of roving over a core splice or core and core reinforcement insertion or over an inverted surface shall exceed .50 inches wide by 12 inches long. All bridging must be filled before assembly is complete.

4.2.4.5 ROVING SLIPPAGE

Verify that during the entire winding operation no roving slippage shall exist to achieve a more natural geodesic path than .25 inches.

4.2.4.6 ROVING KNOTS

Verify that no roving knots exist that have not been removed with broken rovings being overlaid by  $2.00 \pm .50$  inch.



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4.2.4.7 ROVING RESIN CONTROL

Verify that all rovings are or will be thoroughly impregnated before tank is thoroughly cured.

Note: Care should also be taken to prevent excess resin from accumulating before tank is thoroughly cured.

4.2.4.8 UNIFORM COMPOSITE CONSTRUCTION

Verify uniform composite construction by compliance of the fabrication process with the manufacturing process sheets and the compliance of the wound assembly weight with engineering design weight.

4.2.5 COMPOSITE CONSTRUCTION TESTING

Perform the following composite construction testing on samples of the actual materials used in the filament winding process.

4.2.5.1 RESIN CONTENT

Verify the filament winding resin content by weighing equal lengths (approximately 50 feet) of an unimpregnated band width of roving and an impregnated band width of roving that has passed through the impregnation system in the same manner and resin as the actual tank. (It is recommended that this test sample be removed at the end of the winding process for the inside layer of the sandwich wall construction.) The resin content shall by volume be  $50\% \pm 5\%$ .

4.2.5.2 LAP SHEAR TESTING

Verify the bond between the liner and the filament wound roving by performing lap shear testing per ASTM-D-1002 method 64. Six (6) specimens shall be prepared as shown in Figure 3. A minimum lap shear strength of 200 psi must be achieved.



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4.2.5.3 COMPOSITE SANDWICH CORE

Verify that composite sandwich core material has a minimum compressive strength of 250 psi either by actual test of a sample of the actual material to be used or by certified test to this requirement from the material supplier.

4.2.5.4 STRUCTURAL COMPOSITE CURING

Verify that each tank has been cured in a regularly certified oven to the engineering design requirements. The cure cycle shall be continuously recorded and a permanent record kept for each tank.

5.0 QUALIFICATION INSPECTION REPORT

A formal qualification inspection test report shall be submitted per MIL-STD-831 within 30 days after the inspection testing is complete. This report is to include copies of all measurements, individual test reports, temperature recorder data sheets and manufacturing process sheets used in actual manufacture of tank. Each test tank shall be retained for further testing.



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APPENDIX "A"  
INSPECTION TEST DATA SHEETS



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INSPECTION TEST DATA SHEET

QTR-2191 SECTION "A"

Inspection Activity \_\_\_\_\_ Activity Quality Engr. \_\_\_\_\_

Tank Serial No. \_\_\_\_\_ F.S.I. Test Engr. \_\_\_\_\_

Inspection Date \_\_\_\_\_ Government Rep. \_\_\_\_\_

INSPECTION EQUIPMENT REVIEW

Ref. Para. 4.1 List of inspection equipment used to verify the requirements of this procedure. List working condition, verify if equipment has been regularly calibrated and last calibration date.

<u>ITEM</u>	<u>WORKING CONDITION</u>	<u>REGULARLY CALIBRATED</u>	<u>LAST CALIBRATION DATE</u>
1. _____	_____	_____	_____
2. _____	_____	_____	_____
3. _____	_____	_____	_____
4. _____	_____	_____	_____
5. _____	_____	_____	_____
6. _____	_____	_____	_____
7. _____	_____	_____	_____
8. _____	_____	_____	_____
9. _____	_____	_____	_____
10. _____	_____	_____	_____
11. _____	_____	_____	_____
12. _____	_____	_____	_____
13. _____	_____	_____	_____
14. _____	_____	_____	_____



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INDIVIDUAL INSPECTION

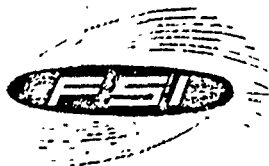
Ref. Para. 4.2: Individual Inspections performed

By \_\_\_\_\_ Date \_\_\_\_\_

INTERNAL CLEANLINESS INSPECTION

Ref. Para 4.2.1: LINT-FREE CLOTH WIPE INSPECTION

<u>ITEM</u>	<u>REMARKS</u>	<u>INSPECTION STAMP</u>
Liner	_____	_____
Frames	_____	_____
Tubing	_____	_____
Bellmouth	_____	_____
Others:	_____	_____
1. _____	_____	_____
2. _____	_____	_____
3. _____	_____	_____
4. _____	_____	_____



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INSPECT LINER FOR LEAKAGE

Ref. Para 4.2.2: LINER PROOF PRESSURE

<u>ITEM</u>	<u>REMARKS</u>	<u>INSPECTION STAMP</u>
2.0 ± .25 psi	_____	_____
Soap Bubble Test	_____	_____
Leaks (If any)	_____	_____

<u>LOCATION</u>	<u>REMARKS</u>	<u>INSPECTION STAMP</u>
1. _____	_____	_____
2. _____	_____	_____
3. _____	_____	_____
4. _____	_____	_____

LINER DIAMETER INSPECTION

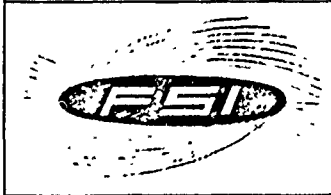
Ref. Para. 4.2.3: LINER MEASURED TO THE REQUIREMENTS OF FIGURE 1

<u>LOCATION</u>	<u>DIAMETER</u>	<u>INSPECTION STAMP</u>
A.	_____	_____
B.	_____	_____
C.	_____	_____
D.	_____	_____

COMPOSITE CONSTRUCTION INSPECTION

Ref. Para. 4.2.4: Composite Construction Inspection performed

By \_\_\_\_\_ Date \_\_\_\_\_



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FILAMENT WINDING EQUIPMENT

Ref. Para. 4.2.4.1: INSPECT EQUIPMENT CAPABILITIES

<u>ITEM</u>	<u>REMARKS</u>	<u>INSP. STAMP</u>
Circumferential Capabilities _____	_____	_____
Helical Capabilities _____	_____	_____
Machine Program _____	_____	_____

ROVING DEGRATION

Ref. Para. 4.2.4.2:

<u>ITEM</u>	<u>REMARKS</u>	<u>INSP. STAMP</u>
Fiber Creel _____	_____	_____
Resin Bath _____	_____	_____
Spreader Bar _____	_____	_____
Winding Eye _____	_____	_____
Guide Eyes (If Applicable) _____	_____	_____
Direction Control Bars (If Applicable) _____	_____	_____

ROVING GAP

Ref. Para. 4.2.4.3: SHALL NOT EXCEED .25 INCHES

<u>LOCATION</u>	<u>REMARKS</u>	<u>INSP. STAMP</u>
1. _____	_____	_____
2. _____	_____	_____
3. _____	_____	_____
4. _____	_____	_____



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ROVING BRIDGING

Ref. Para. 4.2.4.4: SHALL NOT EXCEED .50 INCHES BY 12.00 INCHES

<u>LOCATION</u>	<u>REMARKS</u>	<u>INSP. STAMP</u>
1. _____	_____	_____
2. _____	_____	_____
3. _____	_____	_____
4. _____	_____	_____

ROVING SLIPPAGE

Ref. Para. 4.2.4.5: SHALL NOT EXCEED .25 INCHES

<u>LOCATION</u>	<u>REMARKS</u>	<u>INSP. STAMP</u>
1. _____	_____	_____
2. _____	_____	_____
3. _____	_____	_____
4. _____	_____	_____

ROVING KNOTS

Ref. Para. 4.2.4.6: SHALL NOT EXIST WITHOUT REMOVAL

<u>LOCATION</u>	<u>REMARKS</u>	<u>INSP. STAMP</u>
1. _____	_____	_____
2. _____	_____	_____
3. _____	_____	_____
4. _____	_____	_____



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ROVING RESIN CONTROL

Ref. Para. 4.2.4.7: VERIFY COMPLETE INPREGNATION

REMARKS: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

INSPECTION STAMP: \_\_\_\_\_

UNIFORM COMPOSITE CONSTRUCTION

Ref. Para. 4.2.4.8: VERIFY MANUFACTURING PROCESS IN COMPLIANCE WITH ENGINEERING REQUIREMENTS, INCLUDING WEIGHT

<u>ITEM</u>	<u>REMARKS</u>	<u>INSP. STAMP</u>
Liner Weight	_____	_____
Manufacturing	_____	_____
Process Compliance	_____	_____
_____	_____	_____
_____	_____	_____
Cured Assembly Weight	_____	_____

COMPOSITE CONSTRUCTION TESTING

Ref. Para. 4.2.5: Composite Construction Testing performed

By \_\_\_\_\_ Date \_\_\_\_\_



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RESIN CONTENT

REF: Para 4.2.5.1

Verify resin content of approximately 50 feet of impregnated roving. Shall be 50% ± 5% by volume.

<u>ITEM</u>	<u>LENGTH</u>	<u>WEIGHT</u>
Dry S-2 Glass Roving	_____	_____
Impregnated Roving	_____	_____

Calculated Resin Content \_\_\_\_\_

Remarks: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

LAP SHEAR TESTING

REF: Para. 4.2.5.2

Prepare Lap Shear per Figure 3.

NOTE: Test method per ASTM-D-1002 method 64 (minimum value 200 psi)

<u>SAMPLE</u>	<u>CURE TEMP.</u>	<u>CURE TIME</u>	<u>TEST VALUE</u>
1	_____	_____	_____
2	_____	_____	_____
3	_____	_____	_____
4	_____	_____	_____
5	_____	_____	_____
6	_____	_____	_____



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COMPOSITE SANDWICH CORE

REF: Para 4.2.5.3

Verify 250 psi compressive strength.

NOTE: Either a or b must comply.

a. Certified vendor test.

Remarks: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

b. Lab test of 5 samples from each batch or lot each from a different sheet in the batch.

<u>Item</u>	<u>Tested Compressive Strength</u>
1	_____
2	_____
3	_____
4	_____
5	_____
6	_____



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STRUCTURAL COMPOSITE CURING

REF: Para 4.2.5.4

Verify proper cure cycle to design requirements.

CURE TEMPERATURE

Design Requirements

Actual Values

Stage 1 \_\_\_\_\_

\_\_\_\_\_

Stage 2 \_\_\_\_\_

\_\_\_\_\_

Stage 3 \_\_\_\_\_

\_\_\_\_\_

Stage 4 \_\_\_\_\_

\_\_\_\_\_

TIME AT TEMPERATURE

Design Requirements

Actual Values

Stage 1 \_\_\_\_\_

\_\_\_\_\_

Stage 2 \_\_\_\_\_

\_\_\_\_\_

Stage 3 \_\_\_\_\_

\_\_\_\_\_

Stage 4 \_\_\_\_\_

\_\_\_\_\_

NOTE: If temperature recorder was used, attach a copy of recorder sheet.



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DATE: 12/1/80 PAGE 23 OF 24

EVALUATION OF DATA

TANK LINER FABRICATION: \_\_\_\_\_

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FILAMENT WINDING OF TANK: \_\_\_\_\_

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TANK COMPOSITE CURING: \_\_\_\_\_

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EXAMINATION OF CURED: \_\_\_\_\_

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FIBER SCIENCE, INC.  
SALT LAKE CITY, UTAH

NO. QTP- 2191 Section "A"

DATE: 12/1/80 PAGE 24 OF 24

DOCUMENT NUMBER

QTP-2191 SECTION "B"

TITLE


QUALIFICATION TEST PROCEDURE

H-53 TANK

REQUIREMENTS FOR PRODUCT EXAMINATION

REVISIONS

LTR.	DATE	PREPARED	APPROVED	DESCRIPTION

PREPARED BY: Richard Lyman	DATE: 1/14/81	 FIBER SCIENCE, INC. SALT LAKE CITY, UTAH
CHECKED BY: <i>Randy F. Stone</i>	DATE: 3/31/81	
APPROVED BY: <i>C. G. Patrone</i>	DATE: 3/31/81	NO. QTP-2191 Section "B"
DATE: 1/14/81		PAGE 1 OF 16

1.0 SCOPE

This procedure covers the requirements for Product Examination of the 450 Gallon Filament Wound External Fuel Tank for the H-53 Helicopter.

2.0 APPLICABLE DOCUMENTS

2.1 MILITARY SPECIFICATIONS

MIL-P-38477	Plastic material, pressure sensitive, for aircraft identification marking. Calibration System Requirements Test Reports, Preparation of.
MIL-C-45664	
MIL-STD-831	

2.2 TECHNICAL EXHIBIT

ASD/ENFEA-78	Tank - 450 gallon external fuel, filament wound light-weight explosion proof.
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2.3 DRAWINGS

FIBER SCIENCE

2191-001	Tank - Installation, 450 gallon H-53
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SARGENT FLETCHER

27-450-4400	Pylon Assembly - 450 gallon fuel tank.
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2.4 QUALIFICATION TEST PROCEDURES

QTP-2191 Section "A"	Requirements for individual inspection.
QTP-2191 Section "M"	Requirements for maintainability



FIBER SCIENCE, INC.  
SALT LAKE CITY, UTAH

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3.0 REQUIREMENTS

3.1 PRODUCT EXAMINATION ARTICLE

Four (4) tank assemblies (2191-001) equipped with a Government furnished pylon (27-450-4400) shall be subjected to the product examination requirements of Paragraph 4.6.1 as described in Technical Exhibit ASD/ENFEA-78.

3.2 PRODUCT EXAMINATION METHOD

The following examinations are to be performed after completion of the tank fabrication process and final assembly by the Quality Assurance Department.

3.2.1 DESIGN CONFORMANCE

Each tank shall be inspected for conformance to the design drawings, construction, materials and workmanship, exterior surface finish, marking and interchangeability.

3.2.1.1 DESIGN DRAWINGS

Each tank assembly shall be inspected for conformance to the correct revision of the tank installation drawing 2191-001.

3.2.1.2 CONSTRUCTION

Each tank shall be examined to verify that the tank was constructed in accordance with the manufacturing job card and complies with Paragraphs 3.2.4 and 3.2.5 of the Qualification Test Procedures QTP-2191 Section "A".

3.2.1.3 MATERIALS

Each tank shall be examined to verify that the materials used to manufacture the tank are in accordance with the applicable drawings and specifications.



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3.2.1.4

WORKMANSHIP

Each tank shall be examined to verify that the workmanship is of a quality commensurate with good composite filament wound practices and complies with Paragraphs 3.2.4.3 to 3.2.4.6 of the Qualification Test Procedures QTP-2191 Section "A".

3.2.1.5

EXTERIOR SURFACE FINISH

Each tank shall be examined to verify that the exterior surfact finish meet or exceeds the requirements of Paragraph 4.6.1.1 of the Technical Exhibit ASD/ENFEA-78.

3.2.1.6

EXTERIOR MARKINGS

Each tank shall be examined to verify that the exterior marking including decals comply with the requirements of the 450 gallon H-53 tank installation Drawing 2191-001. The identification decal shall be per MIL-P-38477. The location of the identification decal and the information required thereon shall be per Paragraph 3.10.2 of the Technical Exhibit ASD/ENFEA-78.

3.2.1.7

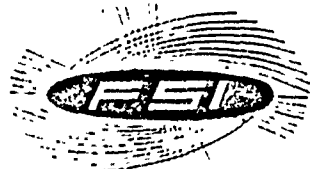
INTERCHANGEABILITY

Each tank shall be examined with a master gage to verify its interchangeability with the 450 gallon fuel tank pylon assembly 27-450-4400-\_. All other interchangeable parts shall be examined by individual inspection or by use of Master Go-Nogo gages, and demonstrated to be interchangeable as part of the maintainability qualification test procedure QTP-2191 Section "I".

3.3

INSPECTION EQUIPMENT

The inspection equipment required to verify compliance of all assemblies, parts, and materials covered by this procedure shall be of good commercial quality in proper working condition, regularly calibrated and under strict equipment control by the Quality Assurance Department.



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3.3.1 INSPECTION EQUIPMENT CALIBRATION

All inspection equipment shall be calibrated and capable of reading or recording data within  $\pm 2\%$  of its full scale value. No inspection equipment shall be used that has not been calibrated within the previous calibration period. Calibration shall be per MIL-C-45662.

3.4 INSPECTION PROCEDURES

The inspection procedures shall be in accordance with Paragraph 4 of this document.

3.5 DOCUMENTATION

At the conclusion of these examination inspection tests, an inspection test report will be prepared for submission to Fiber Science Engineering.



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4.0 PRODUCT EXAMINATION QUALIFICATION PRODECURES

4.1 EXAMINATION EQUIPMENT REVIEW

All inspection equipment to be used for this examination shall be reviewed for accuracy relative to the task assigned, be in good working condition and to possess documentation showing equipment to have been regularly calibrated.

4.1.1 PRODUCT EXAMINATION EQUIPMENT CALIBRATION

All examination inspection equipment shall be inspected to verify that each piece of equipment has had a calibration check within the last calibration period.

4.2 SUBMISSION FOR EXAMINATION

Verify that each tank submitted for examination of product inspection has completed all operations on the job card, has completed the qualification test procedure for individual inspection and that the appendix data sheets have been filled out and where applicable, approved by an assigned authorized signature.

4.2.1 EXAMINATION OF PRODUCT

Each tank submitted for examination shall be examined to the following design conformance criteria:

4.2.1.1 DESIGN DRAWINGS

Verify that the tank conforms to the latest revision of 2191-001 and any sub assembly drawings or detail drawings that have not received previous conformance inspection.

4.2.1.2 CONSTRUCTION

Verify that the tank was constructed in accordance with the manufacturing job card and complies with Paragraphs 3.2.4 and 3.2.5 of the Qualification Test Procedure QTP-2191 Section "A".



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4.2.1.3 MATERIALS

Verify either by vendor certification or actual test that the tank was constructed from materials in accordance with the applicable drawings and specifications.

4.2.1.4 WORKMANSHIP

Verify that the quality of workmanship on the tank is commensurate with the requirements of Paragraph 3.2.1.4.

4.2.1.5 EXTERIOR SURFACE FINISH

Examine and verify that the exterior surface finish is in accordance with Paragraph 4.6.1.1 of the Technical Exhibit ASD/ENFEA-78.

4.2.1.6 EXTERIOR MARKINGS

Verify that the exterior markings on the tank including the decal conform to the requirements of Paragraph 3.2.1.6.

4.2.1.7 INTERCHANGEABILITY

Verify the interchangeability of all removable and replaceable parts per Paragraph 3.2.1.7. The interchangeability of the mounting holes for the pylon shall be verified with the master gage.

5.0 QUALIFICATION EXAMINATION REPORT

A formal qualification examination test report shall be submitted per MIL-STD-831 within 30 days after the examination of the product is complete. This report is to include copies of all examinations made and measurements taken. Each test tank shall be retained for further testing.



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APPENDIX "A"  
PRODUCT EXAMINATION DATA SHEETS



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SALT LAKE CITY, UTAH

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PRODUCT EXAMINATION DATA SHEET

QTR-2191 SECTION "B"

Inspection Activity \_\_\_\_\_ Activity Quality Engr. \_\_\_\_\_

Tank Serial No. \_\_\_\_\_ F. S. I. Test Engr. \_\_\_\_\_

Inspection Date \_\_\_\_\_ Government Rep. \_\_\_\_\_

PRODUCT EXAMINATION EQUIPMENT REVIEW

Ref. Para. 4.1 List of examination inspection equipment used to verify the requirements of this procedure. List working condition, verify if equipment has been regularly calibrated and last calibration date.

<u>ITEM</u>	<u>WORKING CONDITION</u>	<u>REGULARLY CALIBRATED</u>	<u>LAST CALIBRATION DATE</u>
1. _____	_____	_____	_____
2. _____	_____	_____	_____
3. _____	_____	_____	_____
4. _____	_____	_____	_____
5. _____	_____	_____	_____
6. _____	_____	_____	_____
7. _____	_____	_____	_____
8. _____	_____	_____	_____
9. _____	_____	_____	_____
10. _____	_____	_____	_____
11. _____	_____	_____	_____
12. _____	_____	_____	_____



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SALT LAKE CITY, UTAH

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SUBMISSION FOR EXAMINATION

Ref. Para. 4.2 VERIFY COMPLETION OF FOLLOWING:

Completion of all Operations on Job Card through Final Assembly.

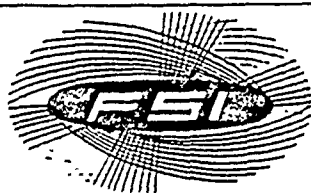
REMARKS: \_\_\_\_\_  
\_\_\_\_\_  
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\_\_\_\_\_

Verified By \_\_\_\_\_ Date \_\_\_\_\_

Completion of Individual Inspection Requirements of QTP-2191 Section "A".

REMARKS: \_\_\_\_\_  
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\_\_\_\_\_  
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Verified By \_\_\_\_\_ Date \_\_\_\_\_



FIBER SCIENCE, INC.  
SALT LAKE CITY, UTAH

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EXAMINATION OF PRODUCT

Ref. Para. 4.2.1 EXAMINED TO FOLLOWING CRITERIA

DESIGN DRAWINGS

Ref. Para. 4.2.1.1 TANK CONFORMS TO INSTALLATION DRAWING 2191-001

REVISION \_\_\_\_\_.

ITEM

REMARKS

IDENTIFICATION: \_\_\_\_\_

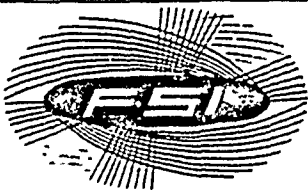
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

DIMENSIONS: \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

ASSEMBLY COMPLETENESS: \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_



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SALT LAKE CITY, UTAH

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CONSTRUCTION

Ref. Para. 4.2.1.2 TANK CONSTRUCTED IN ACCORDANCE WITH INDIVIDUAL INSPECTION REQUIREMENTS OF QTP-2191 SECTION A

COMPLIES WITH PARAGRAPH 3.2.4

REMARKS: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

COMPLIES WITH PARAGRAPH 3.2.5

REMARKS: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

MATERIALS

Ref Para. 4.2.1.3 VERIFY CONSTRUCTION MATERIALS:

PURCHASED PARTS

REMARKS: \_\_\_\_\_

\_\_\_\_\_

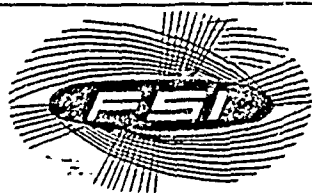
\_\_\_\_\_

RAW MATERIALS

REMARKS: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_



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WORKMANSHIP

Ref: Para. 4.2.1.4 TANK WORKMANSHIP IN ACCORDANCE WITH INDIVIDUAL INSPECTION REQUIREMENTS OF QTP-2191 SECTION "A"

COMPLIES WITH PARAGRAPH 3.2.4.3

REMARKS: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

COMPLIES WITH PARAGRAPH 3.2.4.4

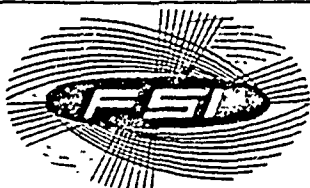
REMARKS: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

COMPLIES WITH PARAGRAPH 3.2.4.5

REMARKS: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

COMPLIES WITH PARAGRAPH 3.2.4.6

REMARKS: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_



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EXTERIOR SURFACE FINISH

Ref. Para. 4.2.1.5 TANK EXTERIOR SURFACE IN ACCORDANCE WITH TECHNICAL EXHIBIT ASD/ENFEA-78

COMPLIES WITH PARAGRAPH 4.6.1.1

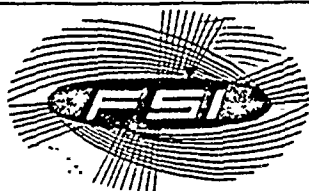
REMARKS: \_\_\_\_\_  
\_\_\_\_\_  
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\_\_\_\_\_  
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\_\_\_\_\_  
\_\_\_\_\_

EXTERIOR SURFACE MARKINGS

Ref. Para. 4.2.1.6 TANK EXTERIOR MARKINGS IN ACCORDANCE WITH INSTALLATION DRAWING 2191-001

COMPLIES WITH DRAWING AND PARAGRAPH 3.10.2. of ASD/ENFEA-78

REMARKS: \_\_\_\_\_  
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INTERCHANGEABILITY

Ref. Para. 4.2.1.7 INTERCHANGEABILITY OF ALL REPLACEABLE OR INTERFACE PARTS

INTERCHANGEABILITY WITH PYLON MASTER GAGE

REMARKS: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

INTERCHANGEABILITY OF REPLACEABLE PARTS

<u>PART NO.</u>	<u>REMARKS</u>
1. _____	_____
2. _____	_____
3. _____	_____
4. _____	_____
5. _____	_____
6. _____	_____
7. _____	_____
8. _____	_____
9. _____	_____
10. _____	_____
11. _____	_____
12. _____	_____



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EVALUATION OF DATA

DESIGN: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

CONSTRUCTION: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

WORKMANSHIP: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

EXTERIOR FINISH: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_



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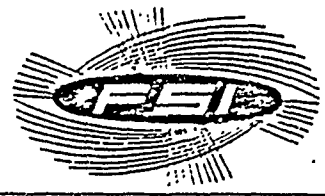
DOCUMENT NUMBER  
QTP-2191 SECTION "C"

TITLE  
QUALIFICATION TEST PROCEDURE  
H-53 TANK  
REQUIREMENTS FOR ASSEMBLED TANK CONTOUR

REVISIONS

LTR.	DATE	PREPARED	APPROVED	DESCRIPTION

PREPARED BY: Richard Lyman  
DATE: 3/31/81



FIBER SCIENCE, INC.  
SALT LAKE CITY, UTAH

CHECKED BY: *R. Stone*  
DATE: 4-1-81

NO. QTP-2191 Section "C"

APPROVED BY: *C. G. Patmore Jr*  
DATE: 4-1-81

DATE: 3/31/81  
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1.0 SCOPE

This procedure covers the requirements for Assembled Tank Contour Test of the 450 Gallon Filament Wound External Fuel Tank for the H-53 Helicopter.

2.0 APPLICABLE DOCUMENTS

2.1 MILITARY SPECIFICATIONS

MIL-STD-831 Test reports, preparation of.

2.2 TECHNICAL EXHIBIT

ASD/ENFEA-78 Tank - 450 gallon external fuel, filament wound light-weight explosion proof.

2.3 DRAWINGS

FIBER SCIENCE

2191-001 Tank - Installation, 450 gallon H-53

2191-006 Liner - 450 gallon tank

SARGENT FLETCHER

27-450-4400 Pylon Assembly - 450 gallon fuel tank.



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SALT LAKE CITY, UTAH

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3.0 REQUIREMENTS

3.1 INSPECTION ARTICLE

Four (4) tank assemblies fully painted and ready for first article inspection (2191-001) shall be securely fastened to a pylon (27-450-4400) and examined for compliance with the assembled tank contour conditions of Technical Exhibit ASD/ENFEA-78, Paragraph 3.9.4.

3.2 TEST METHOD

Each tank secured to the integral pylon shall be accurately inspected for assembled tank contour and fit of the integral pylon (27-450-4400) contour to the tank contour.

3.2.1 ACCURACY OF CONTOUR

The accuracy shall be a repeatable function of the tank liner contour (2191-006) and held within the tolerance requirements of the Engineering drawing.

3.2.2 SMOOTHNESS OF CONTOUR

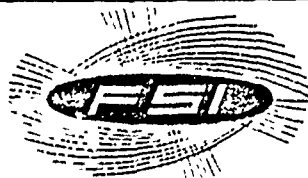
The tank contour shall be smooth and there shall be no bump or valleys in the contour greater than the Engineering drawing tolerance over any six (6) inches of the outside tank surface except around fitting or access openings.

3.3 INSPECTION EQUIPMENT

The inspection equipment required to verify compliance of the tank contour to Engineering drawing shall include an approved master contour template and a twenty-four (24) inch flexible scale. All other inspection equipment shall be of good commercial quality and in proper working condition. The contour template contour shall be within  $\pm$  .030 inches.

3.3.1 INSTRUMENTATION CALIBRATION

All contour inspection equipment shall have been calibrated or inspected within the previous calibration period.



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3.4

DOCUMENTATION

At the conclusion of testing, a test report will be prepared for submission to Fiber Science Engineering Dept. Any out of contour condition shall be addressed in detail.



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4.0 QUALIFICATION TEST PROVISIONS

4.1 SUBMISSION FOR CONTOUR INSPECTION

Each tank and pylon submitted for contour inspection shall be reviewed for completeness of assembly and compliance with previous qualification test procedures. The results of this inspection shall be recorded.

4.2 INSTRUMENTATION AND TEST EQUIPMENT

4.2.1 INSTRUMENTATION CALIBRATION

All inspection instruments shall be inspected to verify that it has had a calibration check within the last calibration period.

4.2.2 CONTOUR TEMPLATE ACCURACY

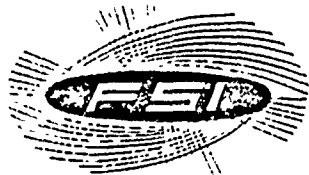
The contour template shall be inspected to verify that it has been accurately fabricated to a tolerance within 25% of the contour tolerance of the applicable contour drawing.

4.3 TANK CONTOUR

Inspect each tank and pylon to verify compliance of the contour to the requirements of Paragraph 3.2 and the applicable Engineering drawings.

5.0 QUALIFICATION TEST REPORT

A formal qualification test report shall be submitted per MIL-STD-831 within 30 days after the inspection is complete. This report is to include all recorded contour deviations if any. The test tank shall be retained for further testing.

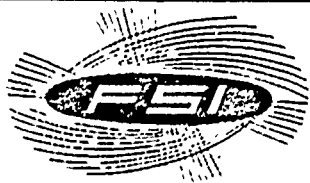


FIBER SCIENCE, INC.  
SALT LAKE CITY, UTAH

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APPENDIX "C"  
TEST DATA SHEETS



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SALT LAKE CITY, UTAH

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TEST DATA SHEET

QTR-2191 SECTION "C"

Testing Activity \_\_\_\_\_ Activity Test Engr. \_\_\_\_\_

Tank Serial No. \_\_\_\_\_ F.S.I. Test Engr. \_\_\_\_\_

Test Date \_\_\_\_\_ Government Rep. \_\_\_\_\_

SUBMISSION FOR CONTOUR INSPECTION

Ref. Para. 4.1: Completeness of Assembly: \_\_\_\_\_

Compliance with Previous Qualification Tests: \_\_\_\_\_

Visual Inspection: \_\_\_\_\_

INSTRUMENTATION AND TEST EQUIPMENT CALIBRATION

Ref. Para 4.2.1: CHECK INSTRUMENTATION CALIBRATION

ITEM

CALIBRATION DATE

- |    |       |       |
|----|-------|-------|
| 1. | _____ | _____ |
| 2. | _____ | _____ |
| 3. | _____ | _____ |
| 4. | _____ | _____ |
| 5. | _____ | _____ |
| 6. | _____ | _____ |



FIBER SCIENCE, INC.  
SALT LAKE CITY, UTAH

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CONTOUR TEMPLATE ACCURACY

Ref. Para. 4.2.2: VERIFY ACCURACY OF CONTOUR TEMPLATE

Contour Coordinate Document

REMARKS: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Contour Template Characteristics  
(That is stand off or net fit template and how used)

REMARKS: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Inspection for Accuracy

REMARKS: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

NOTE: Supply inspection of template data sheet.



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SALT LAKE CITY, UTAH

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TANK CONTOUR

Ref. Para. 4.3: VERIFY COMPLIANCE OF TANK CONTOUR

Contour Tolerance from Engineering Drawing

Tolerance: \_\_\_\_\_

Contour Inspection

Forward Eliptical: \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Center Straight: \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Aft Eliptical: \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Pylon Contour Fit: \_\_\_\_\_

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\_\_\_\_\_  
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SALT LAKE CITY, UTAH

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TANK CONTOUR

Ref. Para. 4.3: VERIFY COMPLIANCE OF CONTOUR SMOOTHNESS

Contour Smoothness Tolerance From  
Engineering Drawing

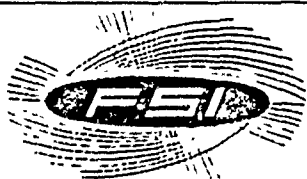
Tolerance: \_\_\_\_\_

Deviations If Any And Location: \_\_\_\_\_

\_\_\_\_\_  
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Approximate Surface Finish (RMS)

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\_\_\_\_\_  
\_\_\_\_\_



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EVALUATION OF DATA

TANK CONTOUR: \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

PYLON CONTOUR FIT: \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

TANK CONTOUR SMOOTHNESS: \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

APPROXIMATE SURFACE FINISH: \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_



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DOCUMENT NUMBER

QTP-2191 SECTION "D"

TITLE

QUALIFICATION TEST PROCEDURE

H-53 TANK

REQUIREMENTS FOR ASSEMBLED TANK WEIGHT

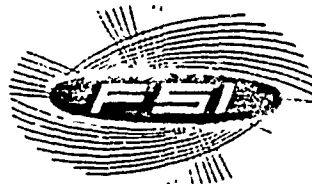
REVISIONS

LTR.	DATE	PREPARED	APPROVED	DESCRIPTION

PREPARED BY: Richard Lyner  
 DATE: 2/11/81

CHECKED BY: *R. Stone*  
 DATE: 3-27-81

APPROVED BY: *C. A. Patnode Jr*  
 DATE: 3/27/81



FIELD SCIENCE, INC.  
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NO. QTP-2191 Section "D"

DATE: 2/11/81

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1. J            SCOPE

This procedure covers the requirements for Assembled Tank Weight Test of the 450 Gallon Filament Wound External Fuel Tank for the H-53 Helicopter.

2.0            APPLICABLE DOCUMENTS

2.1            MILITARY SPECIFICATIONS

MIL-STD-831                      Test reports, preparation of.

2.2            TECHNICAL EXHIBIT

ASD/ENFEA-78                      Tank - 450 gallon external fuel, filament wound light-weight explosion proof.

2.3            DRAWINGS

FIBER SCIENCE

2191-001                              Tank - Installation,  
450 gallon H-53

SARGENT FLETCHER

27-450-4400                              Pylon Assembly - 450  
gallon fuel tank.



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3.0 REQUIREMENTS

3.1 TEST ARTICLE

Four (4) tank assemblies fully painted and ready for first article test (2191-001) shall be securely fastened to a pylon (27-450-4400) and examined for compliance with the assembled tank weight conditions of Technical Exhibit ASD/ENFEA-78, Paragraph 4.6.9.

3.2 TEST METHOD

Each tank secured to the integral pylon shall be accurately weighed and the weight recorded on the data sheet and on the tank nameplate.

3.3 TEST INSTRUMENTATION

The weighing device used for this procedure shall be of good commercial quality and in proper working condition. The weighing device shall be capable of accurately reading the fuel tank weight to within 1/2 pound over the full scale of the device

3.3.1 INSTRUMENTATION CALIBRATION

The weighing device shall have been calibrated within the previous calibration period.

3.4 DOCUMENTATION

At the conclusion of testing, a test report will be prepared for submission to the contractor. Any overweight condition shall be addressed in detail.



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4.0 QUALIFICATION TEST PROVISIONS

4.1 EXAMINATION OF PRODUCT

Each tank and pylon shall be fully examined prior to weighing for completeness of assembly and compliance with previous qualification test procedures. The results of this inspection shall be recorded by the testing activity in the presence of an authorized Fiber Science Test Engineer.

4.2 INSTRUMENTATION AND TEST EQUIPMENT

4.2.1 INSTRUMENTATION CALIBRATION

The weighing device shall be inspected to verify that it has had a calibration check within the last calibration period.

4.2.2 OPERATION

The weighing device shall be checked for proper operation. Any defects in the device shall be recorded and the test shall not proceed until the defect is removed or deemed not critical for the test required by the testing activity and approved by an authorized Fiber Science Test Engineer.

4.3 ASSEMBLED TANK WEIGHT

Each tank and pylon shall then be mounted to or placed on the weighing device and weighed separately and combined. Record total weight on data sheets and tank nameplate.

5.0 QUALIFICATION TEST REPORT

A formal qualification test report shall be submitted per MIL-STD-831 within 30 days after the testing is complete. This report is to include all recorded inspection and weight data sheets. The test tank shall be retained for further testing.



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DATE: 2/11/81 PAGE 4 OF 8

APPENDIX "A"  
TEST DATA SHEETS



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DATE: 2/11/81

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TEST DATA SHEET

QTR-2191 SECTION "D"

Testing Activity \_\_\_\_\_ Activity Test Engr. \_\_\_\_\_

Tank Serial No. \_\_\_\_\_ F.S.I. Test Engr. \_\_\_\_\_

Test Date \_\_\_\_\_ Government Rep. \_\_\_\_\_

EXAMINATION OF PRODUCT

Ref. Para. 4.1: Completeness of Assembly: \_\_\_\_\_

Compliance with Previous Qualification Tests: \_\_\_\_\_

Visual Inspection: \_\_\_\_\_

INSTRUMENTATION

Ref. Para. 4.2.1: CHECK INSTRUMENTATION CALIBRATION

ITEM

CALIBRATION DATE

Weighing Device \_\_\_\_\_

Other Instruments: \_\_\_\_\_

1. \_\_\_\_\_

2. \_\_\_\_\_



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Ref. Para. 4.2.2 CHECK PROPER OPERATION

ITEM

REMARKS

Weighing Device \_\_\_\_\_

Other Instruments: \_\_\_\_\_

1. \_\_\_\_\_

2. \_\_\_\_\_

ASSEMBLED TANK WEIGHT

Ref. Para. 4.3: WEIGH COMPLETELY ASSEMBLED TANK AND PYLON

ITEM

WEIGHT

Tank Assembly \_\_\_\_\_

Pylon Assembly \_\_\_\_\_

Combined Assembly \_\_\_\_\_



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EVALUATION OF DATA

TANK ASSEMBLY WEIGHT: \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

PYLON ASSEMBLY WEIGHT: \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

TANK AND PYLON ASSEMBLY WEIGHT: \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

WEIGHING DEVICE: \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_



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DOCUMENT NUMBER  
QTP-2191 SECTION "E"

TITLE  
QUALIFICATION TEST PROCEDURE  
H-53 TANK  
REQUIREMENTS FOR FUNCTIONAL TEST

REVISIONS

LTR.	DATE	PREPARED	APPROVED	DESCRIPTION

PREPARED BY: Richard Lyman  
DATE: 12/29/80



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SALT LAKE CITY, UTAH

CHECKED BY: James O. Cumbaker  
DATE: 12-30-80

NO. QTP-2191 Section "E"

APPROVED BY: C. L. Paton Jr.  
DATE: 12/30/80

DATE: 12/29/80

1.0 SCOPE

This procedure covers the requirements for the General and the Compatibility Functional Testing of the 450 Gallon Filament Wound External Fuel Tank for the H-53 helicopter.

2.0 APPLICABLE DOCUMENTS

2.1 MILITARY SPECIFICATIONS

MIL-T-5624 Turbine Fuel, Aviation, Grades JP-4 and JP-5

MIL-STD-831 Test Reports, Preparation of.

2.2 FEDERAL SPECIFICATION

P-D-680 Dry Cleaning Solvent

TT-S-735 Standard Test Fluid, Hydrocarbon

2.3 TECHNICAL EXHIBIT

ASD/ENFEA-78 Tank - 450 gallon external fuel, filament wound light-weight explosion proof.

2.4 DRAWINGS

FIBER SCIENCE

2191-001 Tank - Installation, 450 gallon H-53

SARGENT FLETCHER

27-450-4400 Pylon Assembly - 450 gallon fuel tank.



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3.0 REQUIREMENTS

3.1 TEST ARTICLE

3.1.1 GENERAL

Four (4) tank assemblies (2191-001) equipped with a Government furnished pylon (27-450-4400) shall be subjected to the General Functional Test requirements of Paragraph 4.6.11 as described in Technical Exhibit ASD/ENFEA-78.

3.1.2 COMPATIBILITY

One of the four (4) tanks of Paragraph 3.1.1 shall also be installed on an operational H-53 Helicopter to demonstrate proper installation or fit to the aircraft and servicing compatibility to the requirements of Paragraph 4.6.11.2 of the Technical Exhibit ASD/ENFEA-78.

3.2 TEST ARRANGEMENT

3.2.1 GENERAL

The General Test Arrangement for the four tank assemblies shall be similar to that shown in Figure 1 with all reasonable precautions taken to simulate the actual mounting of the tank and pylon to the helicopter.

3.2.2 COMPATIBILITY

The Compatibility Test Arrangement for one of the four tank assemblies shall be as shown in Figure 2, that is, installing one of the test articles to the H-53 Helicopter.

3.3 TEST METHOD

3.3.1 TEST SETUP



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3.3.1.1 GENERAL

The tank, mounted to the pylon, shall be suspended in a 20° nose down position from the test fixture, as shown in Figure 1. The fuel and air fittings shall automatically open as the tank is mounted to the test fixture. The operational hydraulic schematic for fueling and defueling of the tank with the test fluid is shown in Figure 3. The test fluid shall be one of the following:

- (a) Stoddard Solvent per P-D-680
- (b) Type II Fluid per TT-S-735
- (c) JP-4 per MIL-T-5624
- (d) JP-5 per MIL-T-5624

When the tank is securely mounted to the test fixture, an approved capacitance test meter shall be connected to the tank capacitance fuel probe to measure the fuel volume in the tank. The operational electrical schematic for the capacitance fuel probe test is shown in Figure 4.

The General Test Setup shall be completed by connecting a 28 volt DC indicator light or buzzer to the tank full and empty float switches. The operational electrical schematic for the full and empty float switch is shown in Figure 5.

3.3.1.2 COMPATIBILITY

The test setup for proper installation and function of the tank with the aircraft shall be determined by the testing activities test engineer and/or technician and an outlined description of the operational fuel, defueling and electrical aspects of the test setup shall be transmitted to the Fiber Science Test Engineer.

3.3.2 FUNCTIONAL TEST

3.3.2.1 GENERAL TEST

3.3.2.1.1 DRY FUEL TEST

With all fuel, air and electrical connections completed, check the dry or empty fuel capacitance reading for compliance with the meter characteristics as guaranteed by the meter manufacturer and the capacitance probe manufacturer. The meter/probe dry fuel capacitance characteristics once



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established shall not vary more than  $\pm 1.5$  pico farads.  
During this test the empty indicator light or buzzer should be activated by the empty tank float switch.

3.3.2.1.2 WET FUEL TEST

Activate the automatic fuel/defuel valve on the test fixture and fuel the tank at the rate of 50 gallons per minute with a maximum pressure of 10 psig. The full tank float switch shall activate and close the automatic fuel valve when the tank is full (450 to 457 gallons). The full tank float switch shall also have activated the full indicator light or buzzer. The full fuel capacitance shall be checked to the manufacturer's established values. The established full fuel capacitance characteristics once established shall not vary more than  $\pm 12.5$  pico farads.

3.3.2.1.3 DEFUELING TEST

The automatic fuel/defuel valve shall be switched to the defuel position and the tank shall be defueled by pressurizing through the vent valve with 30 to 45 psig air pressure. The pressure shall be adjusted so that the differential pressure drop across the fuel/defuel valve is 15 psig. The tank shall be capable of defueling at a minimum rate of 85 gallons per minute. When the tank is empty, the empty tank indicator light or buzzer should be activated.

3.3.2.2 COMPATIBILITY TEST

3.3.2.2.1 DRY FUEL TEST

The H-53 Helicopter tank empty indicator mechanism shall be actuated and the fuel quantity gauge shall read properly for an empty tank condition before the tank is fueled.

3.3.2.2.2 WET FUEL TEST

The tank shall be fueled to a full tank condition and the H-53 Helicopter tank full indicator mechanism shall be activated. The fuel quantity gauge shall also read properly for a full tank condition.



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3.3.2.2.3 DEFUELING TEST

The tank shall be automatically drained to an empty tank condition. The fuel quantity gauge shall read properly for an empty tank condition and the tank float switch shall activate the aircraft empty tank indicator mechanism and if applicable close the tank defuel valve.

3.4 TEST INSTRUMENTATION

3.4.1 GENERAL TEST

Test instrumentation shall be those gauges, meters, and indicators shown in the operational schematics of Figure 3, 4, and 5, and each shall be capable of displaying continuous reading during the test.

3.4.2 COMPATIBILITY TEST

Test instrumentation shall be those gauges, meters, and indicators normally used aboard the H-53 Helicopter for ground refueling and inflight fuel monitoring. In addition a full color 16 mm movie and 12 still photographs shall be taken to document installation procedures and establish any problems that may exist, such as improper handling, improper fit or improper operation of the fueling or defueling mechanisms.

3.4.3 INSTRUMENTATION CALIBRATION

All instrumentation shall be calibrated and capable of reading or recording data within  $\pm 2\%$  of its full scale value. No instrument shall be used that has not been calibrated within the previous calibration period.

3.5 TEST PROCEDURES

The test procedures shall be in accordance with Paragraph 4 of this document.

3.6 DOCUMENTATION

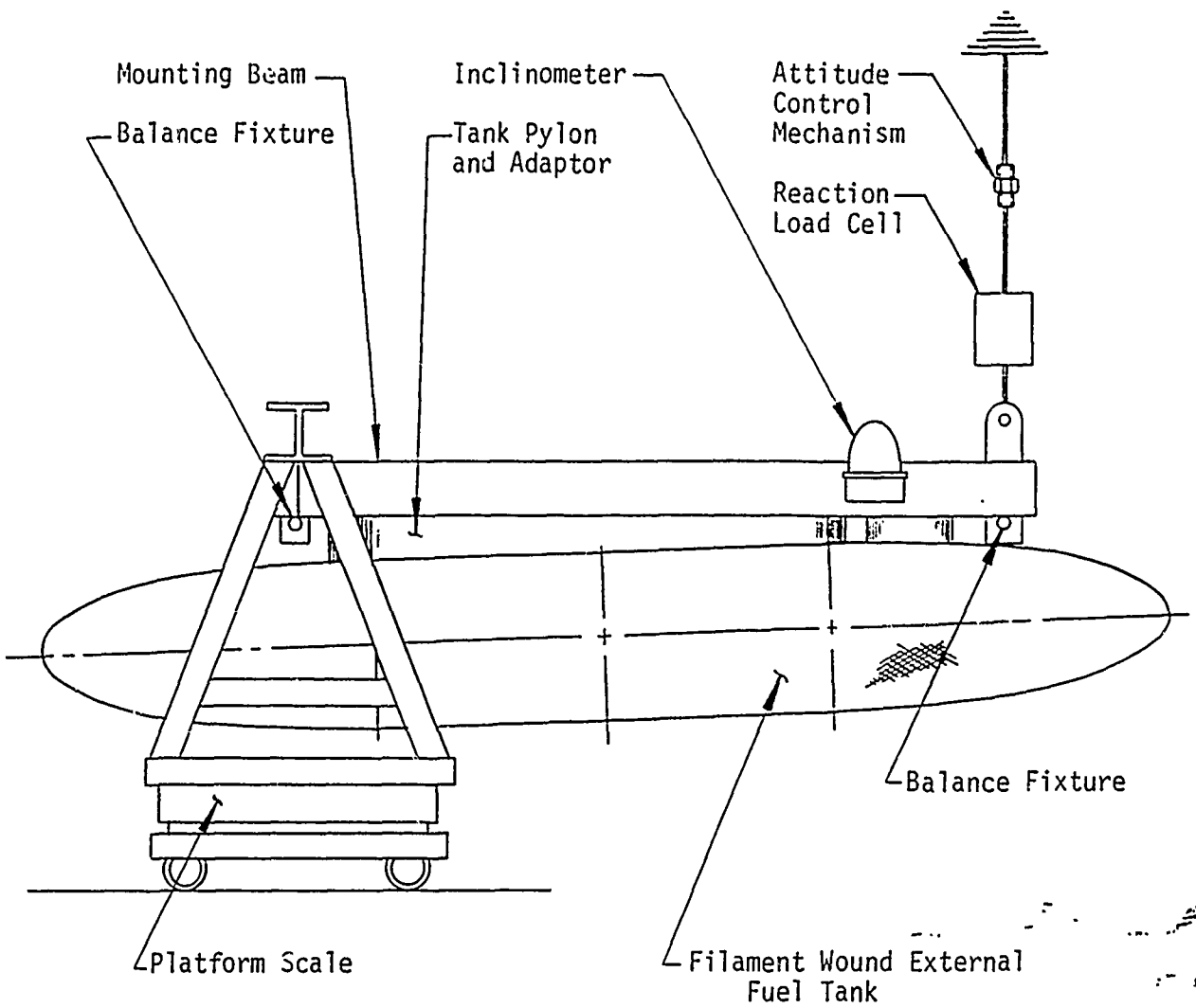
At the conclusion of testing a test report shall be prepared for submission to the contractor.



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FUNCTIONAL TEST FIXTURE

FIGURE 1

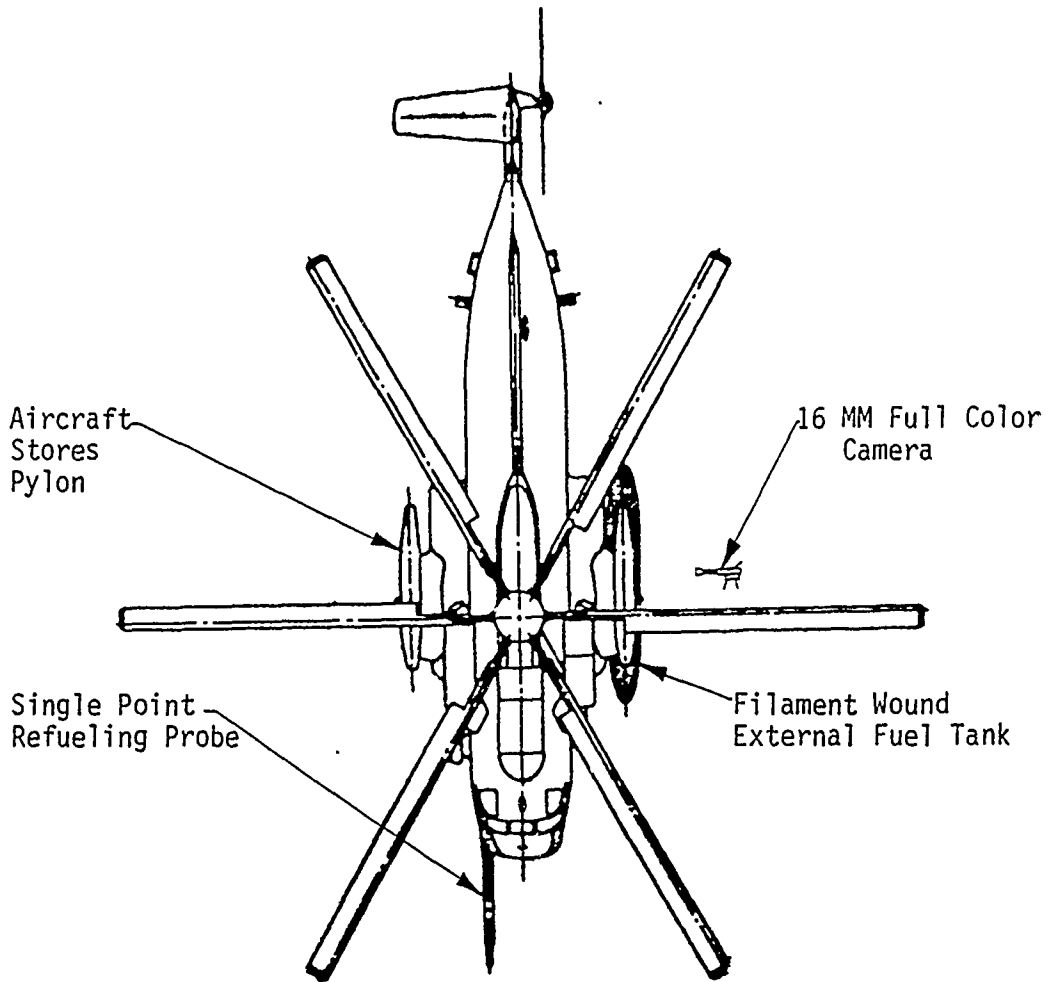
GENERAL TEST ARRANGEMENT



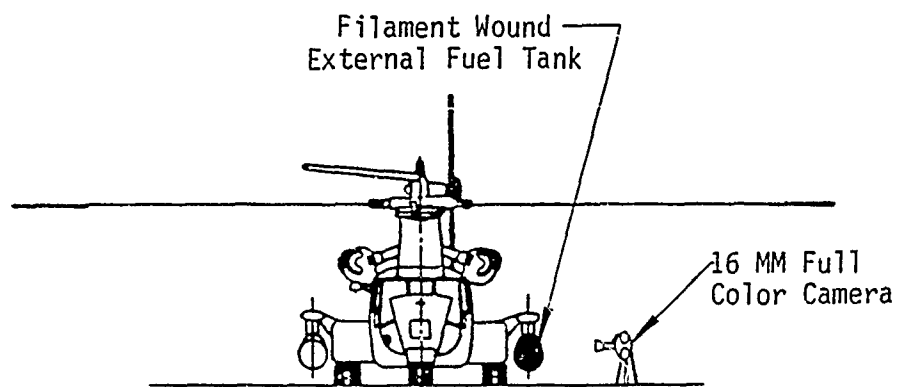
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HELICOPTER TOP VIEW



HELICOPTER FRONT VIEW

FIGURE 2

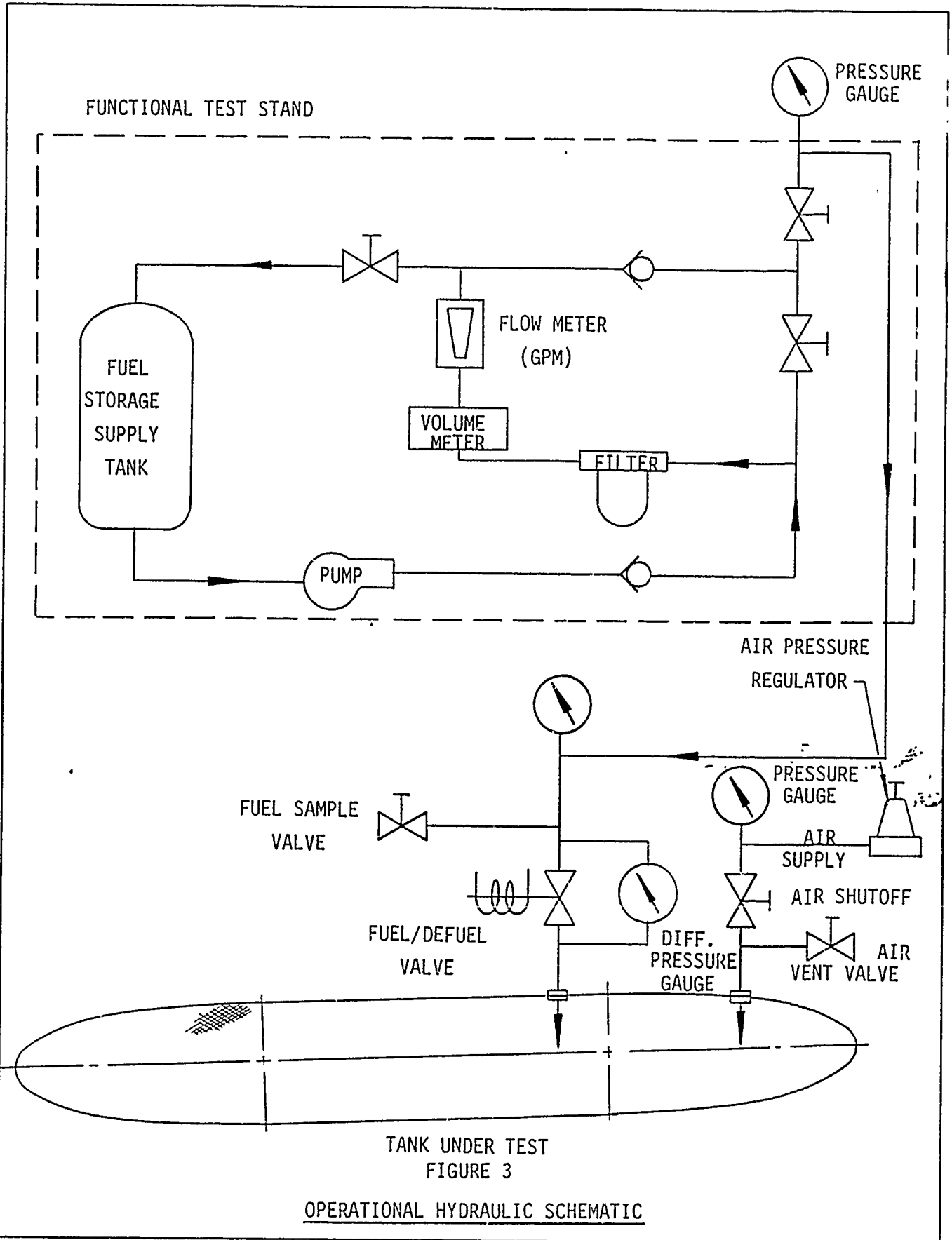
H-53 HELICOPTER COMPATIBILITY TEST ARRANGEMENT



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NO. QTP-2191 Section "E"

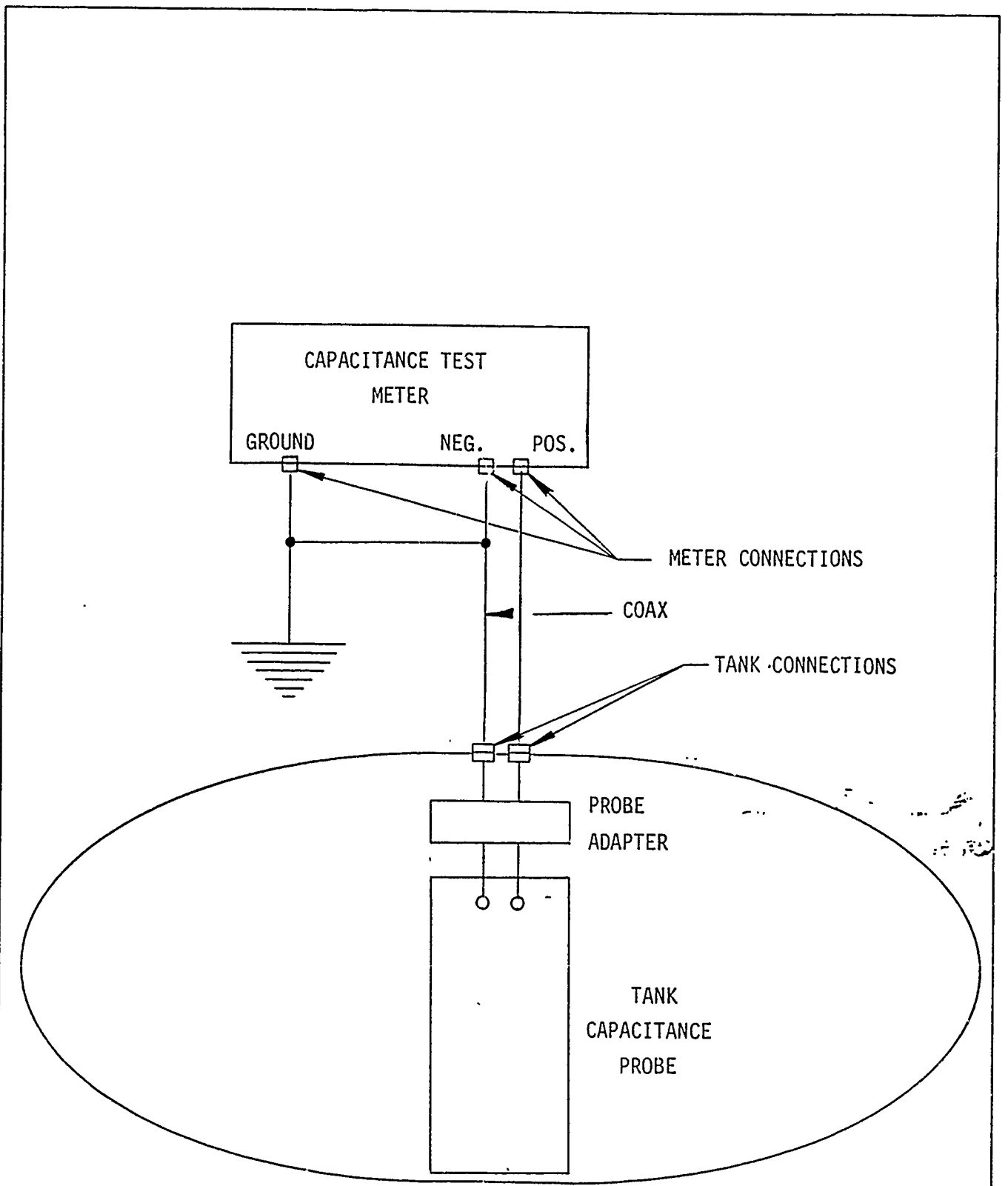
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FUEL TANK WITH CAPACITANCE PROBE

FIGURE 4

OPERATIONAL ELECTRICAL SCHEMATIC FUEL CAPACITANCE PROBE TEST

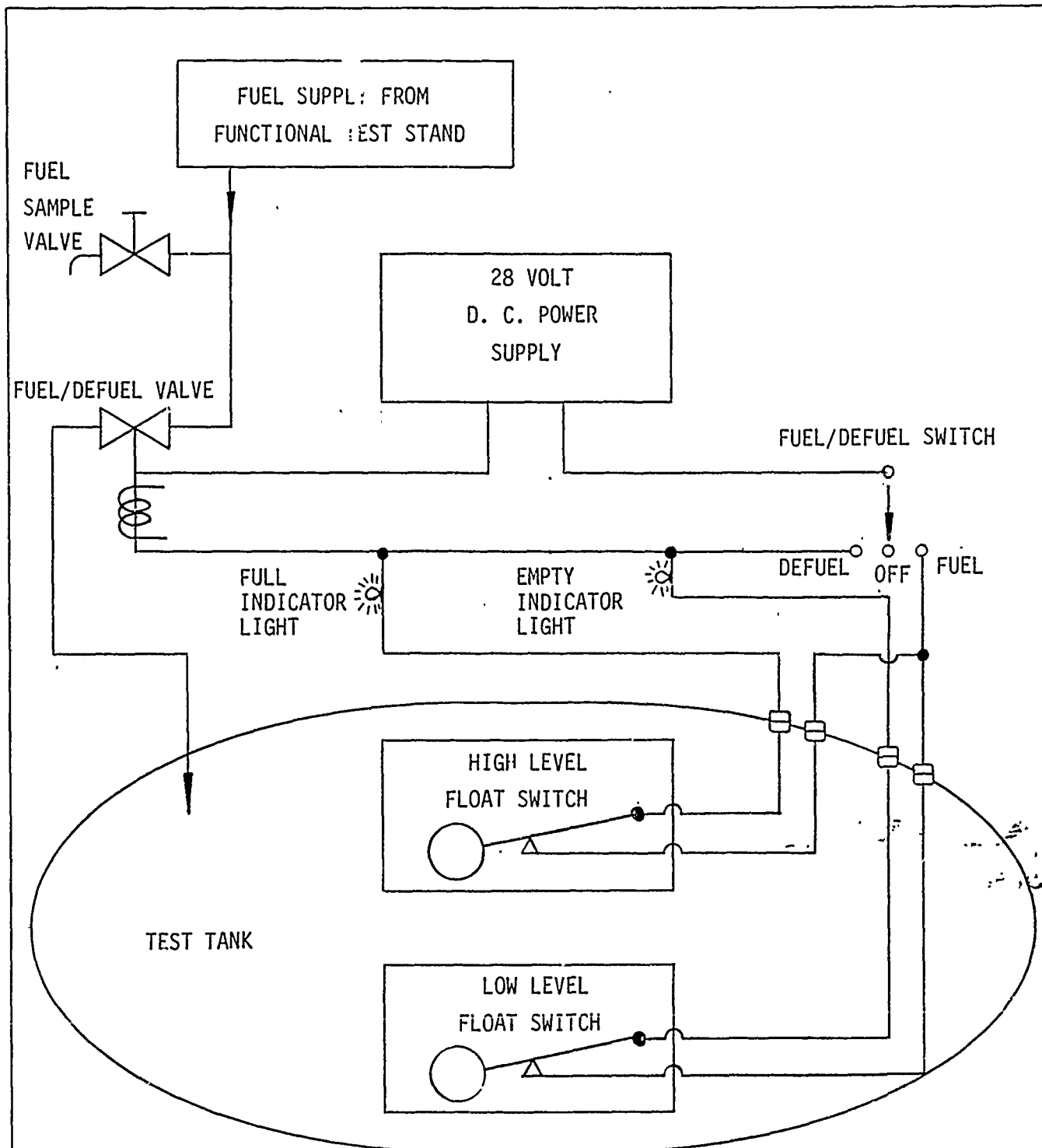


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FUEL TANK WITH FLOAT SWITCHES

FIGURE 5

OPERATIONAL ELECTRICAL SCHEMATIC FLOAT SWITCH TEST



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4.0 QUALIFICATION TEST PROCEDURES

4.1 EXAMINATION OF PRODUCT

4.1.1 GENERAL EXAMINATION

Each tank and pylon shall be fully examined prior to mounting to the test stand for compliance with Qualification Test Procedures Section "A" through "D". The results of this inspection shall be recorded in the respective test section of each document and verification that this has been accomplished shall be noted on the test data sheets of Appendix A of this test procedure.

4.1.2 COMPATIBILITY EXAMINATION

The selected tank and pylon for this test shall be fully examined prior to mounting to the H-53 Helicopter for shipping damage to the test site. This examination shall include a visual inspection and a tap test for delaminations. The results of this inspection shall be recorded by the testing activity in the presence of an authorized Fiber Science Test Engineer.

4.2 MOUNTING

4.2.1 GENERAL TEST

Each tank and pylon shall then be mounted to the test fixture and examined for proper attachment and assimilation to the actual aircraft installation. Any significant variations or deviations shall be recorded.

4.2.2 COMPATIBILITY TEST

The selected tank and pylon shall be mounted to the H-53 Helicopter and examined for proper attachment and fit to the aircraft. Any significant variations or deviations shall be recorded.



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4.3 ARRANGEMENT

4.3.1 GENERAL TEST

The test arrangement shall be examined for compliance with Figure 1, 3, 4, and Figure 5 of this procedure and applicable paragraphs of ASD/ENFEA-78 Technical Exhibit.

4.3.2 COMPATIBILITY TEST

The test arrangements shall be examined for compliance with Figure 2 of this procedure and the testing activities requirements for performing a fit and function test on the H-53 Helicopter. If available a fueling/defueling and electrical schematic of the H-53 Helicopter external tank fuel system should be acquired as part of the test documentation data.

4.4 INSTRUMENTATION

4.4.1 INSTRUMENTATION CALIBRATION

All instrumentation shall be inspected to verify that each instrument has had a calibration check within the last calibration period. Record the calculated meter/probe dry tank capacitance values in accordance with Paragraph 3.3.2.1.1 of this document.

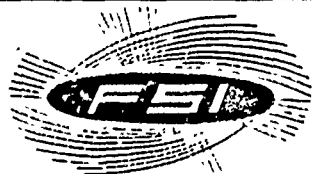
Instrumentation calibration aboard the H-53 Helicopter shall be verified by the testing activity.

4.4.2 MONITORING

All instruments required for recording test data shall either be manned by a test technician or employ a synchronized continuous recording device.

4.4.3 OPERATION

All instrumentation and test equipment shall be checked for proper operation. Any defects in instrumentation shall be recorded and the test shall not proceed until the defect is removed or deemed not critical for the test required by the testing activity and approved by an authorized Fiber Science Test Engineer.



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4.5 GENERAL FUNCTIONAL TEST

4.5.1 DRY FUEL TEST

With all instrumentation energized record the dry fuel capacitance and whether the empty tank float switch indicator light or buzzer is on. The capacitance reading shall be in accordance with Paragraph 3.3.2.1.1 of this document.

4.5.2 WET FUEL TEST

With all instrumentation still energized, close the air supply valve and open the vent valve. Activate the fuel/defuel valve by moving the switch to the fuel position. Record the following:

- (a) The fuel flow rate in gallons per minute at a maximum pressure of 10 psig. The minimum flow rate allowable shall be 50 gallons per minute.
- (b) The air pressure required to provide a flow rate of 50 gallons per minute. The maximum gauge pressure allowable shall be 10 psig.
- (c) Verify that the float switch activated the fuel/defuel valve to stop the fuel flow when the tank was full.
- (d) Record the actual amount of fuel in the tank by weight. The useable fuel volume shall be between 450 and 457 gallons.
- (e) Record the wet fuel capacitance. The capacitance value shall be in accordance with the requirements of Paragraph 3.3.2.1.2 of this document.

4.5.3 DEFUELING TEST

Close the vent valve and open the air supply valve. Adjust the air supply valve to 15 psig and place the fuel/defuel switch in the defuel position. Record the defueling rate. The tank and plumbing shall be capable of being defueled at the rate of 85 gallons per minute.

Verify that the empty tank float switch shut off the fuel/defuel valve and activated the empty tank indicator light or buzzer.



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4.5.4 FUEL DRAIN

Close the air supply valve and open the vent valve. With the fuel/defuel valve in the off position open the tank drain and remove the remaining fuel from the tank. The measured sump fuel removed from the tank shall be 1.00 to 1.25 gallons.

4.6 COMPATIBILITY FUNCTIONAL TEST

4.6.1 DRY FUEL TEST

With all instrumentation energized record the fuel quantity gauge reading. The fuel quantity gauge readings shall be the same as that recorded when the standard external fuel tank is used.

Verify that the empty tank indicator mechanism has been activated if such a mechanism exists aboard the helicopter or on refueling panel.

4.6.2 WET FUEL TEST

With all instrumentation still energized fuel the tank to a full tank condition. Record the following values if such instrumentation exists aboard the aircraft to do so relative to those values achieved when the standard external fuel tank is used:

- (a) The fuel flow rate in gallons per minute at a maximum pressure of 10 psig. The minimum flow rate allowable is 50 gallons per minute.
- (b) The air pressure required to provide a flow rate of 50 gallons per minute. The maximum gauge pressure allowable shall be 10 psig.
- (c) Verify that the float switch activated the fueling valve if applicable to stop the fuel flow when the tank is full.
- (d) Record if applicable the amount of fuel in the tank either by flow meter or gauge. The useable fuel volume shall be between 450 and 457 gallons.



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4.6.3 DEFUELING TEST

Defuel the tank to an empty tank condition. The tank fuel system should be capable of defueling at a rate of 85 gallons per minute if the helicopter defueling pressure system is capable of producing 30 to 45 psig air pressure to the tank for defueling. Record the pressure at which 85 gallons per minute is achieved.

4.6.4 FUEL DRAIN

With all fuel systems de-energized open the drain valve and remove the remaining fuel from the tank. The measured sump fuel removed from the tank shall be 1.00 to 1.25 gallons.

5.0 QUALIFICATION REPORT

A formal qualification test report shall be submitted per MIL-STD-831 within 30 days after the testing is complete. This report shall include all recorded functional test data sheets, 16 mm movie film and still photos used to document the compatibility of the tank and pylon to the helicopter. The tank used for the Functional Compatibility Test shall be returned to Fiber Science for further testing in the same shipping container it was received in.



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APPENDIX "A"  
TEST DATA SHEETS



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TEST DATA SHEET

QTR-2191 SECTION "E"

Testing Activity \_\_\_\_\_ Activity Test Engr. \_\_\_\_\_  
Tank Serial No. \_\_\_\_\_ F.S.I. Test Engr. \_\_\_\_\_  
Test Date \_\_\_\_\_ Government Rep. \_\_\_\_\_

EXAMINATION OF PRODUCT

Ref. Para. 4.1.1 GENERAL EXAMINATION

Verify that the test article has successfully passed the previous test.

<u>TEST</u>	<u>COMPLETED</u>	<u>REMARKS</u>
a. Individual Inspection per QTP-2191 Section "A"	_____	_____
b. Examination of Product per QTP-2191 Section "B"	_____	_____
c. Tank Contour per QTP-2191 Section "C"	_____	_____
d. Assembled Tank Weight per QTP-2191 Section "D"	_____	_____

Ref. Para. 4.1.2 COMPATIBILITY EXAMINATION

Visual Inspection \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
Delaminations (Tap Test) \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_



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MOUNTING

Ref. Para. 4.2

GENERAL TEST

Aircraft Simulated Attachment

Deviations if any \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Ref. Para. 4.2.2

COMPATIBILITY TEST

Aircraft Attachment (Supply sketch if necessary to describe fit or connection problems).

Primary Pylon Fit \_\_\_\_\_

\_\_\_\_\_

Stub Pylon Fit \_\_\_\_\_

\_\_\_\_\_

Fuel Connection \_\_\_\_\_

\_\_\_\_\_

Air Connection \_\_\_\_\_

\_\_\_\_\_

Float Switch Electrical Connection \_\_\_\_\_

\_\_\_\_\_

Fuel Probe Electrical Connection \_\_\_\_\_

\_\_\_\_\_



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ARRANGEMENT

Ref. Para. 4.3

GENERAL TEST

Approved Test Arrangement  
(Ref. Figures 1, 3, 4, 5, & ASD/ENFEA-78  
Technical Exhibit)

Testing Activity Approval

Approved By \_\_\_\_\_ Date \_\_\_\_\_

F.S.I. Test Engineer Approval

Approved By \_\_\_\_\_ Date \_\_\_\_\_

Government Approval

Approved By \_\_\_\_\_ Date \_\_\_\_\_

Minimum of two signatures required.

Ref. Para 4.3.2

COMPATIBILITY TEST

Inspection and acquisition of fueling/defueling and  
electrical schematic of the H-53 Helicopter External  
Tank Fuel System.

Remarks: \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Verify Compliance With Schematic.

\_\_\_\_\_



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Approved Test Arrangement  
(Ref. Figure 2 & ASD/ENFEA-78 Technical Exhibit)

Testing Activity Approval

Approved By \_\_\_\_\_ Date \_\_\_\_\_

F.S.I. Test Engineer Approval

Approved By \_\_\_\_\_ Date \_\_\_\_\_

Government Approval

Approved By \_\_\_\_\_ Date \_\_\_\_\_

Minimum of two signatures required.

INSTRUMENTATION

Ref. Para. 4.4.1

CHECK INSTRUMENTATION CALIBRATION

<u>ITEM</u>	<u>CALIBRATION DATE</u>
Fuel Quantity Gauges	_____
Flow Meters (If Applicable)	_____
Pressure Gauges (If Applicable)	_____
Capacitance Meters (If Applicable)	_____
Timing Devices	_____
Other Instruments:	
1. _____	_____
2. _____	_____
3. _____	_____
4. _____	_____



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Ref. Para 4.4.2

CHECK INSTRUMENTATION MONITORING

All instrumentation is manned or synchronized with a continuous recording device.

Remarks \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Ref. Para 4.4.3

CHECK FOR PROPER OPERATION

<u>ITEM</u>	<u>REMARKS</u>
Fuel/Defuel Valve	_____
System Pump	_____
Flow Meters (If Applicable)	_____
Gauges	_____
Switches	_____
Cameras (If Applicable)	_____
Other Instruments:	
1. _____	_____
2. _____	_____
3. _____	_____
4. _____	_____



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GENERAL FUNCTIONAL TEST

Ref. Para. 4.5.1

DRY FUEL TEST

ITEM

REMARKS

System Energized \_\_\_\_\_

Empty Tank Indicator  
Light or Buzzer On \_\_\_\_\_

Manufacturer's Meter/  
Probe Dry Fuel Capacitance  
Valve \_\_\_\_\_

Actual Dry Fuel Capacitance  
Reading ( $\pm$  1.5 Pico Farads  
of Manufacturer's Value) \_\_\_\_\_

Ref. Para. 4.5.2

WET FUEL TEST

ITEM

REMARKS

System Fueling \_\_\_\_\_

Flow Rate at 10 PSIG \_\_\_\_\_

Air Pressure at 50 GPM \_\_\_\_\_

Float Switch Shut Off Fuel  
Value When Tank was Full \_\_\_\_\_

Full Tank Indicator Light  
or Buzzer On \_\_\_\_\_

Weight/Gallons of Fuel in  
Tank \_\_\_\_\_

Manufacturer's Meter/Probe  
Full Tank Capacitance Value \_\_\_\_\_

Actual Dry Fuel Capacitance  
Reading ( $\pm$  12.5 Pico Farads  
of Manufacturer's Value) \_\_\_\_\_



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Ref. Para. 4.5.3

DEFUELING TEST

ITEM

REMARKS

Defueling Air Pressure at which 85 GPM was achieved.

Empty Tank Indicator Light or Buzzer on.

Actual Empty Tank Capacitance Reading.

Ref. Para. 4.5.4

FUEL DRAIN

ITEM

REMARKS

Actual Amounts of Sump Fuel collected from Draining Tank.

COMPATIBILITY FUNCTIONAL TEST

Ref. Para. 4.6.1

DRY FUEL TEST

ITEM

REMARKS

System Energized

Empty Tank Indicator Mechanism On

Standard Aircraft Dry Fuel Quantity Gauge Reading

Actual Aircraft Dry Fuel Quantity Gauge Reading

Ref. Para. 4.6.2

WET FUEL TEST

ITEM

REMARKS

System Fueling

Flow Rate at 10 PSI

Air Pressure at 50 GPM

Float Switch Shut Off Fuel Valve When Tank Was Full



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Full Tank Indicator  
Mechanism On

\_\_\_\_\_

Standard Aircraft Full  
Quantity Gauge Reading

\_\_\_\_\_

Actual Aircraft Full  
Quantity Gauge Reading

\_\_\_\_\_

Ref. Para 4.6.3

DEFUELING TEST

ITEM

REMARKS

Defueling Air Pressure at  
which 85 GPM was achieved

\_\_\_\_\_

Empty Tank Indicator  
Mechanism On

\_\_\_\_\_

Actual Empty Tank Fuel  
Quantity Gauge Reading

\_\_\_\_\_

Ref. Para. 4.6.4

FUEL DRAIN

ITEM

REMARKS

Actual Amount of Sump  
Fuel collected from  
Draining Tank

\_\_\_\_\_



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EVALUATION OF DATA

FUELING/DEFUELING: \_\_\_\_\_

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CAPACITANCE PROBE: \_\_\_\_\_

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FLOAT SWITCHES: \_\_\_\_\_

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FIT CHECK: \_\_\_\_\_

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DOCUMENT NUMBER

QTP-2191 SECTION "F"

TITLE

QUALIFICATION TEST PROCEDURE

H-53 TANK

REQUIREMENTS FOR

FIRST ARTICLE PRESSURE TEST

REVISIONS

LTR.	DATE	PREPARED	APPROVED	DESCRIPTION

PREPARED BY: Richard Lyman  
DATE: 2/5/81

CHECKED BY: *R. Stone*  
DATE: 2-10-81

APPROVED BY: *C. G. Patmsh*  
DATE: 2/11/81



FIBER SCIENCE, INC.  
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DATE: 2/5/81



1.0 SCOPE

This procedure covers the requirements for First Article Pressure Testing of the 450 Gallon Filament Wound External Fuel Tank for the H-53 Helicopter.

2.0 APPLICABLE DOCUMENTS

2.1 MILITARY SPECIFICATIONS

MIL-T-5624 Turbine fuel, aviation grade JP-4 and JP-5.

MIL-STD-831 Test reports, preparation of.

2.2 FEDERAL SPECIFICATION

P-D-680 Dry cleaning solvent

2.3 TECHNICAL EXHIBIT

ASD/ENFEA-78 Tank - 450 gallon external fuel, filament wound light weight explosion proof.

2.4 DRAWINGS

FIBER SCIENCE

2191-001 Tank - Installation, 450 gallon H-53

SARGENT FLETCHER

27-450-4400 Pylon Assembly - 450 gallon fuel tank.



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3.0 REQUIREMENTS

3.1 TEST ARTICLE

*450 GALLON*  
*ENCH. TANK ASSEMBLY*  
Four ~~(4)~~ tank assemblies (2191-001) shall be securely fastened to a pylon (27-450-4400) which in turn is mounted to ~~the~~ *THE FUNCTIONAL* test fixture by means of a simulated air-frame adaptor. Each tank shall then be fueled to a full tank condition and subjected to the first article testing conditions of Technical Exhibit ASD/ENFEA-78, Paragraph 4.6.12.2.

3.2 TEST ARRANGEMENT

The test arrangement shall be similar to that shown in Figure 1 with all reasonable precautions taken to simulate the actual mounting of the tank and pylon to the helicopter.

3.3 POSITIVE PRESSURE TEST METHOD

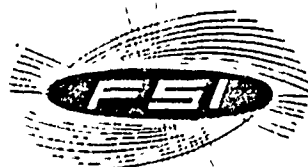
Each tank secured to the pylon support points shall be suspended from the functional test fixture in a 2<sup>o</sup> nose down position. Each tank shall then be filled to a full tank condition with 450 to 457 gallons of JP-5 fuel per MIL-T-5624 or Stoddard Solvent per P-D-680. Each tank shall then be pressurized to  $86 \pm 2$  psi for three (3) minutes without leakage.

3.4 NEGATIVE PRESSURE TEST METHOD

Each tank after completion of the positive pressure test shall be drained and a  $10 \pm 1/2$  psi negative pressure applied to each tank for three minutes without leakage or rupture.

3.5 TEST INSTRUMENTATION

A staining agent or fluorescent dye shall be mixed in the test fluid to aid in the detection of leakage. If a staining agent is used, brown paper should be placed snugly over all access openings or ports to detect leakage. If a fluorescent dye is used, an ultraviolet light should be acquired to visually detect leakage. Calibrated quality pressure regulator and pressure and vacuum gauges shall be used.



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3.5.1 INSTRUMENTATION CALIBRATION

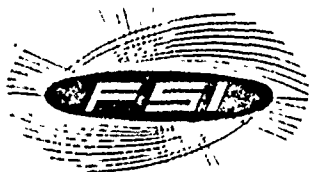
All instrumentation shall be calibrated and capable of reading or recording data within  $\pm 2\%$  of its full scale value. No instrument shall be used that has not been calibrated within the previous calibration period.

3.6 TEST PROCEDURES

The test procedures shall be in accordance with Paragraph 4 of this document.

3.7 DOCUMENTATION

At the conclusion of testing, a test report will be prepared for submission to the contractor.



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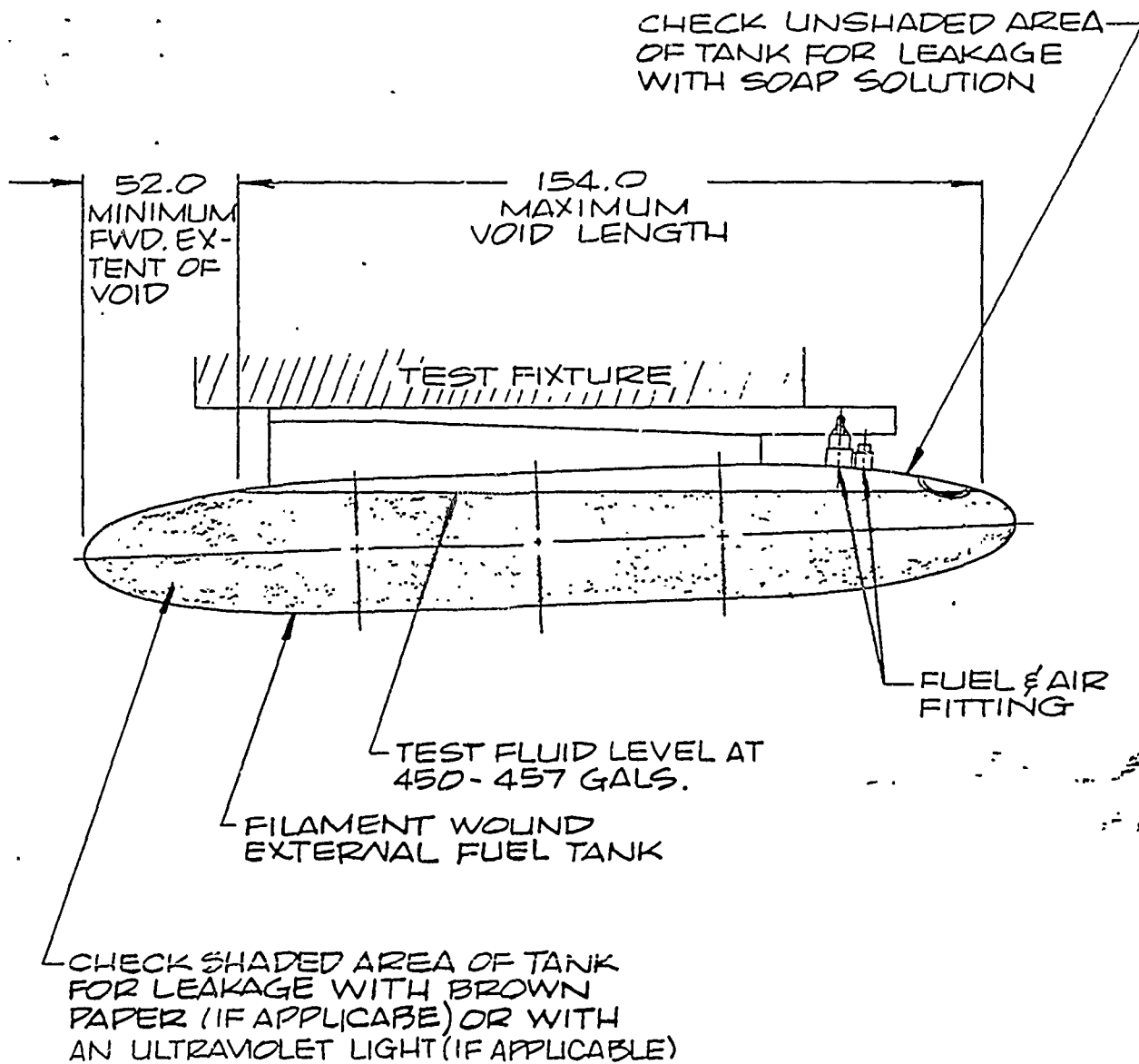


FIGURE 1

PRESSURE TEST ARRANGEMENT



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4.0 QUALIFICATION TEST PROVISIONS

4.1 EXAMINATION OF PRODUCT

Each tank and pylon shall be fully examined prior to mounting to the test fixture for damage. This examination shall include a visual inspection and a tap test for delaminations if not accomplished as part of the final inspection from previous test. The results of this inspection shall be recorded by the testing activity in the presence of an authorized Fiber Science Test Engineer.

4.2 MOUNTING

Each tank and pylon shall then be mounted to the test fixture in a 20° nose down attitude by means of the simulated airframe adaptor and examined for proper attachment and assimilation to the actual aircraft installation. Install all fuel, air, and electrical connections for simulated operation. Any significant variations or deviations shall be recorded.

4.3 ARRANGEMENT

The test arrangement shall be examined for compliance with Figure 1 of this procedure or shall be deemed to be in compliance with the applicable paragraphs of ASD?ENFEA-78 Technical Exhibit and approved by an authorized Fiber Science Test Engineer and an authorized Government representative.

4.4 INSTRUMENTATION AND TEST EQUIPMENT

4.4.1 INSTRUMENTATION CALIBRATION

All instrumentation shall be inspected to verify that each instrument has had a calibration check within the last calibration period.

4.4.2 INSTALLATION

All pressure and vacuum gauges shall be installed so as to have little or no affect on the test other than to provide accurate pressure and vacuum readings.



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#### 4.4.3 OPERATION

All test equipment shall be checked for proper operation. Any defects in equipment shall be recorded and the test shall not proceed until the defect is removed or deemed not critical for the test required by the testing activity and approved by an authorized Fiber Science Test Engineer.

#### 4.5 FUELING

Each tank shall be filled with 450 to 457 gallons of JP-5 fuel or Stoddard Solvent in which an approved fluorescent dye or staining agent has been added for leak detection. Each tank will be full when the float switch actuates a full tank warning device. Each tank will also be properly filled when the test fluid pours out the open vent line. If a staining agent is used in the test fluid, place brown paper snugly around all fittings or ports in the fuel portion of the tank. See Figure 1.

#### 4.6 POSITIVE PRESSURE TEST

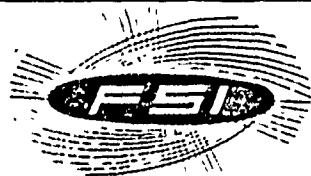
When each tank is full, close the vent valve and pressurize the tank to  $86 \pm 2$  psi for three (3) minutes.

#### 4.6.1 POSITIVE PRESSURE TEST INSPECTION

Soap solution test the fuel void portion of each tank as shown in Figure 1. Leakage in this portion of the tank will be indicated by the presence of air bubbles forming in the soap solution. If a staining agent has been used in the test fluid, inspect all brown paper covered fittings and ports for test fluid stains to detect leakage. If a fluorescent dye is used in the test fluid, an ultraviolet light should be used to visually detect the presence of the red dye for leakage. There shall be no leakage during this test.

#### 4.7 NEGATIVE PRESSURE TEST

Reduce pressure to zero (0) and drain each tank of all test fluid. Connect vacuum line to fuel or vent port. With all other ports closed, evacuate each tank of air to a negative 10 psig. Close vacuum valve and hold vacuum for three (3) minutes.



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4.7.1 NEGATIVE PRESSURE TEST INSPECTION

Inspect each tank and vacuum gauge for leak detection. There shall be no leakage, rupture or failure of any of the tanks. There shall be no drop in the vacuum gauge reading during the test.

4.8 POST PRESSURE TEST EXAMINATION

Following the foregoing pressure tests, each tank shall be opened and visually inspected for any damage. The entire outer surface of each tank shall be tap tested for delaminations.

5.0 QUALIFICATION TEST REPORT

A formal qualification test report shall be submitted per MIL-STD-831 within 30 days after the testing is complete. This report is to include all recorded positive and negative pressure data sheets and a record of any leakage and its location if such occurred. Each test tank shall be retained for further testing before returning to Fiber Science, Inc.



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APPENDIX "A"  
TEST DATA SHEETS



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TEST DATA SHEET

QTR-2191 SECTION "F"

Testing Activity \_\_\_\_\_ Activity Test Engr. \_\_\_\_\_  
Tank Serial No. \_\_\_\_\_ F.S.I. Test Engr. \_\_\_\_\_  
Test Date \_\_\_\_\_ Government Rep. \_\_\_\_\_

EXAMINATION OF PRODUCT

Ref. Para. 4.1: Visual Inspection \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Delaminations (Tap Test) \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

MOUNTING

Ref. Para. 4.2: Aircraft Simulated Attachment  
Deviations If Any \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_



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ARRANGEMENT

Ref. Para. 4.3: APPROVED TEST ARRANGEMENT  
(REF. FIGURE 1 AND ASD/ENFEA-78 TECHNICAL EXHIBIT).

Testing Activity Approval

Approved By \_\_\_\_\_ Date \_\_\_\_\_

F.S.I. Test Engineer Approval

Approved By \_\_\_\_\_ Date \_\_\_\_\_

Government Approval

Approved By \_\_\_\_\_ Date \_\_\_\_\_

Minimum of two signatures required.

INSTRUMENTATION

Ref. Para. 4.4.1: CHECK INSTRUMENTATION CALIBRATION

ITEM

CALIBRATION DATE ...

Pressure Gauges \_\_\_\_\_

Vacuum Gauges \_\_\_\_\_

Other Instruments:

1. \_\_\_\_\_
2. \_\_\_\_\_
3. \_\_\_\_\_
4. \_\_\_\_\_



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Ref. Para. 4.4.2: CHECK PROPER INSTALLATION

ITEM

REMARKS

Tank

Simulated Aircraft  
Adaptor

Pressure Gauges

Vacuum Gauges

Other Instruments:

1. \_\_\_\_\_
2. \_\_\_\_\_
3. \_\_\_\_\_
4. \_\_\_\_\_

Ref. Para. 4.4.3: CHECK PROPER OPERATION

ITEM

REMARKS

Fuel/Defuel System

Pressure Gauges

Vacuum Gauges

Other Instruments:

1. \_\_\_\_\_
2. \_\_\_\_\_
3. \_\_\_\_\_
4. \_\_\_\_\_



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FUELING

Ref. Para. 4.5: FUEL TANK AT PROPER ATTITUDE

ITEM

REMARKS

Attitude (20° Nose Down) \_\_\_\_\_

Fill with 450 to 457 Gal.  
Of Test Fluid \_\_\_\_\_

Type of Leak Detecting  
Additive \_\_\_\_\_

Amount of Leak Detecting  
Additive \_\_\_\_\_

Secure All Openings \_\_\_\_\_

POSITIVE PRESSURE TEST

Ref. Para. 4.6: WITH ALL EQUIPMENT AND INSTRUMENTATION WORKING  
PROPERLY, PRESSURIZE TANK

ITEM

OPERATIONAL REMARKS

Pressure Achieved (86 ± 2 psi) \_\_\_\_\_

Elapsed Time (3 Minutes) \_\_\_\_\_



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POSITIVE PRESSURE TIGHT INSPECTION

Ref. Para. 4.6.1: LEAK CHECK TANK UNDER PRESSURE

Brown Paper Dye Stain Examination for Leakage  
(If Applicable): \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Ultraviolet Light Dye Detection for Leakage  
(If Applicable): \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Soap Solution Test Void Area for Leakage  
(See Figure 1): \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_



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NEGATIVE PRESSURE TEST

Ref. Para. 4.7: WITH ALL EQUIPMENT AND INSTRUMENTATION WORKING PROPERLY, DRAIN TANK, RELIEVE PRESSURE AND EVACUATE TANK.

<u>ITEM</u>	<u>OPERATIONAL REMARKS</u>
Vacuum Achieved (10 ± 1/2 PSI)	_____
Time to Achieve	_____
Time at Required Vacuum (3 Min.)	_____

NEGATIVE PRESSURE TEST INSPECTION

Ref. Para. 4.7.1: LEAK CHECK UNDER VACUUM

Close Vacuum Line and Inspect Vacuum Gauge for Vacuum Loss: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Inspect Tank for Leakage if Vacuum Loss: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_



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POST PRESSURE TEST EXAMINATION

Ref. Para 4.8: RELIEVE VACUUM AND OPEN ACCESS PORTS

Visual Examination: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Delaminations (Tap Test): \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_



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EVALUATION OF DATA

POSITIVE PRESSURE TEST: \_\_\_\_\_

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NEGATIVE PRESSURE TEST: \_\_\_\_\_

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GENERAL CONDITION OF TANK: \_\_\_\_\_

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DOCUMENT NUMBER

QTP-2191 SECTION "G"

TITLE

QUALIFICATION TEST PROCEDURE


H-53 TANK

REQUIREMENTS FOR TANK FUEL CAPACITY

REVISIONS

LTR.	DATE	PREPARED	APPROVED	DESCRIPTION

PREPARED BY: Richard Lyman  
DATE: 2/9/81



FIBER SCIENCE, INC.  
SALT LAKE CITY, UTAH

CHECKED BY: *R. S. [Signature]*  
DATE: 2-11-81

NO. QTP-2191 Section "G"

APPROVED BY: *C. A. [Signature]*  
DATE: 2/12/81

1.0 SCOPE

This procedure covers the requirements for Tank Fuel Capacity Testing of the 450 Gallon Filament Wound External Fuel Tank for the H-53 Helicopter.

2.0 APPLICABLE DOCUMENTS

2.1 MILITARY SPECIFICATIONS

MIL-T-5624 Turbine fuel, aviation grade JP-4 and JP-5.  
MIL-STD-831 Test reports, preparation of.

2.2 FEDERAL SPECIFICATION

P-D-680 Dry cleaning solvent.

2.3 TECHNICAL EXHIBIT

ASD/ENFEA-78 Tank - 450 gallon external fuel, filament wound light-weight explosion proof.

2.4 DRAWINGS

FIBER SCIENCE

2191-001 Tank - Installation, 450 gallon H-53

SARGENT FLETCHER

27-450-4400 Pylon Assembly - 450 gallon fuel tank.



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3.0 REQUIREMENTS

3.1 TEST ARTICLE

Two (2) tank assemblies (2191-001) shall be securely fastened to a pylon (27-450-4400) which in turn is mounted to a functional test fixture by means of a simulated airframe adaptor. The tank shall then be fueled to a specified tank condition and subjected to the fuel capacity testing conditions of Technical Exhibit ASD/ENFEA-78, Paragraph 4.6.13.

3.2 TEST ARRANGEMENT

The test arrangement shall be similar to that shown in Figure 1 with all reasonable precautions taken to simulate the actual mounting of the tank and pylon to the helicopter.

3.3 TEST FLUIDS

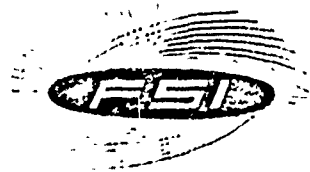
The recommended test fluid for this test shall be JP-5 per MIL-T-5624 or Stoddard Solvent per P-D-680. The actual density of the test fluid shall be established by sample test.

3.4 TEST METHOD

Each tank secured to the integral pylon shall be suspended in a 2<sup>o</sup> nose down position from the functional test fixture by two (2) reaction load measuring devices similar to that shown in Figure 1. The actual tank capacity shall be verified by fuel weight to within 1/2 pound using the following test methods:

3.4.1 TOTAL TANK CAPACITY

Each completely empty and dry tank, pylon and all non-fuel carrying connecting hardware necessary for the test shall be weighed and recorded. The tank shall then be filled with the test fluid to its total capacity using special adaptors or venting devices to achieve a completely full tank condition. The totally full tank weight including fuel, pylon and non-fuel carrying hardware shall then be recorded, and the completely full tank capacity calculated.



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3.4.2

TANK SUMP CAPACITY

Each completely full tank of Paragraph 3.4.1 shall be defueled through the fuel transfer tube using  $15 \pm 2$  psi pressure applied through the vent line. The weight of the tank, pylon, non-fuel carrying hardware and the remaining fuel shall be recorded when the low level float switch is actuated and again when the actual fuel transfer is complete. The tank sump capacity and the usable fuel remaining in the tank when the float switch is actuated shall be calculated.

3.4.3

USEABLE FUEL CAPACITY

Each empty tank of Paragraph 3.4.2 shall then be filled at a rate of  $50 \pm 5$  gallons per minute with  $10 \pm 2$  psi pressure until the high level float switch is actuated. The weight of the tank, pylon, fuel and non fuel carrying test hardware shall be recorded at the high level float switch actuation. This test shall be repeated for overflow at the vent line and again for overflow at the fill cap with the fill cap removed.

3.5

TEST INSTRUMENTATION

The instrumentation and test equipment used for this procedure shall be of good commercial quality and in proper working condition. Weighing devices used to measure fuel capacity shall be properly calibrated and capable of accurately reading the fuel and tank weights to within  $\frac{1}{2}$  pound over the full scale of the device.

3.5.1

INSTRUMENTATION CALIBRATION

All instrumentation shall be calibrated and capable of reading or recording data within  $\pm 2\%$  of its full scale value unless otherwise specified. No instrument shall be used that has not been calibrated within the previous calibration period.

3.6

DOCUMENTATION

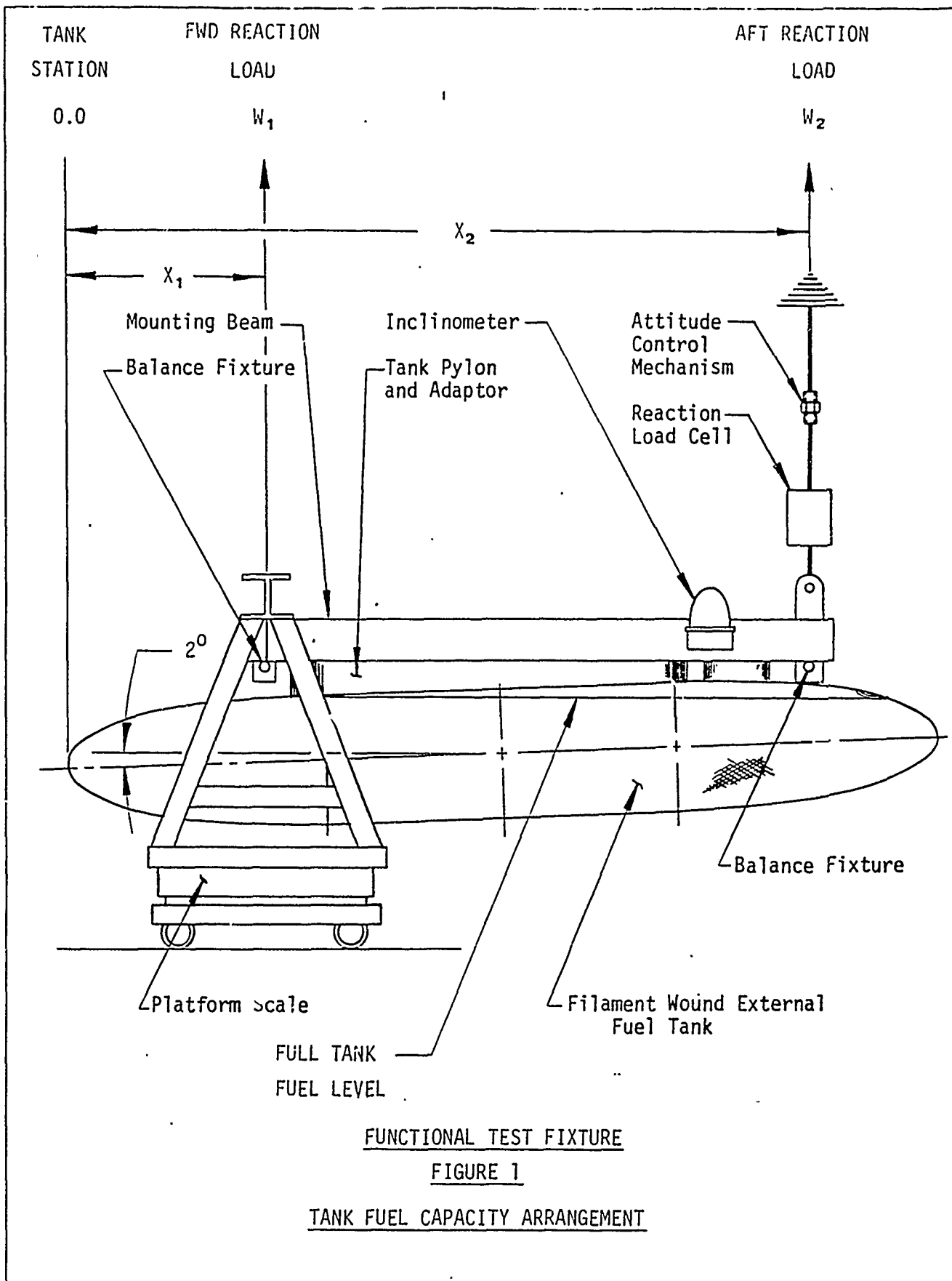
At the conclusion of testing a test report will be prepared for submission to the contractor.



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4.0 QUALIFICATION TEST PROVISIONS

4.1 EXAMINATION OF PRODUCT

Each tank and pylon shall be fully examined prior to mounting to the test fixture for damage. This examination shall include a visual inspection and a tap test for delaminations if not accomplished as part of the final inspection from previous test. The results of this inspection shall be recorded by the testing activity in the presence of an authorized Fiber Science Test Engineer.

4.2 MOUNTING

Each tank and pylon shall then be mounted to the test fixture in a 2<sup>o</sup> nose down attitude by means of the simulated airframe adaptor and examined for proper attachment and assimilation to the actual aircraft installation. Install all fuel air and electrical connections for simulated operation. Any significant variations or deviations shall be recorded.

4.3 ARRANGEMENT

The test arrangement shall be examined for compliance with Figure 1 of this procedure or shall be deemed to be in compliance with the applicable paragraphs of ASD/ENFEA-78 Technical Exhibit and approved by an authorized Fiber Science Test Engineer and an authorized Government representative.

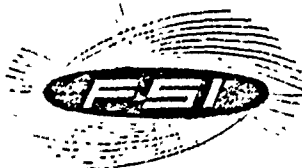
4.4 INSTRUMENTATION AND TEST EQUIPMENT

4.4.1 INSTRUMENTATION CALIBRATION

All instrumentation shall be inspected to verify that each instrument has had a calibration check within the last calibration period.

4.4.2 INSTALLATION

All reaction load measuring devices, fuel and pressure transfer lines, flow meters, and pressure gages shall be installed so as to have little or no affect on the test other than to provide accurate weight measurements.



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4.4.3 OPERATION

All test equipment shall be checked for proper operation. Any defects in equipment shall be recorded and the test shall not proceed until the defect is removed or deemed not critical for the test required by the testing activity and approved by an authorized Fiber Science Test Engineer.

4.5 PREPARATION FOR TEST

Examine each tank for the following conditions before performing the tank capacity test:

4.5.1 DRY TANK INSPECTION

Remove each access cover and inspect tank to verify that the tank is completely empty. If tank is not completely empty, remove all remaining fluid and secure access covers.

4.5.2 TEST FLUID DENSITY

Remove a representative sample of the test fluid to determine the fluid density either by use of a hydrometer or by accurately weighing a known volume of the test fluid. The density of the test fluid is its weight in pounds divided by the fluid volume in cubic inches.

4.5.3 VOID VOLUME VENT

A special adapter for venting all air from the tank when completely filled with test fluid shall be vented through one of the access doors.

4.5.4 EMPTY TANK WEIGHT

Each completely empty tank shall be secured to an integral pylon, mounted in the test fixture, with all non-fuel carrying connecting hardware properly tethered so as to have little or no affect on the test. Record the combined weight of tank, pylon and all non-fuel carrying connecting hardware.



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4.6 TOTAL TANK CAPACITY TEST

With each tank properly weighed and mounted in the test fixture in a 20° nose down position, open the fueling valve and completely fill tank. Vent all trapped air in the tank thru the void volume vent adapter of paragraph 4.5.3. When the tank is completely full, record the reaction loads and calculate the total volume in gallons. The total tank volume should be 463.2 to 477.3 gallons.

4.7 TANK SUMP CAPACITY TEST

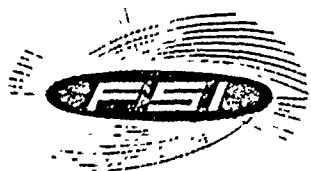
Empty each tank thru the fuel transfer tube using air pressure at  $15 \pm 2$  psi. Record total reaction loads at the low level float switch actuation and again at an empty tank condition. Calculate the float switch signal volume and the actual sump volume in gallons. The sump volume should be 1.25 gallons maximum.

4.8 USABLE FUEL CAPACITY TEST

Refill tank to the requirements of paragraph 3.4.3. Record the combined reaction loads for each of the three (3) conditions. Calculate the usable fuel volume and record in gallons for each of the three (3) conditions. The usable fuel volume should be 450 to 457 gallons.

5.0 QUALIFICATION TEST REPORT

A formal qualification test report shall be submitted per MIL-STD-831 within 30 days after the testing is complete. This report is to include all recorded reaction load data sheets. Each test tank shall be retained for further testing before returning to Fiber Science, Inc.



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APPENDIX "A"  
TEST DATA SHEETS



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TEST DATA SHEET

QTR-2191' SECTION "G"

Testing Activity \_\_\_\_\_ Activity Test Engr. \_\_\_\_\_

Tank Serial No. \_\_\_\_\_ F.S.I. Test Engr. \_\_\_\_\_

Test Date \_\_\_\_\_ Government Rep. \_\_\_\_\_

EXAMINATION OF PRODUCT

Ref. Para. 4.1: Visual Inspection: \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Delaminations (Tap Test): \_\_\_\_\_

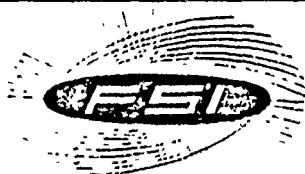
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

MOUNTING

Ref. Para. 4.2: Aircraft Simulated Attachment

Deviations If Any: \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_



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ARRANGEMENT

Ref. Para. 4.3: APPROVED TEST ARRANGEMENT (Ref. Figure 1 and ASD/ENFEA-78 TECHNICAL EXHIBIT)

Testing Activity Approval

Approved By \_\_\_\_\_ Date \_\_\_\_\_

F.S.I. Test Engineer Approval

Approved By \_\_\_\_\_ Date \_\_\_\_\_

Government Approval

Approved By \_\_\_\_\_ Date \_\_\_\_\_

Minimum of two signatures required.

INSTRUMENTATION

Ref. Para. 4.4.1 CHECK INSTRUMENTATION CALIBRATION

ITEM

CALIBRATION DATE

Reaction Load Devices \_\_\_\_\_

Hydrometer (If Applicable) \_\_\_\_\_

Weighing Scales (If Applicable) \_\_\_\_\_

Flow Meter \_\_\_\_\_

Pressure Gauges \_\_\_\_\_

Other Instruments: \_\_\_\_\_

1. \_\_\_\_\_

2. \_\_\_\_\_

3. \_\_\_\_\_



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Ref. Para. 4.4.2: CHECK PROPER INSTALLATION

ITEM

REMARKS

Tank

Simulated Aircraft Adapter

Load Reaction Devices

Fuel Level Indicator  
(Float Switch)

Pressure Gages

Flow Meters

Other Instruments:

1. \_\_\_\_\_

2. \_\_\_\_\_

3. \_\_\_\_\_

4. \_\_\_\_\_

Ref. Para. 4.4.3: CHECK PROPER OPERATION

ITEM

REMARKS

Load Reaction Devices

Fuel Level Indicator  
(Float Switch)

Pressure Gauges

Flow Meters

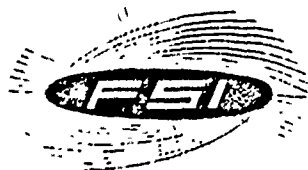
Other Instruments:

1. \_\_\_\_\_

2. \_\_\_\_\_

3. \_\_\_\_\_

4. \_\_\_\_\_



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PREPARATION FOR TEST  
DRY TANK INSPECTION

Ref. Para. 4.5.1 REMOVE ACCESS COVERS AND INSPECT TANK FOR FUEL

Remarks: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Ref. Para 4.5.2 VERIFY DENSITY OF TEST FLUID

Pyrometer reading (If Applicable)

<u>ITEM</u>	<u>REMARKS</u>
Type of Test Fluid	_____
Quantity of Test Fluid	_____
Pyrometer Density	_____

Volume Weight Calculation (If Applicable)

<u>ITEM</u>	<u>REMARKS</u>
Type of Test Fluid	_____
Fluid Sample Container Volume	_____
Container Weight	_____
Weight of Container and Sample	_____
Calculated Sample Weight	_____
Calculated Density	_____



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VOID VOLUME VENT

Ref. Para. 4.5.3 CONSTRUCT VOID VOLUME VENT ADAPTER

Remarks: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Sketch Of Adapter Assembly:



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EMPTY TANK WEIGHT

Ref. Para. 4.5.4

RECORD EMPTY TANK, PYLON AND NON-FUEL CARRYING HARDWARE WEIGHT

<u>ITEM</u>	<u>REMARKS</u>
Tank Shipping Weight	_____
Pylon Shipping Weight	_____
Non-Fuel Carrying Hardware	_____
1. _____	_____
2. _____	_____
3. _____	_____
4. _____	_____
5. _____	_____
6. _____	_____
7. _____	_____
8. _____	_____
Empty Tank Reaction Load Weight:	
Fwd. Reaction Load	_____
Aft. Reaction Load	_____
Total Empty Weight	_____



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TOTAL TANK CAPACITY

Ref. Para. 4.6

FUEL TANK TO A COMPLETELY FULL TANK CONDITION WITH VENT ADAPTER OPEN

ITEM

REMARKS

Test Fluid Density (Ref.Para.4.5.2) \_\_\_\_\_

Empty Tank Weight (Ref.Para.4.5.4) \_\_\_\_\_

Fueling Rate (50 GPM) \_\_\_\_\_

Fueling Pressure (10 p.s.i.) \_\_\_\_\_

Completely Full Reaction Loads:

Fwd. Reaction Load \_\_\_\_\_

Aft. Reaction Load \_\_\_\_\_

Total Tank and Fluid Weight \_\_\_\_\_

Calculated Total Fluid Weight \_\_\_\_\_

Calculated Total Fluid Volume \_\_\_\_\_

Remarks (Test Requirement 463.2 to 477.3 Gallons): \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_



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TANK SUMP CAPACITY

Ref. Para 4.7

DEFUEL TANK TO AN EMPTY TANK CONDITON THRU FUEL TRANSFER TUBE.

A. Low Level Float Switch Empty Signal

<u>ITEM</u>	<u>REMARKS</u>
Test Fluid Density (Ref.Para.4.5.2)	_____
Empty Tank weight (Ref.Para.4.5.4)	_____
Defueling Rate (50 GPM)	_____
Defueling Pressure (15 p.s.i.)	_____
Low Level Float Switch Actuation Reaction Loads:	
Fwd. Reaction Load	_____
Aft. Reaction Load	_____
Total Tank and Fluid Weight	_____
Calculated Sump Fluid Weight	_____
Calculated Sump Fluid Volume	_____



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B. ACTUAL USABLE, FUEL EMPTY TANK CONDITION

<u>ITEM</u>	<u>REMARKS</u>
Test Fluid Density (Ref.Para.4.5.2)	_____
Empty Tank Weight(Ref.Para.4.5.4)	_____
Defueling Rate (50 GPM)	_____
Defueling Pressure (15 p.s.i.)	_____
Empty Tank Reaction Loads:	
Fwd. Reaction Load	_____
Aft. Reaction Load	_____
Total Tank and Fluid Weight	_____
Calculated Sump Fluid Weight	_____
Calculated Sump Fluid Volume	_____

Remarks (Test Requirement 1.25 gallons maximum at empty tank condition.):

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_



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TANK USABLE FUEL CAPACITY

Ref. Para. 4.8

REFUEL TANK TO AN OPERATIONAL FULL TANK CONDITION

A. HIGH LEVEL FLOAT SWITCH FULL

ITEM

REMARKS

Test Fluid Density(Ref. Para. 4.5.2) \_\_\_\_\_

Empty Tank Weight (Ref. Para. 4.5.4) \_\_\_\_\_

Fueling Rate (50 GPM) \_\_\_\_\_

Fueling Pressure (10 psi) \_\_\_\_\_

High Level Float Switch Actuation Reaction Loads:

Fwd. Reaction Load \_\_\_\_\_

Aft. Reaction Load \_\_\_\_\_

Total Tank and Fluid Weight \_\_\_\_\_

Calculated Usable Fluid Weight \_\_\_\_\_

Calculated Usable Fluid Volume \_\_\_\_\_

B. FILLER CAP OVERFLOW FULL

ITEM

REMARKS

Test Fluid Density (Ref. Para. 4.5.2) \_\_\_\_\_

Empty Tank Weight(Ref. Para. 4.5.4) \_\_\_\_\_

Fuel Overflow at Filler Cap Reaction Loads:

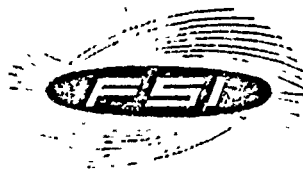
Fwd. Reaction Load \_\_\_\_\_

Aft. Reaction Load \_\_\_\_\_

Total Tank and Fluid Weight \_\_\_\_\_

Calculated Usable Fluid Weight \_\_\_\_\_

Calculated Usable Fluid Volume \_\_\_\_\_



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Ref. Para. 4.8 C. VENT LINE OVERFLOW FULL

<u>ITEM</u>	<u>REMARKS</u>
Test Fluid Density(Ref.Para.4.5.2)	_____
Fuel Overflow at Air Vent:	_____
Fwd. Reaction Load	_____
Aft. Reaction Load	_____
Total Tank and Fluid Weight	_____
Calculated Usable Fluid Weight	_____
Calculated Usable Fluid Volume	_____

Remarks(Test Requirement 450 to 457 gallons of usable fuel)

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_



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EVALUATION OF DATA

TOTAL TANK CAPACITY: \_\_\_\_\_

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TANK SUMP CAPACITY: \_\_\_\_\_

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USABLE FUEL CAPACITY: \_\_\_\_\_

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LOAD REACTION DEVICE: \_\_\_\_\_

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DOCUMENT NUMBER

QTP-2191 SECTION "H"

TITLE

QUALIFICATION TEST PROCEDURE

H-53 TANK

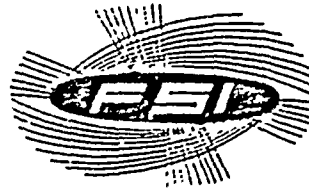
REQUIREMENTS FOR CENTER OF GRAVITY EXCURSION

REVISIONS

LTR.	DATE	PREPARED	APPROVED	DESCRIPTION

**RELEASED COPY**  
TO Dick Lyman DATE 4-1-81

PREPARED BY: Richard Lyman  
DATE: 2/10/81



FIBER SCIENCE, INC.  
SALT LAKE CITY, UTAH

CHECKED BY: Jimmy Cumberaker DATE: 2-13-81

NO. QTP-2191 Section "H"

APPROVED BY: C. G. Patridge DATE: 2/13/81

DATE: 2/10/81

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1.0 SCOPE

This procedure covers the requirements for center of gravity excursion testing of the 450 Gallon Filament Wound External Fuel Tank for the H-53 Helicopter.

2.0 APPLICABLE DOCUMENTS

2.1 MILITARY SPECIFICATIONS

MIL-T-5624 Turbine Fuel, aviation grade JP-4 and JP-5.

MIL-STD-831 Test reports, preparation of.

2.2 TECHNICAL EXHIBIT

ASD/ENFEA-78 Tank - 450 gallon external fuel, filament wound light-weight explosion proof.

2.3 DRAWINGS

FIBER SCIENCE

2191-001 Tank - Installation, 450 gallon H-53

SARGENT FLETCHER

27-450-4400 Pylon Assembly - 450 gallon fuel tank.



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3.0 REQUIREMENTS

3.1 TEST ARTICLE

One (1) tank assembly (2191-001) shall be securely fastened to a pylon (27-450-4400) which in turn is mounted to a functional test fixture by means of a simulated air frame adaptor. The tank shall then be fueled with a test fluid to a full tank condition and subjected to the center of gravity excursion test conditions of Paragraph 4.6.10 of the Technical Exhibit ASD/ENFEA-78.

3.2 TEST ARRANGEMENT

The test arrangement shall be similar to that shown in Figure 1 with all reasonable precautions taken to simulate the actual mounting of the tank and pylon to the helicopter.

3.3 TEST FLUIDS

The recommended test fluid for this test shall be JP-5 per MIL-T-5624. The actual density of the test fluid shall be established by sample test.

3.4 TEST METHOD

A completely empty and dry tank shall be prepared for testing. A simulated airframe adaptor shall be mounted to the functional test fixture by two (2) reaction load measuring devices in such a way as to support the tank in a  $20 \pm 15'$  nose down position. The forward and aft reaction loads and their location relative to the pylon mounting hook locations shall be measured and recorded and the exact weight and center of gravity of the simulated airframe adaptor shall be calculated. The tank shall then be mounted to the simulated airframe adaptor, with no excess hardware attached to the tank that would not be present during normal usage on the H-53 Helicopter, and tested to the following conditions:

3.4.1 COMPLETELY EMPTY TANK CENTER OF GRAVITY

With the tank mounted to the simulated airframe adaptor in a  $20 \pm 15'$  nose down attitude, record the forward and aft reaction loads and calculate the exact weight and center of gravity of the empty and dry tank.



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### 3.4.2 NORMAL FULL TANK CENTER OF GRAVITY

With the empty weight and center of gravity of the tank and pylon established, fuel the tank through the fuel transfer tube with JP-5 test fluid to a full tank condition (450 to 457 gallons) as determined by the float switch actuation. Record the forward and aft reaction loads and calculate the exact full tank weight and center of gravity.

### 3.4.3 CENTER OF GRAVITY EXCURSION

The 2<sup>0</sup> nose down center of gravity excursion caused by fuel transfer from the tank shall be established. This shall be done by removing the test fluid in 25 gallon increments from the tank as accurately as possible, recording the forward and aft reaction loads at each fuel transfer increment and calculating the weight and center of gravity at each increment.

### 3.5 TEST INSTRUMENTATION

The instrumentation and test equipment used for this procedure shall be of good commercial quality and in proper working condition. Weighing devices used to measure the center of gravity excursion shall be properly calibrated and capable of accurately reading the fuel and tank weights to within 1/2 pound over the full scale of the device.

#### 3.5.1 INSTRUMENTATION CALIBRATION

All instrumentation shall be calibrated and capable of reading or recording data within  $\pm 2\%$  of its full scale value unless otherwise specified. No instrument shall be used that has not been calibrated within the previous calibration period.

### 3.6 DOCUMENTATION

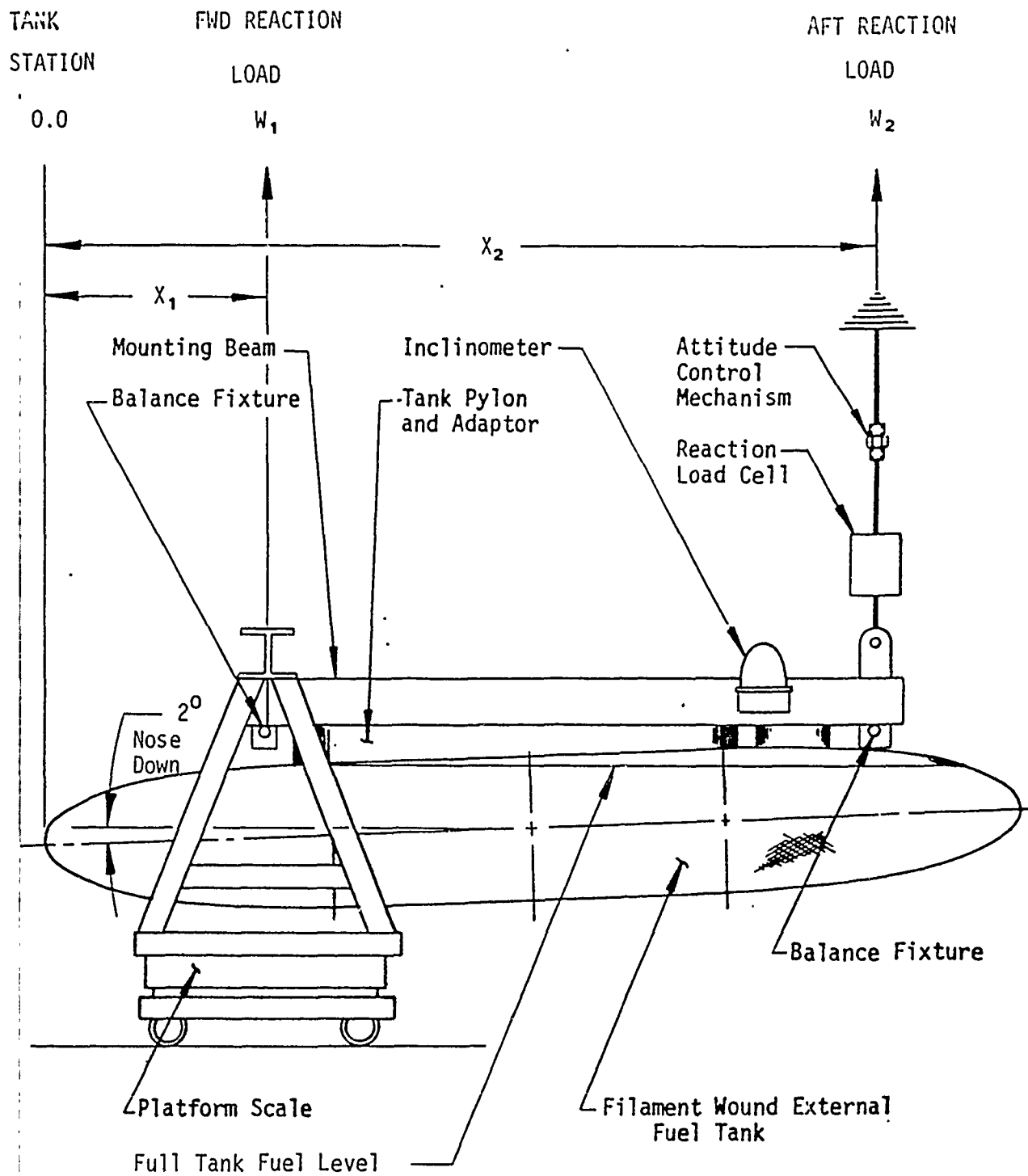
At the conclusion of testing, a test report will be prepared for submission to the contractor.



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FUNCTIONAL TEST FIXTURE

FIGURE 1

CENTER OF GRAVITY EXCURSION ARRANGEMENT



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4.0 QUALIFICATION TEST PROVISIONS

4.1 EXAMINATION OF PRODUCT

The tank and pylon shall be fully examined prior to mounting to the test fixture for damage. This examination shall include a visual inspection and a tap test for delaminations if not accomplished as part of the final inspection from previous test. The results of this inspection shall be recorded by the testing activity in the presence of an authorized Fiber Science Test Engineer.

4.2 ARRANGEMENT

The test arrangement shall be examined for compliance with Figure 1 of this procedure or shall be deemed to be in compliance with the applicable paragraphs of ASD/ENFEA-78 Technical Exhibit and approved by an authorized Fiber Science Test Engineer and an authorized Government representative.

4.3 INSTRUMENTATION AND TEST EQUIPMENT

4.3.1 INSTRUMENTATION CALIBRATION

All instrumentation shall be inspected to verify that each instrument has had a calibration check within the last calibration period.

4.3.2 INSTALLATION

All reaction load measuring devices, fuel and pressure transfer lines, flow meters, and pressure gauges shall be installed so as to have no affect on the test results other than to provide accurate weight measurements.

4.3.3 OPERATION

All test equipment shall be checked for proper operation. Any defects in equipment shall be recorded and the test shall not proceed until the defect is removed or deemed not critical for the test required by the testing activity and approved by an authorized Fiber Science Test Engineer.



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#### 4.4 PREPARATION FOR TEST

Examine the tank for the following conditions before performing the tank center of gravity excursion test:

##### 4.4.1 DRY TANK INSPECTION

Remove each access cover and inspect tank to verify that the tank is completely empty. If tank is not completely empty, remove all remaining fluid and secure access covers.

##### 4.4.2 TEST FLUID DENSITY

Remove a representative sample of the test fluid to determine the fluid density either by use of a hydrometer or by accurately weighing a known volume of the test fluid. The density of the test fluid is its weight in pounds divided by the fluid volume in cubic inches.

##### 4.4.3 SIMULATED AIR FRAME ADAPTOR TARE WEIGHT

The simulated airframe adaptor shall be mounted to the reaction load measuring device of the functional test fixture to the requirements of Paragraph 3.4. The adaptor shall be examined for proper attachment and assimilation to the actual aircraft installation. Install all fuel, air and electrical connections for simulated operation. Any significant variations or deviations shall be recorded. Record the tare weight of the fwd and aft reaction loads and calculate the total adaptor weight and center of gravity.

#### 4.5 CENTER OF GRAVITY TESTING

The tank secured to the pylon shall be mounted to the simulated airframe adaptor and tested to the following provisions:

##### 4.5.1 EMPTY TANK CENTER OF GRAVITY TEST

Perform the empty tank center of gravity test to the requirements of Paragraph 3.4.1. Calculate the exact location of the empty tank center of gravity.



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4.5.2 NORMAL FULL TANK CENTER OF GRAVITY TEST

Fuel tank to a normal full condition and perform the normal full tank center of gravity test to the requirements of Paragraph 3.4.2. Calculate the exact location of the normal full center of gravity.

4.5.3 CENTER OF GRAVITY EXCURSION

Perform the center of gravity excursion tests to the requirements of Paragraph 3.4.3. Calculate the exact location of each increment of the center of gravity excursion and plot the excursion.

5.0 QUALIFICATION TEST REPORT

A formal qualification test report shall be submitted per MIL-STD-831 within 30 days after the testing is complete. This report is to include all recorded weight data sheets for calculating tank volume. The test tank shall be returned to Fiber Science for further testing in the same shipping container it was received in.

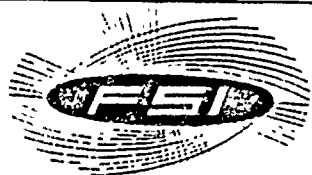


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APPENDIX "A"  
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TEST DATA SHEET

QTR-2191 SECTION "H"

Testing Activity \_\_\_\_\_ Activity Test Engr. \_\_\_\_\_

Tank Serial No. \_\_\_\_\_ F.S.I. Test Engr. \_\_\_\_\_

Test Date \_\_\_\_\_ Government Rep. \_\_\_\_\_

EXAMINATION OF PRODUCT

Ref. Para. 4.1: Visual Inspection: \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Delaminations (Tap Test) \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_



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ARRANGEMENT

Ref. Para. 4.2: APPROVED TEST ARRANGEMENT (Ref. Figure 1 and ASD/ENFEA-78 TECHNICAL EXHIBIT)

Testing Activity Approval

Approved By \_\_\_\_\_ Date \_\_\_\_\_

F.S.I. Test Engineer Approval

Approved By \_\_\_\_\_ Date \_\_\_\_\_

Government Approval

Approved By \_\_\_\_\_ Date \_\_\_\_\_

Minimum of two signatures required.

INSTRUMENTATION

Ref. Para. 4.3.1: CHECK INSTRUMENTATION CALIBRATION

ITEM

CALIBRATION DATE

Reaction Load Devices \_\_\_\_\_

Hydrometer (If Applicable) \_\_\_\_\_

Inclinometer (If Applicable) \_\_\_\_\_

Flow Meter \_\_\_\_\_

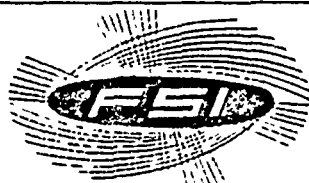
Pressure Gauges \_\_\_\_\_

Other Instruments:

1. \_\_\_\_\_

2. \_\_\_\_\_

3. \_\_\_\_\_



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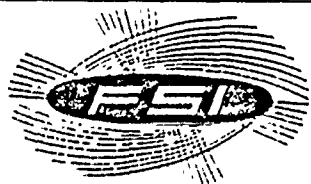


Ref. Para. 4.3.2: CHECK PROPER INSTALLATION

<u>ITEM</u>	<u>REMARKS</u>
Tank	
Simulated Aircraft Adaptor	
Load Reaction Devices	
Fuel Level Indicator (Float Switch)	
Inclinometer	
Pressure Gauges	
Flow Meters	
Other Instruments:	
1. _____	
2. _____	
3. _____	

Ref. Para. 4.3.3: CHECK PROPER OPERATION

<u>ITEM</u>	<u>REMARKS</u>
Load Reaction Devices	
Fuel Level Indicator (Float Switch)	
Inclinometer	
Pressure Gauges	
Flow Meters	
Other Instruments:	
1. _____	
2. _____	
3. _____	



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PREPARATION FOR TEST

DRY TANK INSPECTION

Ref. Para. 4.4.1: REMOVE ACCESS COVERS AND INSPECT TANK FOR FUEL

Remarks: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Ref. Para. 4.4.2: VERIFY DENSITY OF TEST FLUID

Pyrometer Reading (If Applicable)

<u>ITEM</u>	<u>REMARKS</u>
Type of Test Fluid	_____
Quantity of Test Fluid	_____
Pyrometer Density	_____

Volume Weight Calculation (If Applicable)

<u>ITEM</u>	<u>REMARKS</u>
Type of Test Fluid	_____
Fluid Sample Container Volume	_____
Container Weight	_____
Weight of Container and Sample	_____
Calculated Sample Weight	_____
Calculated Density	_____



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SIMULATED AIRFRAME ADAPTOR TARE WEIGHT

Ref. Para. 4.4.3: RECORD TARE WEIGHT REACTION LOADS AND CENTER OF GRAVITY

Description of Tare Weight: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

TARE WEIGHT

<u>ITEM</u>	<u>REMARKS</u>
Fwd. Reaction Load	_____
Aft. Reaction Load	_____
Calculated Total Tare Weight	_____
Calculated Tare C. G.	_____

CENTER OF GRAVITY TEST

EMPTY TANK CENTER OF GRAVITY TEST

Ref. Para. 4.5.1: RECORD EMPTY TANK AND PYLON WEIGHT AND CENTER OF GRAVITY

<u>ITEM.</u>	<u>REMARKS</u>
Tank Shipping Weight	_____
Pylon Shipping Weight	_____
Empty Tank Reaction Load Weight:	
Fwd. Reaction Load	_____
Aft. Reaction Load	_____
Calculated Total Empty Weight	_____
Calculated Empty Tank Center of Gravity	_____



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NORMAL FULL TANK CENTER OF GRAVITY TEST

Ref. Para. 4.5.2: FUEL TANK TO A FULL TANK CONDITION THROUGH THE FUEL TRANSFER TUBE

<u>ITEM</u>	<u>REMARKS</u>
Test Fluid Density (Ref. Para. 4.4.2)	_____
Empty Tank Weight (Ref. Para. 4.5.1)	_____
Empty Tank Center of Gravity (Ref. Para. 4.5.1)	_____
Fueling Rate (50 GPM)	_____
Fueling Pressure (10 PSI)	_____
Completely Full Reaction Loads:	
Fwd. Reaction Load	_____
Aft. Reaction Load	_____
Calculated Total Tank and Fluid Weight	_____
Calculated Total Tank and Fluid Center of Gravity	_____
Calculated Total Fluid Weight	_____
Calculated Total Center of Gravity	_____

Remarks: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_



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ENTER OF GRAVITY EXCURSION TEST

Ref. Para. 4.5.3: DEFUEL TANK THROUGH THE FUEL TRANSFER LINE IN  
25 GALLON INCREMENTS

ITEM

Test Fluid Density  
(Ref. Para. 4.4.2)

\_\_\_\_\_

Empty Tank Weight  
(Ref. Para. 4.5.1)

\_\_\_\_\_

Empty Tank Center of Gravity  
(Ref. Para. 4.5.1)

\_\_\_\_\_

Defueling Rate (50 G.P.M.)

\_\_\_\_\_

Fueling Pressure (10 PSI)

\_\_\_\_\_

Reaction Load Locations Relative  
To Tank Station Lines:

Fwd. Reaction Load Location  
( $X_1$ )

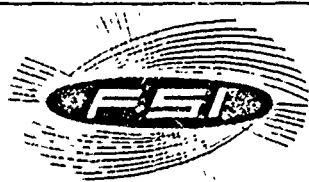
\_\_\_\_\_

Aft. Reaction Load Location  
( $X_2$ )

\_\_\_\_\_

NOTE: Fwd reaction load  $W$  is the fwd reaction load  
reading minus the fwd reaction tare load.

Aft reaction load  $W$  is the aft reaction load  
reading minus the aft reaction tare load.



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CENTER OF GRAVITY & CURSION LOCATION

I T E M	USEABLE FUEL VOLUME	FWD. REACTION LOAD	AFT. REACTION LOAD	TOTAL REACTION LOAD	FWD. REACTION MOMENT	AFT. REACTION MOMENT	CENTER OF GRAVITY LOCATION
	V	$W_1$	$W_2$	$W_1 + W_2$	$W_1 X_1$	$W_2 X_2$	$\frac{W_1 X_1 + W_2 X_2}{W_1 + W_2}$
1	450						
2	425						
3	400						
4	375						
5	350						
6	325						
7	300						
8	275						
9	250						
10	225						
11	200						
12	175						
13	150						
14	125						
15	100						
16	75						
17	50						
18	25						
19	0						
20	EMPTY						

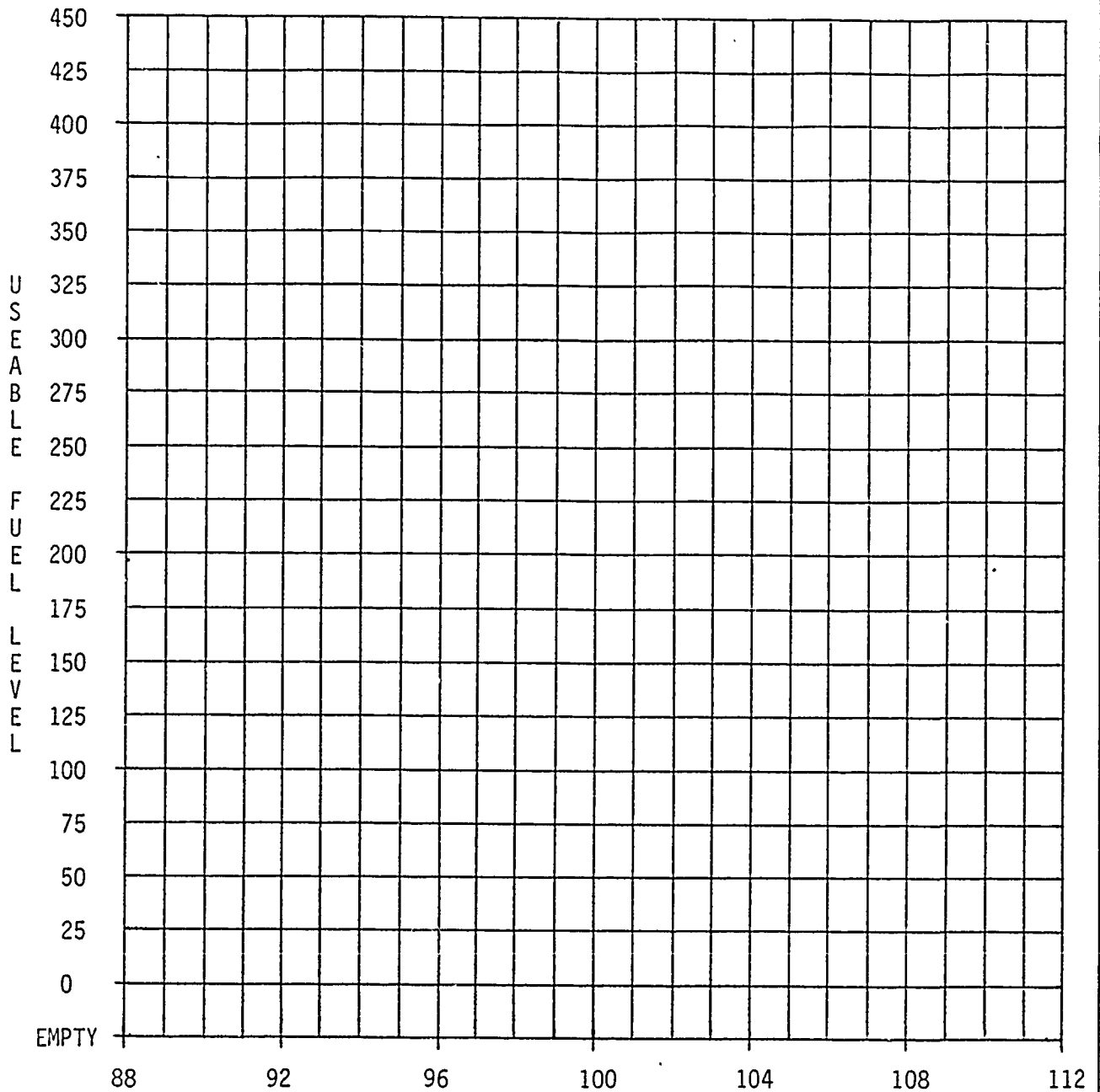


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CENTER OF GRAVITY EXCURSION GRAPH



TANK STATION



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EVALUATION OF DATA

EMPTY TANK AND PYLON CENTER OF GRAVITY: \_\_\_\_\_

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FULL TANK CENTER OF GRAVITY: \_\_\_\_\_

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---

CENTER OF GRAVITY EXCURSION: \_\_\_\_\_

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---

LOAD REACTION DEVICE: \_\_\_\_\_

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DOCUMENT NUMBER

QTP-2191 SECTION "I"

TITLE

QUALIFICATION TEST PROCEDURE

H-53 TANK

REQUIREMENTS FOR MAINTAINABILITY DEMONSTRATION

FOR SERIAL NUMBER \_\_\_\_\_

REVISIONS

LTR.	DATE	PREPARED	APPROVED	DESCRIPTION

PREPARED BY: Richard Lyman  
DATE: 4/4/81

CHECKED BY: \_\_\_\_\_  
DATE: \_\_\_\_\_



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APPROVED BY: *C. A. Patunde*  
DATE: 4/17/81

DATE: 4/4/81

1.0 SCOPE

This procedure covers the requirements for maintainability demonstration of the 450 Gallon Filament Wound External Fuel Tank for the H-53 Helicopter.

2.0 APPLICABLE DOCUMENTS

2.1 MILITARY SPECIFICATIONS

MIL-STD-831 Test Reports, Preparation of.

2.2 TECHNICAL EXHIBIT

ASD/ENFEA-78 Tank - 450 Gallon External Fuel, Filament Wound Lightweight Explosion Proof.

2.3 DRAWINGS

FIBER SCIENCE

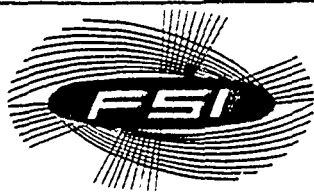
2191-001 Tank - Installation, 450 Gallon H-53

SARGENT FLETCHER

27-450-4400 Pylon Assembly - 450 Gallon Fuel Tank

2.4 QUALIFICATION TEST PROCEDURES

QTP-2191 SECTION "B" Requirements For Product Examination.



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3.0 REQUIREMENTS

3.1 TEST ARTICLES

Two (2) tank assemblies (2191-001) shall each be securely fastened to a pylon (27-450-4400) and placed on or secured to an assembly or maintenance fixture. The two tank units shall then be simultaneously subjected to the maintainability and interchangeability demonstration requirements of Paragraphs 3.4.3 and 3.12 of the Technical Exhibit ASD/ENFEA-78.

3.2 PREPARATION FOR TEST

3.2.1 EXAMINATION OF THE TEST ARTICLES

Each tank assembly shall be examined to verify that it is representative of a production article in completeness and workmanship and was fabricated in accordance with the approved manufacturing procedures.

3.2.2 ASSEMBLY DOCUMENTS

A complete set of documents covering the tank assembly and associated purchased parts shall be available.

3.2.3 TEST PERSONNEL

Two (2) mechanics or assembly technicians familiar with the tank assembly and two (2) or more test technicians shall be required to conduct the test and record data. A technical writer shall record the process as a rough draft for the tank overhaul manual.

3.2.4 EQUIPMENT FOR MAINTAINABILITY

Standard tools shall be provided by or for each mechanic or assembly technician.

3.3 TEST METHOD

The maintainability and interchangeability of each removable subassembly or part shall be demonstrated by the removal of all interchangeable subassemblies or parts from one tank assembly and reinstalling them in a second tank within eight (8) man-hours. A complete history of the time required to remove each individual subassembly or part and the time required to replace the same shall be recorded along with the



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tools required to complete the task.

3.4 TEST EQUIPMENT

Two (2) stopwatches shall be used to record disassembly and assembly time of each interchangeable assembly or part. Torque wrenches and electrical meters or gauges used by mechanics or assembly technicians during the demonstration shall be of good commercial quality.

3.4.1 TEST EQUIPMENT CALIBRATION

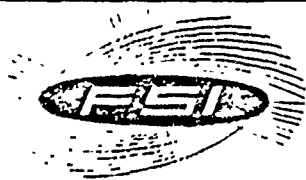
All test equipment shall be calibrated and capable of reading or recording data within  $\pm 2\%$  of its full scale value. No test equipment shall be used that has not been calibrated within the previous calibration period.

3.5 TEST PROCEDURES

The test procedures shall be in accordance with Paragraph 4 of this document.

3.6 DOCUMENTATION

At the conclusion of the demonstration a technical report will be prepared for submission to the contractor.



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4.0 QUALIFICATION TEST PROVISIONS

4.1 TEST EQUIPMENT

Two (2) stopwatches of good commercial quality shall be used to verify the disassembly and reassembly time of each interchangeable assembly or component of the tank. Any torque wrenches, electrical meters or gauges used in the maintainability demonstration shall be examined for proper working condition and ability to perform accurately the work required.

4.1.1 TEST EQUIPMENT CALIBRATION

The test equipment used to either monitor the maintainability demonstration or used as part of the maintainability demonstration shall be inspected to verify that each instrument has had a calibration check within the last calibration period.

4.2 TEST PREPARATIONS

The following preparations shall be made prior to the actual maintainability demonstration test.

4.2.1 EXAMINATION OF TEST ARTICLES

Examine each tank assembly to verify that they were fabricated according to the Manufacturing Job Card and are in compliance with the latest revision of the Engineering drawings. It shall also be verified that each tank is thoroughly representative of future production tanks and that the pylon is fully assembled and fastened to the tank in a manner representative of a field-use condition.

4.2.2 ASSEMBLY DOCUMENTS

Verify that one complete set of documentation, that is, Engineering drawings and associated Parts List, wiring diagrams, special assembly instructions or specifications for purchased parts or assemblies and a preliminary outline for the Overhaul or Maintenance Manual is available.

4.2.3 TEST PERSONNEL

Sufficient test personnel shall be on hand to satisfy the requirements of Paragraph 3.2.3 as follows:



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4.2.3.1 MECHANICS OR ASSEMBLY TECHNICIANS

Verify that the mechanics or assembly technicians who will be performing the maintainability demonstration are a) familiar with the assembly and disassembly process of the tank, b) of average ability, and c) have less than five (5) years experience as a mechanic.

4.2.3.2 TEST TECHNICIANS

Verify that a minimum of two test technicians are available with calibrated stopwatches and sufficient test data sheets (see Appendix A) to record the removal and reassembly time of each subassembly or part.

4.2.3.3 TECHNICAL WRITER

Verify that a technical writer with a preliminary outline of the demonstration procedure is available and ready to record the disassembly and assembly process.

4.2.4 MAINTAINABILITY EQUIPMENT

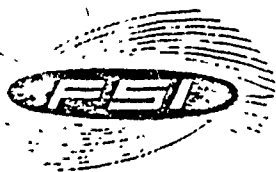
Verify that the tools and equipment to be used by the mechanics or assembly technicians are commonly found in any well supplied tool chest. All tools must be purchased at a well equipped tool supply store and be of common usage by mechanics or technicians involved in aircraft maintenance of fuel tanks.

4.3 MAINTAINABILITY DEMONSTRATION

The maintainability demonstration, which will also include by reason of the test an interchangeability demonstration of all subassemblies and parts removed and replaced, shall not exceed eight (8) man hours and shall be conducted as follows:

4.3.1 DISASSEMBLY

One (1) mechanic or assembly technician shall be assigned to each tank and pylon assembly. Each mechanic or assembly technician shall disassemble and remove from his assigned tank all required items. A test technician shall list all items removed from the tank, the tools required to remove the items, and the time required to accomplish the removal. Do not mix the parts removed from one tank with those removed from the other. The technical writer shall



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record the various operations required to remove the parts as a rough draft for the Overhaul Manual. The replaceable and interchangeable items to be removed are as follows:

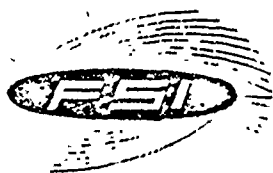
<u>ITEM</u>	<u>PART NO.</u>	<u>QTY</u>
Pylon Leading Edge Skin Assembly	27-450-4429	1
Pylon Trailing Edge Skin Assembly	27-450-4431	1
Pylon Structure Assembly	27-450-4399	1
Stub Pylon Assembly	2191-019	1
Fuel Shutoff Valve Assembly	2191-030	1
Air Shutoff Valve Assembly	2191-036	1
Tank Access Cap	2191-024	3
Tank Fill Cap	502-9	1
Tank Fuel Gauge Assembly	78-113-1099	1
Tank Fuel Gauge Harness Assembly	78-118-1099	1
Fuel Gauge Upper Attach Fitting	2191-042-3	1
Fuel Level Float Switch Assembly	FS-1533	1
Float Switch Tube Assembly		
Drain Valve Assembly	2191-068	1
Pylon Attach Lug	2191-048	4

#### 4.3.2 REASSEMBLY

Each mechanic or assembly technician shall take the items that have been disassembled and rotate them to the opposite tank for reassembly. There shall be no mixing of parts. A test technician shall on the same data sheet used to record the item and its removal list the reassembly time and the tools required to accomplish the task.

#### 4.4 INSPECTION

Upon completion of the reassembly per Paragraph 4.3.2 each tank shall be examined and inspected for compliance with the Engineering drawing, specifications and inspection criteria by the Quality Assurance Department. Any deviations shall be properly noted or corrected.



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4.5 ACCEPTANCE TEST

Each tank after completion of maintainability demonstration shall receive an Acceptance Test to verify that the tank is leak tight and ready for further testing.

5.0 QUALIFICATION TEST REPORT

A formal Qualification Test Report shall be submitted per MIL-STD-831 within 30 days after the maintainability demonstration is complete. This report is to include copies of all demonstration test data sheets and the actual and average time to accomplish the task. Each test tank shall be prepared for shipment and further testing.



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APPENDIX "A"  
TEST DATA SHEETS



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TEST DATA SHEET  
QTP-2191 SECTION "I"

Testing Activity \_\_\_\_\_ Activity Test Engr. \_\_\_\_\_  
 Tank Serial No. \_\_\_\_\_ F.S.I. Test Engr. \_\_\_\_\_  
 Test Date \_\_\_\_\_ Government Rep. \_\_\_\_\_

TEST EQUIPMENT

Ref. Para. 4.1: CHECK PROPER OPERATION AND ACCURACY

<u>ITEM</u>	<u>REMARKS</u>
Stop Watch	_____
Torque Wrenches	_____
Electrical Meter	_____
Other Instruments:	
1. _____	_____
2. _____	_____

TEST EQUIPMENT CALIBRATION

Ref. Para. 4.1.1: CHECK EQUIPMENT CALIBRATION

<u>ITEM</u>	<u>CALIBRATION DATE</u>
Stop Watch	_____
Torque Wrenches	_____
Electrical Meter	_____
Other Instruments:	
1. _____	_____
2. _____	_____



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PREPARATION FOR TEST  
EXAMINATION OF TEST ARTICLE

Ref. Para. 4.2.1: VERIFY TANK ASSEMBLIES ARE REPRESENTATIVE OF PRODUCTION ARTICLES

Remarks: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

ASSEMBLY DOCUMENTS

Ref. Para. 4.2.2: VERIFY PRESENCE OF ALL ASSEMBLY DOCUMENTS

<u>ITEM</u>	<u>REMARKS</u>
Fiber Science Drawings	_____
Vendor Drawings	_____
Fiber Science Specifications	_____
Vendor Specifications	_____

TEST PERSONNEL

MECHANICS OR ASSEMBLY TECHNICIANS

Ref. Para. 4.3.2.1: CERTIFY QUALIFICATIONS

Name and age of each mechanic or assembly technician

#1 NAME _____	AGE _____
#2 NAME _____	AGE _____
#3 NAME _____	AGE _____
#4 NAME _____	AGE _____



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Mechanic or assembly technician is familiar with the assembly and disassembly process of the test article.

Remarks:

#1 \_\_\_\_\_  
#2 \_\_\_\_\_  
#3 \_\_\_\_\_  
#4 \_\_\_\_\_

Mechanic or assembly technician is of average ability and has less than five years experience.

#1 \_\_\_\_\_  
#2 \_\_\_\_\_  
#3 \_\_\_\_\_  
#4 \_\_\_\_\_

TEST TECHNICIANS

Ref. Para. 4.2.3.2: LIST NAMES AND ASSIGNMENT

<u>NAME</u>	<u>ASSIGNMENT</u>
#1 _____	_____
#2 _____	_____
#3 _____	_____
#4 _____	_____



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TECHNICAL WRITER

Ref. Para 4.2.3.3: LIST NAME AND FILE OUTLINE WITH THIS REPORT

NAME

\_\_\_\_\_

OUTLINE FILED

REMARKS:

\_\_\_\_\_

\_\_\_\_\_

MAINTAINABILITY EQUIPMENT

Ref. Para 4.2.4: VERIFY TOOLS ARE COMMONLY FOUND IN WELL SUPPLIED TOOL CHEST

TOOL LIST

- |           |           |           |
|-----------|-----------|-----------|
| 1. _____  | 17. _____ | 33. _____ |
| 2. _____  | 18. _____ | 34. _____ |
| 3. _____  | 19. _____ | 35. _____ |
| 4. _____  | 20. _____ | 36. _____ |
| 5. _____  | 21. _____ | 37. _____ |
| 6. _____  | 22. _____ | 38. _____ |
| 7. _____  | 23. _____ | 39. _____ |
| 8. _____  | 24. _____ | 40. _____ |
| 9. _____  | 25. _____ | 41. _____ |
| 10. _____ | 26. _____ | 42. _____ |
| 11. _____ | 27. _____ | 43. _____ |
| 12. _____ | 28. _____ | 44. _____ |
| 13. _____ | 29. _____ | 45. _____ |
| 14. _____ | 30. _____ | 46. _____ |
| 15. _____ | 31. _____ | 47. _____ |
| 16. _____ | 32. _____ | 48. _____ |



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MAINTAINABILITY DEMONSTRATION

DISASSEMBLY

Ref. Para. 4.3.1: APPROVED TEST ARRANGEMENT

TESTING ACTIVITY APPROVAL

APPROVED BY \_\_\_\_\_ DATE \_\_\_\_\_

F.S.I. TEST ENGINEER APPROVAL

APPROVED BY \_\_\_\_\_ DATE \_\_\_\_\_

GOVERNMENT APPROVAL

APPROVED BY \_\_\_\_\_ DATE \_\_\_\_\_

MINIMUM OF TWO SIGNATURES REQUIRED

RECORD OF ACTUAL DISASSEMBLY OF EACH SUBASSEMBLY  
OR PART AND THE TIME REQUIRED TO ACCOMPLISH EACH  
(SEE PAGES 15 THRU 29).

REASSEMBLY

Ref. Para. 4.3.2: APPROVED TEST MANAGEMENT

TESTING ACTIVITY APPROVAL

APPROVED BY \_\_\_\_\_ DATE \_\_\_\_\_

F.S.I. TEST ENGINEER APPROVAL

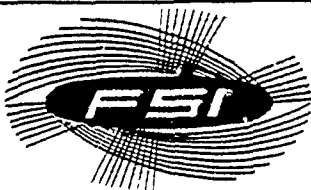
APPROVED BY \_\_\_\_\_ DATE \_\_\_\_\_

GOVERNMENT APPROVAL

APPROVED BY \_\_\_\_\_ DATE \_\_\_\_\_

MINIMUM OF TWO SIGNATURES REQUIRED

RECORD OF ACTUAL REASSEMBLY OF EACH SUBASSEMBLY  
OR PART AND THE TIME REQUIRED TO ACCOMPLISH EACH  
(SEE PAGES 15 THRU 29).



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DISASSEMBLY

Ref. Para. 4.3.1: PYLON LEADING EDGE SKIN ASSEMBLY

ITEMS

- |          |           |
|----------|-----------|
| 1. _____ | 6. _____  |
| 2. _____ | 7. _____  |
| 3. _____ | 8. _____  |
| 4. _____ | 9. _____  |
| 5. _____ | 10. _____ |

REMARKS: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

DISASSEMBLY TIME REQUIRED \_\_\_\_\_

REASSEMBLY

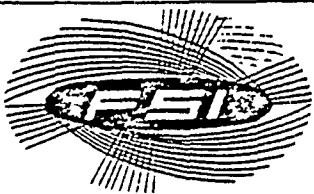
Ref. Para. 4.3.2: PYLON LEADING EDGE SKIN ASSEMBLY

ITEMS

- |          |           |
|----------|-----------|
| 1. _____ | 6. _____  |
| 2. _____ | 7. _____  |
| 3. _____ | 8. _____  |
| 4. _____ | 9. _____  |
| 5. _____ | 10. _____ |

REMARKS: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

REASSEMBLY TIME REQUIRED \_\_\_\_\_



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DISASSEMBLY

Ref. Para. 4.3.1: PYLON TRAILING EDGE SKIN ASSEMBLY

ITEMS

- |          |           |
|----------|-----------|
| 1. _____ | 6. _____  |
| 2. _____ | 7. _____  |
| 3. _____ | 8. _____  |
| 4. _____ | 9. _____  |
| 5. _____ | 10. _____ |

REMARKS: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

DISASSEMBLY TIME REQUIRED \_\_\_\_\_

REASSEMBLY

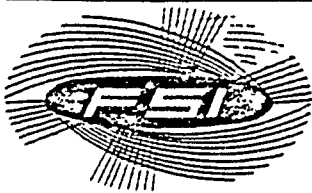
Ref. Para. 4.3.2: PYLON TRAILING EDGE SKIN ASSEMBLY

ITEMS

- |          |           |
|----------|-----------|
| 1. _____ | 6. _____  |
| 2. _____ | 7. _____  |
| 3. _____ | 8. _____  |
| 4. _____ | 9. _____  |
| 5. _____ | 10. _____ |

REMARKS: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

REASSEMBLY TIME REQUIRED \_\_\_\_\_



FIBER SCIENCE, INC.  
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DISASSEMBLY

Ref. Para. 4.3.1: PYLON STRUCTURE ASSEMBLY

ITEMS

- |          |           |
|----------|-----------|
| 1. _____ | 6. _____  |
| 2. _____ | 7. _____  |
| 3. _____ | 8. _____  |
| 4. _____ | 9. _____  |
| 5. _____ | 10. _____ |

REMARKS: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

DISASSEMBLY TIME REQUIRED \_\_\_\_\_

REASSEMBLY

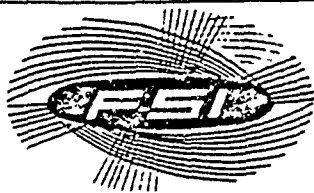
Ref. Para. 4.3.2: PYLON STRUCTURE ASSEMBLY

ITEMS

- |          |           |
|----------|-----------|
| 1. _____ | 6. _____  |
| 2. _____ | 7. _____  |
| 3. _____ | 8. _____  |
| 4. _____ | 9. _____  |
| 5. _____ | 10. _____ |

REMARKS: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

REASSEMBLY TIME REQUIRED \_\_\_\_\_



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DISASSEMBLY

Ref. Para. 4.3.1: STUB PYLON ASSEMBLY

ITEMS

- |          |           |
|----------|-----------|
| 1. _____ | 6. _____  |
| 2. _____ | 7. _____  |
| 3. _____ | 8. _____  |
| 4. _____ | 9. _____  |
| 5. _____ | 10. _____ |

REMARKS: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

DISASSEMBLY TIME REQUIRED \_\_\_\_\_

REASSEMBLY

Ref. Para. 4.3.2: STUB PYLON ASSEMBLY

ITEMS

- |          |           |
|----------|-----------|
| 1. _____ | 6. _____  |
| 2. _____ | 7. _____  |
| 3. _____ | 8. _____  |
| 4. _____ | 9. _____  |
| 5. _____ | 10. _____ |

REMARKS: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

REASSEMBLY TIME REQUIRED \_\_\_\_\_



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DISASSEMBLY

Ref. Para. 4.3.1: FUEL SHUTOFF VALVE ASSEMBLY

ITEMS

- |          |           |
|----------|-----------|
| 1. _____ | 6. _____  |
| 2. _____ | 7. _____  |
| 3. _____ | 8. _____  |
| 4. _____ | 9. _____  |
| 5. _____ | 10. _____ |

REMARKS: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

DISASSEMBLY TIME REQUIRED \_\_\_\_\_

REASSEMBLY

Ref. Para. 4.3.2: FUEL SHUTOFF VALVE ASSEMBLY

ITEMS

- |          |           |
|----------|-----------|
| 1. _____ | 6. _____  |
| 2. _____ | 7. _____  |
| 3. _____ | 8. _____  |
| 4. _____ | 9. _____  |
| 5. _____ | 10. _____ |

REMARKS: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

REASSEMBLY TIME REQUIRED \_\_\_\_\_



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DISASSEMBLY

Ref. Para. 4.3.1: AIR SHUTOFF VALVE ASSEMBLY

ITEMS

- |          |           |
|----------|-----------|
| 1. _____ | 6. _____  |
| 2. _____ | 7. _____  |
| 3. _____ | 8. _____  |
| 4. _____ | 9. _____  |
| 5. _____ | 10. _____ |

REMARKS: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

DISASSEMBLY TIME REQUIRED \_\_\_\_\_

REASSEMBLY

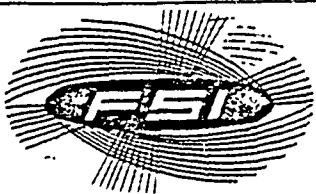
Ref. Para. 4.3.2: AIR SHUTOFF VALVE ASSEMBLY

ITEMS

- |          |           |
|----------|-----------|
| 1. _____ | 6. _____  |
| 2. _____ | 7. _____  |
| 3. _____ | 8. _____  |
| 4. _____ | 9. _____  |
| 5. _____ | 10. _____ |

REMARKS: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

REASSEMBLY TIME REQUIRED \_\_\_\_\_



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DISASSEMBLY

Ref. Para. 4.3.1: TANK ACCESS CAP

ITEMS

- |          |           |
|----------|-----------|
| 1. _____ | 6. _____  |
| 2. _____ | 7. _____  |
| 3. _____ | 8. _____  |
| 4. _____ | 9. _____  |
| 5. _____ | 10. _____ |

REMARKS: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

DISASSEMBLY TIME REQUIRED \_\_\_\_\_

REASSEMBLY

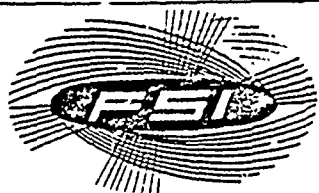
Ref. Para. 4.3.2: TANK ACCESS CAP

ITEMS

- |          |           |
|----------|-----------|
| 1. _____ | 6. _____  |
| 2. _____ | 7. _____  |
| 3. _____ | 8. _____  |
| 4. _____ | 9. _____  |
| 5. _____ | 10. _____ |

REMARKS: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

REASSEMBLY TIME REQUIRED \_\_\_\_\_



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DISASSEMBLY

Ref. Para. 4.3.1: TANK FILL CAP

ITEMS

- |          |           |
|----------|-----------|
| 1. _____ | 6. _____  |
| 2. _____ | 7. _____  |
| 3. _____ | 8. _____  |
| 4. _____ | 9. _____  |
| 5. _____ | 10. _____ |

REMARKS: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

DISASSEMBLY TIME REQUIRED \_\_\_\_\_

REASSEMBLY

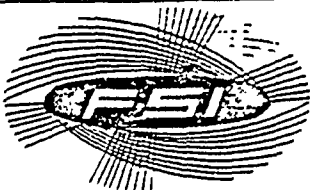
Ref. Para. 4.3.2: TANK FILL CAP

ITEMS

- |          |           |
|----------|-----------|
| 1. _____ | 6. _____  |
| 2. _____ | 7. _____  |
| 3. _____ | 8. _____  |
| 4. _____ | 9. _____  |
| 5. _____ | 10. _____ |

REMARKS: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

REASSEMBLY TIME REQUIRED \_\_\_\_\_



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DISASSEMBLY

Ref. Para. 4.3.1: TANK FUEL GAUGE ASSEMBLY

ITEMS

- |          |           |
|----------|-----------|
| 1. _____ | 6. _____  |
| 2. _____ | 7. _____  |
| 3. _____ | 8. _____  |
| 4. _____ | 9. _____  |
| 5. _____ | 10. _____ |

REMARKS: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

DISASSEMBLY TIME REQUIRED \_\_\_\_\_

REASSEMBLY

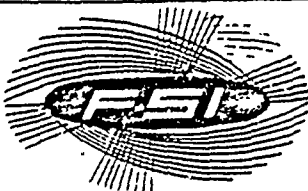
Ref. Para. 4.3.2: TANK FUEL GAUGE ASSEMBLY

ITEMS

- |          |           |
|----------|-----------|
| 1. _____ | 6. _____  |
| 2. _____ | 7. _____  |
| 3. _____ | 8. _____  |
| 4. _____ | 9. _____  |
| 5. _____ | 10. _____ |

REMARKS: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

REASSEMBLY TIME REQUIRED \_\_\_\_\_



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DISASSEMBLY

Ref. Para. 4.3.1: TANK FUEL GAUGE HARNESS ASSEMBLY

ITEMS

- |          |           |
|----------|-----------|
| 1. _____ | 6. _____  |
| 2. _____ | 7. _____  |
| 3. _____ | 8. _____  |
| 4. _____ | 9. _____  |
| 5. _____ | 10. _____ |

REMARKS: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

DISASSEMBLY TIME REQUIRED \_\_\_\_\_

REASSEMBLY

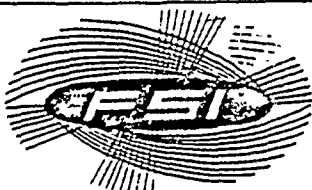
Ref. Para. 4.3.2: TANK FUEL GAUGE HARNESS ASSEMBLY

ITEMS

- |          |           |
|----------|-----------|
| 1. _____ | 6. _____  |
| 2. _____ | 7. _____  |
| 3. _____ | 8. _____  |
| 4. _____ | 9. _____  |
| 5. _____ | 10. _____ |

REMARKS: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

REASSEMBLY TIME REQUIRED \_\_\_\_\_



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DISASSEMBLY

Ref. Para. 4.3.1: FUEL GAUGE UPPER ATTACH FITTING

ITEMS

- |          |           |
|----------|-----------|
| 1. _____ | 6. _____  |
| 2. _____ | 7. _____  |
| 3. _____ | 8. _____  |
| 4. _____ | 9. _____  |
| 5. _____ | 10. _____ |

REMARKS: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

DISASSEMBLY TIME REQUIRED \_\_\_\_\_

REASSEMBLY

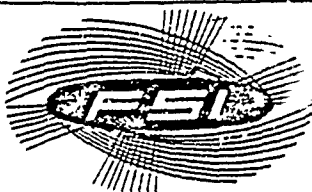
Ref. Para. 4.3.2: FUEL GAUGE UPPER ATTACH FITTING

ITEMS

- |          |           |
|----------|-----------|
| 1. _____ | 6. _____  |
| 2. _____ | 7. _____  |
| 3. _____ | 8. _____  |
| 4. _____ | 9. _____  |
| 5. _____ | 10. _____ |

REMARKS: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

REASSEMBLY TIME REQUIRED \_\_\_\_\_



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DATE: 4/4/81

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DISASSEMBLY

Ref. Para. 4.3.1: FUEL LEVEL FLOAT SWITCH ASSEMBLY

ITEMS

- |          |           |
|----------|-----------|
| 1. _____ | 6. _____  |
| 2. _____ | 7. _____  |
| 3. _____ | 8. _____  |
| 4. _____ | 9. _____  |
| 5. _____ | 10. _____ |

REMARKS: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

DISASSEMBLY TIME REQUIRED \_\_\_\_\_

REASSEMBLY

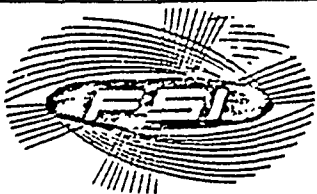
Ref. Para. 4.3.2: FUEL LEVEL FLOAT SWITCH ASSEMBLY

ITEMS

- |          |           |
|----------|-----------|
| 1. _____ | 6. _____  |
| 2. _____ | 7. _____  |
| 3. _____ | 8. _____  |
| 4. _____ | 9. _____  |
| 5. _____ | 10. _____ |

REMARKS: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

REASSEMBLY TIME REQUIRED \_\_\_\_\_



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DISASSEMBLY

Ref. Para. 4.3.1: FLOAT SWITCH TUBE ASSEMBLY

ITEMS

- |          |           |
|----------|-----------|
| 1. _____ | 6. _____  |
| 2. _____ | 7. _____  |
| 3. _____ | 8. _____  |
| 4. _____ | 9. _____  |
| 5. _____ | 10. _____ |

REMARKS: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

DISASSEMBLY TIME REQUIRED \_\_\_\_\_

REASSEMBLY

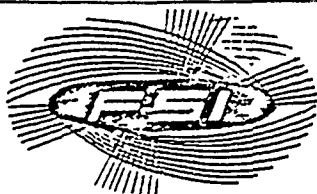
Ref. Para. 4.3.2: FLOAT SWITCH TUBE ASSEMBLY

ITEMS

- |          |           |
|----------|-----------|
| 1. _____ | 6. _____  |
| 2. _____ | 7. _____  |
| 3. _____ | 8. _____  |
| 4. _____ | 9. _____  |
| 5. _____ | 10. _____ |

REMARKS: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

REASSEMBLY TIME REQUIRED \_\_\_\_\_



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NO. QTP-2191 Section "I"

DATE: 4/4/81

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DISASSEMBLY

Ref. Para. 4.3.1: DRAIN VALVE ASSEMBLY

ITEMS

- |          |           |
|----------|-----------|
| 1. _____ | 6. _____  |
| 2. _____ | 7. _____  |
| 3. _____ | 8. _____  |
| 4. _____ | 9. _____  |
| 5. _____ | 10. _____ |

REMARKS: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

DISASSEMBLY TIME REQUIRED \_\_\_\_\_

REASSEMBLY

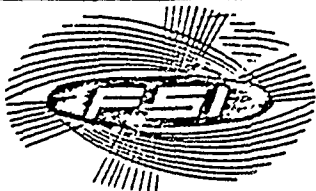
Ref. Para. 4.3.2: DRAIN VALVE ASSEMBLY

ITEMS

- |          |           |
|----------|-----------|
| 1. _____ | 6. _____  |
| 2. _____ | 7. _____  |
| 3. _____ | 8. _____  |
| 4. _____ | 9. _____  |
| 5. _____ | 10. _____ |

REMARKS: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

REASSEMBLY TIME REQUIRED \_\_\_\_\_



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NO. QTP-2191 Section "I"

DATE: 4/4/81

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DISASSEMBLY

Ref. Para. 4.3.1: PYLON ATTACH LUG

ITEMS

- |          |           |
|----------|-----------|
| 1. _____ | 6. _____  |
| 2. _____ | 7. _____  |
| 3. _____ | 8. _____  |
| 4. _____ | 9. _____  |
| 5. _____ | 10. _____ |

REMARKS: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

DISASSEMBLY TIME REQUIRED \_\_\_\_\_

REASSEMBLY

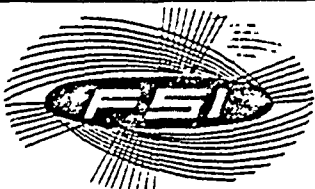
Ref. Para. 4.3.2: PYLON ATTACH LUG

ITEMS

- |          |           |
|----------|-----------|
| 1. _____ | 6. _____  |
| 2. _____ | 7. _____  |
| 3. _____ | 8. _____  |
| 4. _____ | 9. _____  |
| 5. _____ | 10. _____ |

REMARKS: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

REASSEMBLY TIME REQUIRED \_\_\_\_\_



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INSPECTION

Ref. Para. 4.4: INSPECT TANK AND PYLON FOR COMPLETENESS OF ASSEMBLY

TANK PER 2191-001

REMARKS: \_\_\_\_\_

\_\_\_\_\_

QUALITY ASSURANCE APPROVAL \_\_\_\_\_

PYLON PER 27-450-4400

REMARKS: \_\_\_\_\_

\_\_\_\_\_

QUALITY ASSURANCE APPROVAL \_\_\_\_\_

ACCEPTANCE TEST

Ref. Para. 4.5: APPROVED ACCEPTANCE TEST

Q.A. REP. \_\_\_\_\_ TEST DATE \_\_\_\_\_

REMARKS: \_\_\_\_\_

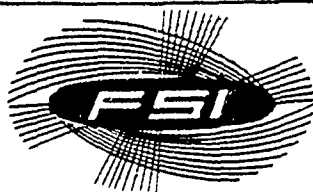
\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

QUALITY ASSURANCE APPROVAL \_\_\_\_\_



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DATE: 4/4/81 PAGE 30 OF 31

EVALUATION OF DATA

DISASSEMBLY DEMONSTRATION: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

REASSEMBLY DEMONSTRATION: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

TIME REQUIRED FOR DEMONSTRATION

ITEM

DISASSEMBLY:		ACTUAL TIME	AVERAGE TIME
SERIAL NUMBER	_____	_____	_____
SERIAL NUMBER	_____	_____	_____
REASSEMBLY:			
SERIAL NUMBER	_____	_____	_____
SERIAL NUMBER	_____	_____	_____

TOTAL DEMONSTRATION

SERIAL NUMBER \_\_\_\_\_  
SERIAL NUMBER \_\_\_\_\_

INSPECTION AND ACCEPTANCE TEST: \_\_\_\_\_  
\_\_\_\_\_



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DOCUMENT NUMBER

QTP-2191 SECTION "J"

TITLE

QUALIFICATION TEST PROCEDURE

H-53 TANK

REQUIREMENTS FOR SLOSH AND VIBRATION TEST


REVISIONS

LTR.	DATE	PREPARED	APPROVED	DESCRIPTION

PREPARED BY: DATE:  
Richard Lyman 1/14/81

CHECKED BY: DATE:  
*Randy Stone* 1-27-81

APPROVED BY: DATE:  
*C.A. Patnode Jr* 1/28/81



FIBER SCIENCE, INC.  
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NO. QTP-2191 Section "J"

DATE: 1/14/81



1.0 SCOPE

This procedure covers the requirements for Sloss and Vibration testing of the 450 Gallon Filament Wound External Fuel Tank for the H-53 Helicopter.

2.0 APPLICABLE DOCUMENTS

2.1 MILITARY SPECIFICATIONS

MIL-T-7378 Tanks, Removable Auxiliary External Aircraft Fuel

MIL-STD-831 Test Reports, Preparation of.

2.2 TECHNICAL EXHIBIT

ASD/ENFEA-78 Tank - 450 gallon external fuel, filament wound lightweight explosion proof.

2.3 DRAWINGS

FIBER SCIENCE

2191-001 Tank - Installation, 450 gallon H-53

SARGENT FLETCHER

27-450-4400 Pylon Assembly - 450 gallon fuel tank.



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3.0 REQUIREMENTS

3.1 TEST ARTICLES

Two (2) tank assemblies 2191-001 each equipped with an integral pylon (27-450-4400) shall be mounted to an adaptor which in turn shall be mounted to a slosh and vibration test fixture and subjected individually to the test requirements as described in Technical Exhibit ASD/ENFEA-78, Paragraph 4.6.14 and those applicable paragraphs of MIL-T-7378.

3.2 TEST ARRANGEMENT

The test arrangement shall be similar to that shown in Figure 1 with all reasonable precautions taken to simulate the actual mounting of the tank and pylon to the helicopter. The tank centerline shall be at least 20 inches above the slosh axis.

3.3 TEST METHOD

Each test tank shall be suspended in a 2° nose down position from the integral pylon when mounted to a support adaptor fastened to the slosh and vibration fixture when the slosh and vibration fixture is positioned in the level or horizontal position. The following test conditions apply:

3.3.1 TEST FIXTURE

The slosh and vibration test fixture shall have the capability of performing the slosh and vibration requirements described in this procedure and have a minimum rocking angle of  $\pm 15^\circ$  from the level or horizontal position and a minimum double amplitude vibration of .020 inches at the mounting bolts of the test article.

3.3.2 VIBRATION DISPLACEMENT

The average displacement during testing between the top and bottom of each tank at the supporting bulkheads shall be a minimum of .032 inches.



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3.3.3 VIBRATION FREQUENCY

The vibration frequency for testing the tank shall be 1940 to 2000 cycles per minute

3.3.4 MOUNTING AXIS

Each tank shall be mounted in a manner such that the longitudinal axis of the tank is 90° to the centerline of the axis of the shaft of the rocker assembly platform. For the pitch portion of the test see Figure 1. For the roll portion of the test, the longitudinal axis of each tank shall be above but in line with the centerline of the axis of the shaft of the rocker arm assembly platform. (See Figure 1).

3.3.5 TEST FLUID

Each test tank shall be filled two thirds (2/3) full with water at ambient temperature for the primary portion of the slosh and vibration test.

3.3.6 TEST PRESSURE

The test pressure inside the tank during the slosh and vibration test shall be the normal operating pressure of the tank when used on the aircraft. The normal operating pressure of the H-53 fuel system is 15 psi.

3.3.7 PRIMARY TEST SEQUENCE

Each tank shall be simultaneously sloshed and vibrated in a pitch condition for twelve and one-half (12-1/2) hours. Each tank shall then be oriented for the roll condition and sloshed and vibrated for an additional twelve and one-half (12-1/2) hours. This test shall be accomplished at the vibration displacement level of Paragraph 3.3.2 and the vibration frequency level of Paragraph 3.3.3.



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3.3.8 VIBRATION TEST SEQUENCE

Following the primary slosh and vibration test of Paragraph 3.3.7, each tank shall be rotated back to the position it was in for the pitch portion of the test, filled to the full fuel level with water, and vibrated only, for a period of ten (10) minutes. The vibration displacement and frequency shall be per Paragraph 3.3.2 and 3.3.3 respectively.

3.3.9 POST VIBRATION EXAMINATION

Each tank upon completion of the slosh and vibration test shall be examined for evidence of leakage, failure or excessive wear.

3.3.10 POST VIBRATION PRESSURE TEST

Each tank shall be subject to the following pressure tests after completion of the slosh and vibration tests:

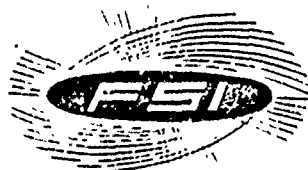
- a. 112 psi positive pressure for 3 minutes.
- b. 05 psi negative pressure for 3 minutes.
- c. 25 psi positive pressure for 15 minutes.

3.4 TEST INSTRUMENTATION

A 16 MM full color movie shall be taken of each aspect of the test. An accelerometer shall be attached to each end of the pylon at the pylon attach points to verify proper vibration. Ten (10) biaxial strain gauges shall be located on the tank to record at periodic intervals the working stress upon the tank structure. During and after the test, 12 color still photos shall be taken to document the test and any damage to the test articles.

3.4.1 INSTRUMENTATION CALIBRATION

All instrumentation shall be calibrated and capable of reading or recording data within  $\pm 2\%$  of its full scale value. No instrument shall be used that has not been calibrated within the previous calibration period.



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3.5 TEST PROCEDURES

The test procedures shall be in accordance with Paragraph 4 of this document.

3.6 DOCUMENTATION

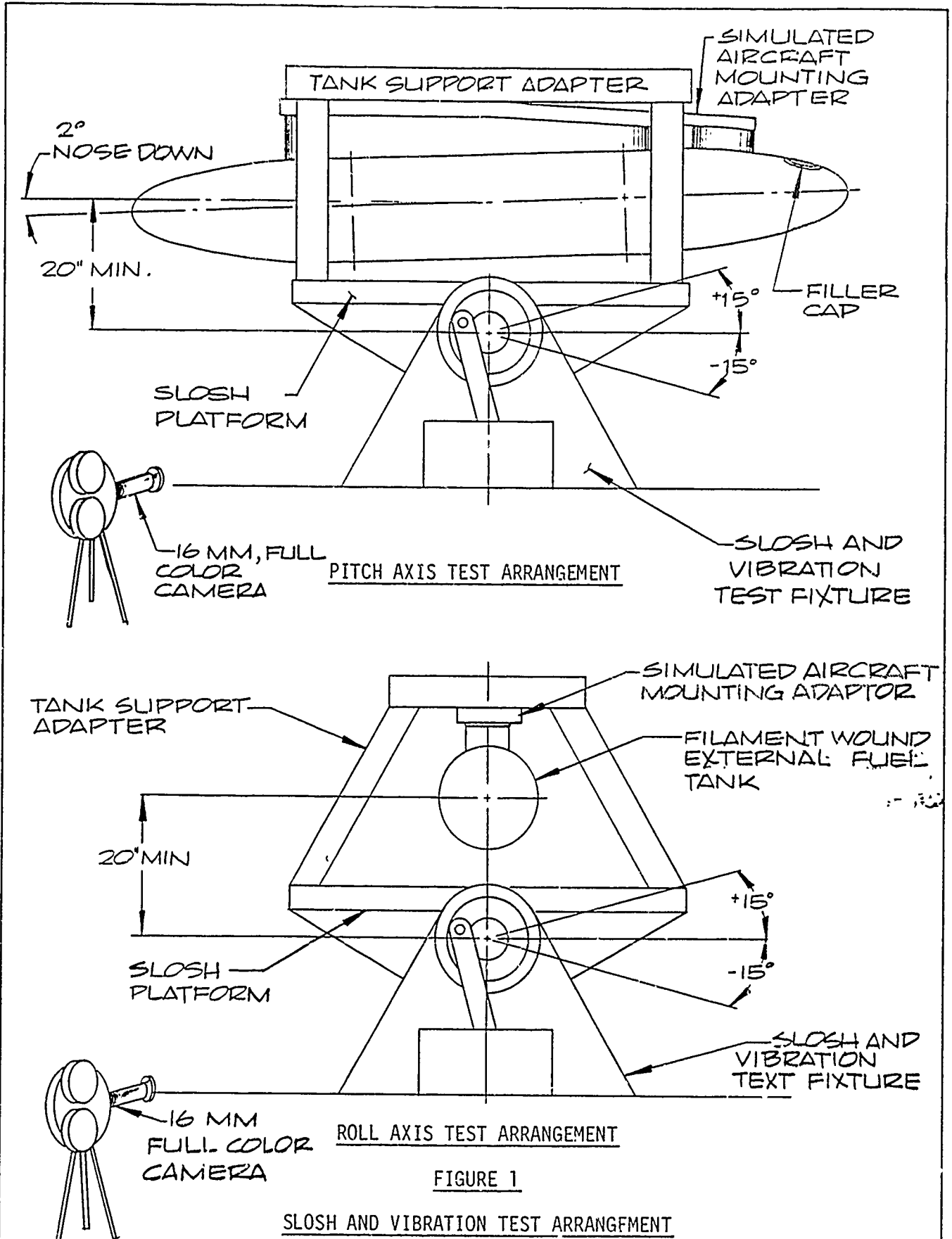
At the conclusion of testing a test report shall be prepared for submission to the contractor.



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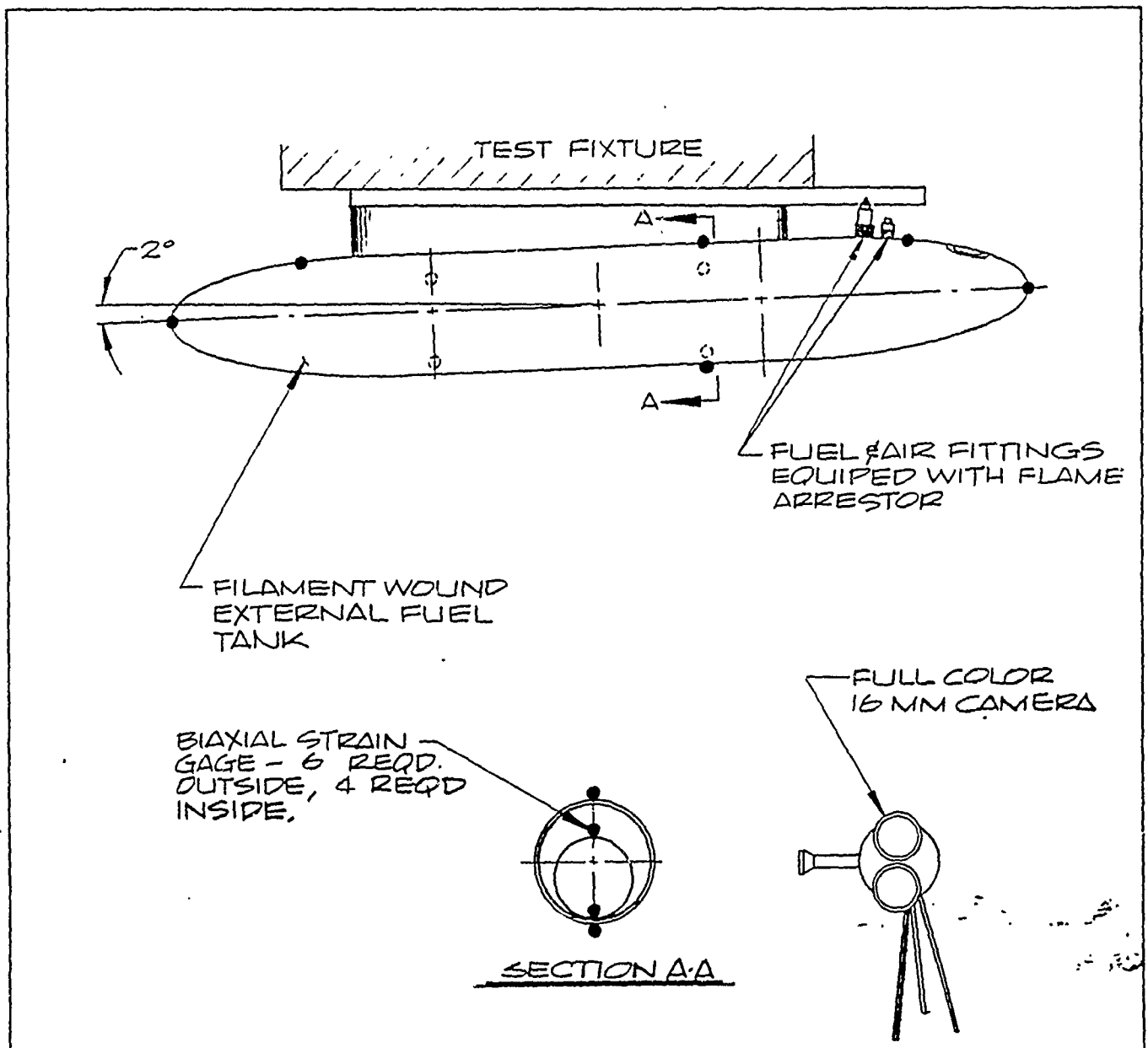


FIGURE 2

STRAIN SENSOR ARRANGEMENT



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4.0 QUALIFICATION TEST PROVISIONS

4.1 EXAMINATION OF PRODUCT

Each tank and pylon shall be fully examined prior to mounting to the test fixture for shipping damage to the test site. This examination shall include a visual inspection and a tap test for delaminations. The results of this inspection shall be recorded by the testing activity in the presence of an authorized Fiber Science Test Engineer.

4.2 MOUNTING

Each tank and pylon shall then be mounted to the test fixture to the requirements of Paragraph 3.3 and examined for proper attachment and assimilation to the actual aircraft installation. Any significant variations or deviations shall be recorded.

4.3 ARRANGEMENT

The test arrangement shall be examined for compliance with Figure 1 of this procedure and applicable paragraphs of ASD/ENFEA-78 Technical Exhibit and MIL-T-7378.

4.4 INSTRUMENTATION AND TEST EQUIPMENT

4.4.1 INSTRUMENTATION CALIBRATION

All instrumentation shall be inspected to verify that each instrument has had a calibration check within the last calibration period.

4.4.2 INSTALLATION

All instruments and test equipment: slosh and vibration test fixture, camera, biaxial strain gauges, pressure gauges, accelerometers, and recorders shall be installed in such a way as to best satisfy the intent of the test. Biaxial strain gauge readings shall be taken at locations indicated in Figure 2 of this procedure.



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4.4.3 OPERATION

All instrumentation and test equipment shall be checked for proper operation. Verify that the slosh and vibration test fixture meets the requirements of Paragraph 3.3.1 through Paragraph 3.3.4. Any defects in instrumentation shall be recorded and the test shall not proceed until the defect is removed or deemed not critical for the test required by the testing activity and approved by an authorized Fiber Science Test Engineer.

4.5 SLOSH AND VIBRATION TEST

4.5.1 FUELING AND PRESSURIZATION

With the tank mounted about the pitch axis in a 20° nose down position, remove the filler cap and fill the tank with 300 to 305 gallons (2/3 full) of water at ambient temperature. Secure filler cap and pressurize tank to 15 psi ± 2 psi in preparation for test.

4.5.2 PITCH AXIS TEST

Slosh and vibrate the test tank about the pitch axis for twelve and one-half (12-1/2) hours. There shall be no leakage or failure during the test. Drain tank then rotate 90° to the roll axis and secure to the test fixture.

4.5.3 ROLL AXIS TEST

Refuel and pressurize tank to the requirements of Paragraph 4.5.1. Slosh and vibrate the test tank about the roll axis for twelve and one-half (12-1/2) hours. There shall be no leakage or failure during the test. Drain tank then rotate 90° back to the pitch axis and secure to the test fixture.

4.5.4 VIBRATION TEST

Refuel the test tank to a full tank condition (450 to 457 gallons) and pressurize to the requirements of Paragraph 4.5.1. The test tank shall then be vibrated for 10 minutes. There shall be no leakage or failure during the test.



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4.6 POST VIBRATION EXAMINATION

The tank shall be emptied and examined for evidence of leakage, failed parts, excessive wear of the tank or undue looseness or wear of the pylon.

4.7 POST VIBRATION PRESSURE TEST

Following the vibration test and examination of Paragraph 4.5.4 and 4.6, refill the tank with water (450 to 457 gallons) and perform the following tests:

- a. Pressurize to 112 psi for three (3) minutes. There shall be no failure or evidence of leakage.
- b. Drain tank and vacuum test to 05 psi (10.2 inches of Hg.) for 3 minutes.. There shall be no failure or evidence of leakage.
- c. Refill tank with water (450 to 457 gallons) and pressurize to 25 psi for 15 minutes. There shall be no failure or evidence of leakage.

4.8 POST SLOSH AND VIBRATION EXAMINATION

Visually inspect and tap test entire surface of tank for delaminations. Record all external damage if any to the outside surface of tank. Remove both access openings and filler cap and visually inspect the interior of the tank. Record all internal damage to the tank shell, frames, baffles, fittings or tubing. Photograph all internal and external damage if any. Identify photographs by number and location.

5.0 QUALIFICATION REPORT

A formal qualification test report shall be submitted per MIL-STD-831 within 30 days after the testing is complete. This report is to include all recorder strain data sheets, 16 MM film and photographs. The test tank shall be returned to Fiber Science for further testing in the same shipping container it was received in.



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APPENDIX "A"  
TEST DATA SHEETS



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TEST DATA SHEET

QTR-2191 SECTION "J"

Testing Activity \_\_\_\_\_ Activity Test Engr. \_\_\_\_\_  
Tank Serial No. \_\_\_\_\_ F.S.I. Test Engr. \_\_\_\_\_  
Test Date \_\_\_\_\_ Government Rep. \_\_\_\_\_

EXAMINATION OF PRODUCT

Ref. Para. 4.1: Visual Inspection \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Delaminations (Tap Test) \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

MOUNTING

Ref. Para. 4.2: Aircraft Simulated Attachment  
Deviations If Any \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_



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ARRANGEMENT

Ref. Para. 4.3: Approved Test Arrangement (Ref. Figure 1, Figure 2, & ASD/ENFEA-78 Technical Exhibit.)

Testing Activity Approval

Approved By \_\_\_\_\_ Date \_\_\_\_\_

F.S.I. Test Engineer Approval

Approved By \_\_\_\_\_ Date \_\_\_\_\_

Government Approval

Approved By \_\_\_\_\_ Date \_\_\_\_\_

Minimum of two signatures required.

INSTRUMENTATION

Ref. Para. 4.4.1: CHECK INSTRUMENTATION CALIBRATION

<u>ITEM</u>	<u>CALIBRATION DATE</u>
Slosh and Vibration Mechanism (If Applicable)	_____
Cameras (If Applicable)	_____
Accelerometer	_____
Strain Gauge Recorder	_____
Timing Devices	_____
Pressure Gauge	_____
Other Instruments:	_____
1. _____	_____
2. _____	_____
3. _____	_____



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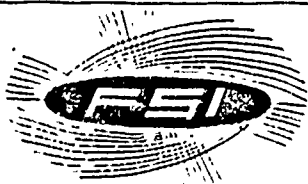
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Ref. Para 4.4.2 CHECK PROPER INSTALLATION

<u>ITEM</u>	<u>REMARKS</u>
Tank Mounting (Pitch or Roll)	_____
Cameras	_____
Accelerometers	_____
Strain Gauges	_____
Pressure Gauges	_____
Recorders	_____
Other Instruments	_____
1. _____	_____
2. _____	_____

Ref. Para. 4.4.3: CHECK PROPER OPERATION

<u>ITEM</u>	<u>REMARKS</u>
Slosh and Vibration Mechanism	_____
a. Pitch Angle	_____
b. Vibration Amplitude	_____
c. Vibration Displacement	_____
d. Vibration Frequency	_____
Cameras	_____
Accelerometer	_____
Strain Gauges	_____
Recorders	_____
Pressure Gauge	_____
Other Instruments:	_____
1. _____	_____



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FUELING AND PRESSURIZATION

Ref. Para. 4.5.1: FUEL TANK AT PROPER ATTITUDE THEN PRESSURIZE

<u>ITEM</u>	<u>REMARKS</u>
Attitude (20° nose down)	_____
Fill with 300 to 305 gal. water	_____
Secure Filler Cap	_____
Pressurize to 15 psi	_____

PITCH AXIS TEST

Ref. Para. 4.5.2: SLOSH AND VIBRATE TANK ABOUT THE PITCH AXIS WITH ALL INSTRUMENTATION SYNCHRONIZED

<u>ITEM</u>	<u>OPERATION REMARKS</u>
Elapsed Time	_____
Pitch Angle	_____
Vibration Amplitude	_____
Vibration Displacement	_____
Vibration Frequency	_____
Strain Gauge Recorder	_____
Accelerometer Recorder	_____
Pressure Reading	_____
Other Instruments:	_____
1. _____	_____
2. _____	_____
Empty Tank and Examine	
Remarks:	_____
	_____



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ROLL AXIS TEST

Ref. Para. 4.5.3: REFUEL AND SLOSH AND VIBRATE TANK ABOUT THE ROLL AXIS

Refuel tank at proper attitude then pressurize.

<u>ITEM</u>	<u>REMARKS</u>
Attitude (2° Nose Down)	_____
Fill with 300 to 305 gal. water	_____
Secure Filler Cap	_____
Pressurize to 15 psi	_____

SLOSH AND VIBRATE WITH ALL INSTRUMENTATION SYNCHRONIZED.

<u>ITEM</u>	<u>OPERATION REMARKS</u>
Elapsed Time	_____
Roll Angle	_____
Vibration Amplitude	_____
Vibration Displacement	_____
Vibration Frequency	_____
Strain Gauge Recorder	_____
Accelerometer Recorder	_____
Pressure Reading	_____
Other Instruments:	_____
1. _____	_____
2. _____	_____

Empty Tank and Examine

Remarks: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_



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VIBRATION TEST

Ref. Para. 4.5.4: REFUEL AND VIBRATE TANK ABOUT THE PITCH AXIS

Refuel Tank at Proper Attitude then Pressurize

ITEM

REMARKS

Attitude (2° Nose Down) \_\_\_\_\_

Fill with 450 to 475 gal. water \_\_\_\_\_

Secure Filler Cap \_\_\_\_\_

Pressurize to 15 psi \_\_\_\_\_

Vibrate Tank with all Instrumentation Synchronized

ITEM

OPERATION REMARKS

Elapsed Time \_\_\_\_\_

Vibration Amplitude  
at Mounting Bolts \_\_\_\_\_

Vibration Displacement  
at Support Bulkheads \_\_\_\_\_

Strain Gauge Recorder \_\_\_\_\_

Accelerometer Recorder \_\_\_\_\_

Pressure Reading \_\_\_\_\_

Other Instruments: \_\_\_\_\_

1. \_\_\_\_\_

2. \_\_\_\_\_

3. \_\_\_\_\_

4. \_\_\_\_\_



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POST VIBRATION EXAMINATION

Ref. Para. 4.6: EXAMINE TANK CONDITION

External Condition \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Internal Condition \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Pylon Condition \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

POST VIBRATION PRESSURE TEST

Ref. Para. 4.7: REFUEL AND PRESSURIZE TANK

Refuel Tank at Proper Attitude, then Pressurize

<u>ITEM</u>	<u>REMARKS</u>
-------------	----------------

Attitude (20° Nose Down)	_____
--------------------------	-------

Fill with 450 to 457 Gal. Water	_____
---------------------------------	-------

Secure Filler Cap	_____
-------------------	-------

Pressurize to 112 psi for 3 Min.	_____
----------------------------------	-------



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Defuel Tank and Vacuum Test

ITEM

REMARKS

Attitude (20° Nose Down) \_\_\_\_\_

Empty Tank \_\_\_\_\_

Secure Filler Cap \_\_\_\_\_

Vacuum Test to 05 psi  
(10.2 inches Hg. ) For 3 min. \_\_\_\_\_

Refuel Tank at Proper Attitude then Pressurize

ITEM

REMARKS

Attitude (20° Nose Down) \_\_\_\_\_

Fill with 450 to 457 gal. water \_\_\_\_\_

Secure Filler Cap \_\_\_\_\_

Pressurize to 25 psi for  
15 minutes \_\_\_\_\_

Empty Tank and Examine

Remarks: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_



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POST SLOSH AND VIBRATION

Ref. Para. 4.8: EXAMINE TANK FOR THE FOLLOWING:

External Damage \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Internal Damage \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Pylon Damage \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Delaminations (Tap Test) \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_



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Ref. Para. 4.8: COLOR PHOTOGRAPHS

PHOTO NUMBER

LOCATION

1	
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Ref. Para. 4.8: COLOR PHOTOGRAPHS

PHOTO NUMBER

LOCATION

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