

Report No. AFRPL-TR-77-92

CSD 257S-FR

AD A051133

84-IN. PROPELLANT CARTRIDGES AND GRAINS

Volume III — Appendix

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30 November 1977

Final Report for Period November 1975 — November 1977
Approved for public release, distribution limited

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Prepared for

AIR FORCE ROCKET PROPULSION LABORATORY
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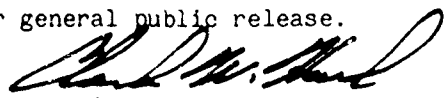
This report was submitted by United Technologies/Chemical Systems Division, P.O. Box 358, Sunnyvale, CA 94086, under Contract No. F04611-76-C-0010, Job Order No. 305909 JM with the Air Force Rocket Propulsion Laboratory, Edwards AFB, CA 93523.

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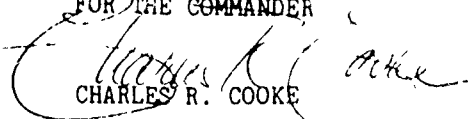
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Unclassified

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER AFRPL-TR-77-92-VOL-3 ✓	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) 84-INCH PROPELLANT CARTRIDGES AND GRAINS. Volume III. Appendix.	5. TYPE OF REPORT & PERIOD COVERED Final rpt. November 1975 - November 1977	6. PERFORMING ORG. REPORT NUMBER CSD-2579-FR-VOL-3
7. AUTHOR(s) Terry V. O'Hara, Wendell A. / Stephen Joe B. Henry	8. CONTRACT OR GRANT NUMBER F04611-76-C-0010 / mrv	9. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS JON 305909 / JM
9. PERFORMING ORGANIZATION NAME AND ADDRESS United Technologies Corporation Chemical Systems Division P. O. Box 358, Sunnyvale, CA 94088	10. REPORT DATE 30 November 1977	11. NUMBER OF PAGES 752 (12/290 p.)
11. CONTROLLING OFFICE NAME AND ADDRESS Air Force Rocket Propulsion Laboratory/MKBS Edwards Air Force Base, CA 93523	12. SECURITY CLASS. (of this report) Unclassified	13. SECURITY CLASS. (of this report) Unclassified
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office) AFPRO, Chemical Systems Division P. O. Box 358 Sunnyvale, CA 94088	15. SECURITY CLASS. (of this report) Unclassified	16. SECURITY CLASS. (of this report) Unclassified
16. DISTRIBUTION STATEMENT (of this Report) Approved for public release; distribution unlimited		
17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)		
18. SUPPLEMENTARY NOTES This report is presented in three volumes: Volume I - Technical Discussion Volume II - Propellant Test Data Volume III - Appendices		
19. KEY WORDS (Continue on reverse side if necessary and identify by block number) HTPB Propellant CHAR Loaded Cartridges High Solids Loaded Propellant Propellant Characterization UTP-18,803A 84-Inch Cartridge ELSH Loaded Cartridges		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) This document reports the results obtained from casting a total of 30 84-inch cartridges with UTP-18,803A propellant (90% solids, 21% aluminum, HTPB). Both ballistic and mechanical property data obtained during the production of over 730,000 lbs of propellant is presented. Documentation for propellant production is provided.		

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This volume presents the appendices to the final report for Contract FO4611-76-C-0010, "84-Inch Propellant Cartridges and Grains". These appendices provide the working documents used for the casting of the ELSH and CHAR grains and provide the Product Acceptance Records for each of the loaded 84-inch cartridges delivered to AFRPL.

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APPENDIX A

PRIME ITEM DEVELOPMENT SPECIFICATION -
EXTENDED LENGTH SUPER HIPPO

PRIME ITEM DEVELOPMENT SPECIFICATION FOR
EXTENDED LENGTH SUPER HIPPO
PROPELLANT GRAIN

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REVISED PAGES TO PRIME ITEM DEVELOPMENT SPECIFICATION

1.0 SCOPE

This specification establishes the technical requirements and quality assurance provisions for a propellant/liner system for the Extended Length Super Hippo motor. The Extended Length Super Hippo motor, loaded with the propellant/liner system, will be used as the vehicle for static testing the MX Lower Stage Movable Nozzle System. The Extended Length Super Hippo motor propellant grain utilizes four propellant loaded cartridges.

2.0 APPLICABLE DOCUMENTS

2.1 Government Documents. The following documents of the exact issue shown form a part of this specification to the extent specified herein. In the event of conflict between the documents referenced herein and the contents of this specification, the contents of this specification shall be considered a superseding requirement.

STANDARDS:

MIL-STD-143B	21 Mar 72	Standards and Specifications, Order of Precedence for the Selection of
MIL-STD-130D	29 Sep 67	Identification Marking of U.S. Military Property
MIL-STD-129F	30 Mar 73	Marking for Shipment and Storage

2.2 Non-Government Documents. The following documents of the exact issue shown form a part of this specification to the extent specified herein. In the event of conflict between the documents referenced herein and the contents of this specification, refer to the Procuring Agency for resolution.

DRAWINGS:

United Technology Center

C11479	No Revision	loaded Cartridge, Extended Length Hippo
C10278	Revision B	Spacer, Cartridge, Super Hippo
C10294	Revision A	Adapter, Hoisting, Cartridge, Super Hippo

3.0 REQUIREMENTS

3.1 Item Definition. The Extended Length Super Hippo Propellant Grain is an HTPB propellant loaded into fiberglass cartridges with silica asbestos loaded Buna-N insulation. Four propellant loaded cartridges equivalent to US drawing C11479 will be used for each motor firing.

3.2 Characteristics.

3.2.1 Performance. When loaded into the Extended Length Super Hippo Motor, the propellant grain shall provide the following performance:

3.2.1.1 Average Chamber Pressure. The average chamber pressure over motor action time shall be 1400 ± 70 psia at 70°F assuming an nozzle throat diameter of 14.675 inches and an average radial throat erosion rate of 6.35 mils/sec over action time.

3.2.1.2 Maximum Expected Operating Pressure. The maximum expected operating pressure (MEOP) during action time shall not exceed 1700 psia at 70°F .

3.2.2 Physical Characteristics. The propellant cartridge weight, envelope, dimensions and service life shall be as follows:

3.2.2.1 Propellant Weight. The total net propellant weight in four loaded cartridges, when loaded in the configurations of 3.2.2.2, shall be a minimum of 88,300 pounds.

3.2.2.2 Propellant Grain Configuration. The propellant grain configuration of the Extended Length Super Hippo motor shall consist of two (forward and third position) propellant loaded cartridges, P/N C11479-01-01 one (second position) propellant loaded cartridge, P/N C11479-02-01, and one (aft position) propellant loaded cartridge, P/N C11479-03-01.

3.2.2.3 Propellant Formulation. The nominal formulation of the propellant shall be as shown in Table 1.

Table 1
Nominal Propellant Formulation

<u>Ingredient</u>	<u>Nominal by Weight</u>
Ammonium Perchlorate	69.0
Aluminum	21.0
HTPB Binder	10.0

3.2.2.4 Service Life. The service life of the propellant grain shall be at least 24 months.

3.2.3 Environmental Conditions. The performance requirements of 3.2.1 shall be met after exposure of the propellant loaded cartridge to the following non-operating environments and during exposure to the following operating environments.

3.2.3.1 Pressure/Altitude. The pressure/altitude environment is ambient sea level or the maximum imposed by land transportation to test site.

3.2.3.2 Temperature. The temperature environments are as follows: a. The storage temperature range environment is +60°F to +80°F
b. The operating temperature range environment is +60°F to +80°F.

3.2.3.3 Humidity. The non-operating relative humidity environment is 50% maximum.

3.2.3.4 Transportation and Handling. Vibration, shock, and acceleration environments are those normally experienced during shipment by truck and/or railway. Transportation temperature range environment is -20°F to +135°F.

3.3 Design and Construction.

3.3.1 Materials and Processes. Materials and processes shall be selected in the order of precedence specified in MIL-STD-143 unless otherwise specified herein or in an individual product specification.

3.3.2 Product Marking. Product markings shall be in accordance with MIL-STD-130.

3.3.3 Workmanship. The propellant cartridge shall be fabricated and finished in a thorough workmanlike manner.

3.3.4 Structural.

3.3.4.1 Bondline Strength. The strength of the propellant to cartridge bondlines shall be greater than the cohesive strength of the propellant.

3.3.4.2 Factors of Safety. Minimum factors of safety shall be based on the worst combination of the +3 sigma material response and capability properties and on a rational consideration of the cumulative damage effects resulting from the simultaneous, sequential, or cyclic application of the environmental and operational loads. The propellant and propellant to cartridge bondline systems shall meet the following minimum factors of safety:

<u>Item</u>	<u>Minimum Factor of Safety</u>
Propellant	1.5
Bondlines	2.0

4.0 QUALITY ASSURANCE PROVISIONS

Quality assurance provisions for the propellant and cartridge shall be determined by the contractor.

5.0 PREPARATION FOR DELIVERY

5.1 General. Propellant loaded cartridges shall be packaged and marked for shipment as specified herein.

5.2 Packaging. The propellant loaded cartridge shall be packaged and transported in a manner to insure its integrity during transit and storage periods. The packaging shall provide adequate protection against humidity, contamination, temperature, shock, vibration, and other hazards encountered during handling, transport and storage.

5.3 Marking. Packaging shall be marked in accordance with the requirements of MIL-STD-129. As a minimum, the following information shall be included:

- a. Item name
- b. Part number
- c. Contract or purchase order number
- d. Supplier's name
- e. Date of manufacture
- f. Hazard warning

APPENDIX B
SPECIFICATION - PROPELLANT UTP-18,803A



UNITED
TECHNOLOGIES.. CHEMICAL SYSTEMS DIVISION

CODE IDENT NO.
14134

Specification No. SE0719A
22 September 1977

Supersedes:
SE0719
26 January 1976

SPECIFICATION

PROPELLANT, UTP-18803A

Prepared by	SPECIFICATIONS	Date
Reviewed by	SPECIFICATIONS	Date
Reviewed by	DESIGN ENGINEERING	Date
Reviewed by	DESIGN ENG. SECTION CHIEF	Date
Approved by	ENGINEERING MANAGEMENT	Date
Approved by	SYSTEMS DESIGN	Date
Approved by	MATERIALS & PROCESSES	Date

Approved by	PROGRAM MANAGEMENT	Date
Approved by	QUALITY ASSURANCE	Date
Approved by	CONFIGURATION MANAGEMENT	Date
Approved by	SAFETY	Date
Approved by		Date
Approved by		Date
Approved by		Date

Rev.	ECO No.	Prepared By	Approved by	Date
A	{ 19712, 19830, 19869, 20339, 20728 }	{ J. H. Smith 2-27-77 }		

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SPECIFICATION

PROPELLANT, UTP-18803A

1.0 SCOPE.

1.1 Scope. This specification covers the technical requirements and quality assurance provisions for UTP-18803A propellant used for the AFRPL Extended Length Super HIPPO (ELSH) and 84-in. Char motors.

2.0 APPLICABLE DOCUMENTS.

2.1 Government documents. The following documents of the issue in effect on date of invitation for bids form a part of this specification to the extent specified herein.

Specifications

AFTO 11A-1-47	Explosive Hazard Classification Procedures
AFM 127-100	Explosive Safety Manual

Publications

- ICRPG Manual	Solid Propellant Mechanical Behavior Manual, CPIA Publication No. 21 (U)
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(Copies of documents required in connection with specific procurement functions should be obtained from the procuring activity, or as directed by the contracting officer.)

2.2 Other publications. The latest issue of the following documents form a part of this specification to the extent specified herein.

CHEMICAL SYSTEMS DIVISION (CSD)

Specifications

40DS-40702	Aluminum Powder
SE0720	Propellant, UTP-18803A, Processing of

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CHEMICAL SYSTEMS DIVISION

SE0719A

SE0751	HTPB, BDR-45
SE0752	Isophorone Diisocyanate, IPDI
SE0753	Iso-decyl Pelargonate, IDP
SE0754	Bonding Agent, HX-752
SE0755	PRO-TECH® 2705
SE0756	Ammonium Perchlorate, Type II, Rotary Rounded

Drawings

C11479	Loaded Cartridge, Extended Length Super HIPPO
C09576	Loaded Cartridge, 84-in. Char Motor

Publications

Quality Control Laboratory Methods and Procedures

Sunnyvale Development Lab Standard Operation Procedure 3.1.6

(Application for copies should be addressed to United Technologies, Chemical Systems Division, Post Office Box 358, Sunnyvale California 94088. Attention: Purchasing Department.)

3.0 REQUIREMENTS

3.1 Preproduction.

3.1.1 Raw material lot qualification. Prior to use of a new lot of materials except HX-752 and Protech 2705 in a 300-gallon or larger batch of UTP-18803A, the new raw material lot shall be qualified in a five-gallon batch. The five-gallon and production batch shall have identical formulations including ammonium perchlorate grind ratio and NCO/OH equivalence ratio. Ammonium perchlorate used for the five-gallon batch shall be obtained in a manner that assures a homogeneous representative sample of the ammonium perchlorate lot.

3.1.2 Mixer demonstration. The adequacy of processing, and mechanical and ballistic properties of the selected UTP-18803A formulation shall be demonstrated in a preproduction scale mix of 300 gallons or larger.

3.2 Formulation.

3.2.1 Nominal formulation. The formulation of UTP-18803A shall conform to Table I.

3.2.2 Chemical and theoretical properties.

3.2.2.1 Chemical properties. The nominal chemical properties of UTP-18803A are presented in Table II.

3.2.2.2 Theoretical properties. The nominal theoretical properties of UTP-18803A are presented in Table III.

3.3 Ballistic properties.

3.3.1 Burning rate. The 70°F burning rate of UTP-18803A shall conform to figure 1.

3.3.2 Temperature sensitivity coefficients. The temperature sensitivity coefficient of chamber pressure, π_K , and of burning rate, σ_p , shall be 0.104%/F and 0.0499%/F, respectively, over the temperature range of 30 to 100°F.

3.4 Mechanical properties.

3.4.1 Mechanical properties required for structural integrity. After exposure to any or all of the environmental conditions of section 3.5, the propellant and propellant liner/insulation bond system shall conform to the minimum requirements of Table IV for a period of time up to and including 24 months. The propellant/liner/insulation bond is defined in CSD loaded cartridge drawings C11479 for Extended Length Super HIPPO and C09576 for 84-in. Char Motor.

TABLE I. FORMULATION OF UTP-18803A PROPELLANT

<u>Ingredient</u>	<u>Function</u>	<u>CSD Specification</u>	<u>Manufacturer Designation</u>	<u>Nominal Equiv.</u>	<u>Nominal Formulation Percent by Wt.</u>	<u>Weight Percent Tolerance Limits, %</u>
HTPR	Binder	SE0751	BDR-45M	1.0	6.67*	±0.2
Isophorone diisocyanate	Curative	SE0752	IPDI	0.85	0.48*	±0.007
Iso-decyl pelargonate	Plasticizer	SE0753	Emolein 2911 (IDP)		2.60	±0.2
PRO-TEC®	Antioxidant	SE0755	2705		0.10	±0.05
HX-752	Bonding agent	SE0754	HX-752		0.15	±0.07
Aluminum	Fuel	40DS-40702	MD101		21.0	±0.4
Ammonium perchlorate	Oxidizer, un-ground, 200µ	SE0756		** (Nominal grind ratio 65/35)	69.0	±1.0
Ammonium perchlorate	Oxidizer, ground, 9.5µ	SE0756				

* For information only; BDR-45M and IPDI are formulated by equivalents.

** Grind ratio is defined unground AP to ground AP ratio. The grind ratio may be adjusted to achieve the proper burning rate.

TABLE II. PROPERTIES OF UTP-18803A
PROPELLANT INGREDIENTS

<u>Ingredient</u>	<u>Molecular Formula</u>	<u>Density, g/cc</u>	<u>Hf, kcal/mole</u>
BDR-45M HTPB	$C_4H_6.052O_{0.052}$	0.93	- 0.25
Isophorone diisocyanate	$C_{12}H_{18}N_2O_2$	0.9	- 58.0
HX-752	$C_{14}H_{16}N_2O_2$	1.12	- 61.0
PRO-TECH ^R 2705	$C_{23}H_{32}O_2$	1.1	-155.0
Iso-decyl palargonate	$C_{19}H_{38}O_2$	0.88	-209.5
Aluminum	Al	2.7	0
Ammonium perchlorate	NH_4ClO_4	1.95	- 70.70

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16 FEB 1976

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INGREDIENTS		WT. PCT.	ELEMENTS	GM ATOMS
195	ALUMINUM	21.000	CL	0.58723404
17	AMMONIUM PERCHLORATE	69.000	H	3.47217298
245	R-45	6.670	N	0.59278076
598	ISOPHORONE DIISOCYANATE	0.480	O	2.37879823
22	ISODECYL PELARGONATE	2.600	C	0.69199238
567	HX 752	0.150	AL	0.77835434
552	PROTECH (TM) 2705 STABILIZER	0.100		
PROPELLANT DENSITY, G/CC		1.85023623		
EFFECTIVE GAMMA = 1.11				
		THROAT	EXHAUST (1)	
AREA RATIO		1.00000	10.40807	
OPTIMUM ISP, SEC		104.24704	263.85091	
VACUUM ISP, SEC		197.19697	288.35228	
C*, FT/SEC		5153.78136		
VELOCITY, FT/SEC		3354.04438	8489.13930	
		CHAMBER	THROAT	EXHAUST (1)
PRESSURE, PSIA		1000.00000	580.26733	14.69600
PRESSURE, ATM		68.04573	39.48471	1.00000
TEMPERATURE, DEG K		3706.15203	3524.17285	2455.44015
FROZEN CP, CAL/DEG/G		0.47255198	0.47268149	0.46322344
ENTHALPY, KCAL/G		-0.43580721	-0.56064218	-1.23550513
ENTROPY, CAL/DEG/G		2.18460808	2.18460805	2.18460808
DENSITY, GM/CC		0.00697351	0.00429332	0.00016298
MOL GAS/100 G TOTAL		3.20857658	3.18027534	3.04529029
COMBUSTION PRODUCTS				
		CHAMBER MOLS/100 G	THROAT MOLS/100 G	EXHAUST (1) MOLS/100 G
AL	G	1.39083122E-03	8.36255460E-04	1.70899494E-06
ALC	G	2.82275189E-10	1.00000000E-10	1.00000000E-10
ALCL	G	3.03660864E-02	2.33804648E-02	6.32668292E-04
ALCL2	G	9.23993460E-03	7.09739897E-03	2.82385926E-04
ALCL3	G	6.32876108E-04	5.21858319E-04	6.13449351E-05
ALH	G	2.03460055E-04	1.05831082E-04	1.02190668E-07
ALH02	G	4.55963650E-03	3.23913083E-03	5.83207090E-05
ALN	G	2.20228068E-07	8.49921487E-08	1.00000000E-10
ALO	G	2.45961947E-03	1.43855019E-03	2.63191244E-06
ALOCCL	G	1.01925726E-02	8.09221849E-03	3.18787663E-04
ALOH	G	2.99262816E-03	2.10031701E-03	3.13143283E-05
AL02	G	3.67762136E-04	2.11602142E-04	3.42403779E-07
AL20	G	5.92923296E-04	2.98222086E-04	7.65086679E-08
L202	G	4.91313044E-06	2.52775518E-06	8.49844176E-10
	G	4.98543406E-08	1.89537637E-08	1.00000000E-10
CCL	G	5.99341930E-09	2.22210841E-09	1.00000000E-10

TABLE III. THEORETICAL PROPERTIES OF UTP-18803A

UNITED TECHNOLOGIES
CHEMICAL SYSTEMS DIVISION

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		CHAMBER	THROAT	EXHAUST (1)
		MOLS/100 G	MOLS/100 G	MOLS/100 G
CCL2	G	5.43667476E-10	1.91839006E-10	1.00000000E-10
CH	G	4.22121744E-08	1.51775775E-08	1.00000000E-10
CHCL	G	6.74529384E-09	2.49339976E-09	1.00000000E-10
CHNO	G	2.31917956E-06	1.31779032E-06	2.73921487E-08
CH2	G	9.64506123E-08	3.83853165E-08	1.00000000E-10
CH2O	G	6.82836028E-06	4.04798413E-06	1.20586403E-07
CH3	G	2.00015665E-07	9.15490925E-08	4.30790747E-10
CH3CL	G	1.81879517E-09	8.07914194E-10	1.00000000E-10
CH4	G	4.59960840E-08	2.33559734E-08	4.98320058E-10
CN	G	1.05245878E-06	4.93416217E-07	1.01711624E-09
CN2	G	3.33886970E-10	9.13109875E-11	1.00000000E-10
CO	G	6.49703660E-01	6.49387972E-01	6.40260255E-01
COCL	G	5.13829699E-05	3.16722396E-05	6.50300063E-07
COCL2	G	9.42187861E-09	4.95877248E-09	1.00000000E-10
CO2	G	4.20907586E-02	4.24861819E-02	5.17300935E-02
C2H	G	9.53745651E-10	3.00328869E-10	1.00000000E-10
C2H2	G	2.54640389E-09	9.47654843E-10	1.00000000E-10
C2O	G	9.96118719E-09	3.68120263E-09	1.00000000E-10
CL	G	6.33823514E-02	5.86256351E-02	1.46766572E-02
CLCN	G	1.58334524E-07	8.01471246E-08	4.99704756E-10
ClO	G	7.78808678E-05	4.85753130E-05	3.88012295E-07
ClO2	G	2.08915436E-09	8.22689184E-10	1.00000000E-10
CL2	G	1.30926984E-04	1.01247859E-04	7.68842541E-06
CL2O	G	1.59522564E-09	6.77894873E-10	1.00000000E-10
H	G	1.88182952E-01	1.67929072E-01	3.51360439E-02
HALO	G	6.44915738E-06	3.10566690E-06	1.66486568E-09
HCN	G	2.40442891E-05	1.42370303E-05	4.01333692E-07
HCO	G	1.11492764E-04	6.61664181E-05	1.11491930E-06
HCL	G	4.62429606E-01	4.81029740E-01	5.70839236E-01
HNO	G	1.02501484E-05	5.64399300E-06	2.95816550E-08
HNO2 C	G	1.13986948E-07	5.30820171E-08	1.00000000E-10
HNO2 T	G	1.25464123E-07	5.86347575E-08	5.41180209E-11
HOCL	G	9.29205755E-05	6.24666700E-05	1.64050361E-06
HO2	G	7.67637454E-06	4.07857044E-06	9.48421322E-09
H2	G	9.00202521E-01	9.10104516E-01	9.65774084E-01
H2O	G	4.80311371E-01	4.77805335E-01	4.65626098E-01
H2O2	G	3.89498027E-06	1.98202421E-06	7.06024571E-09
N	G	6.50291295E-05	3.78030269E-05	1.79994682E-07
NCO	G	3.35845460E-07	1.58659750E-07	3.64021880E-10
NH	G	2.78120325E-05	1.48450569E-05	5.59954415E-08
NH2	G	7.27536209E-05	4.30957981E-05	6.87977688E-07
NH3	G	4.69354382E-05	3.02878274E-05	1.88915913E-06
NO	G	4.78865897E-03	3.46887573E-03	1.20236105E-04
NOCL	G	7.79517991E-07	3.99256604E-07	9.95899467E-10
NO2	G	5.83417563E-07	2.98915297E-07	5.08356708E-10
N2	G	2.93869090E-01	2.94581140E-01	2.96328670E-01
N2H2	G	6.31817164E-09	2.60115165E-09	1.00000000E-10
NO	G	7.13202137E-07	3.91475027E-07	2.11764868E-09
N3	G	1.73412283E-09	6.37500953E-10	1.00000000E-10
O	G	6.34875023E-03	4.52966806E-03	8.09023383E-05

TABLE III. (Continued)

UNITED TECHNOLOGIES
CHEMICAL SYSTEMS DIVISION

SE0719A

NO.2401		NO.2401 03				
16 FEB 1976		PAGE 3				
		CHAMBER	THROAT	EXHAUST (1)		
		MOLS/100 G	MOLS/100 G	MOLS/100 G		
OH	G	5.21849727E-02	4.15877112E-02	3.29717141E-03		
O2	G	1.33546928E-03	9.42304197E-04	1.62477805E-05		
O3	G	6.56273064E-10	2.21381318E-10	1.00000000E-10		
ALN	S	0.	0.	0.		
AL2O3	L	3.57373293E-01	3.65363010E-01	3.88482289E-01		
AL2O3	S	0.	0.	0.		
C	S	0.	0.	0.		
MINIMUM CONCENTRATION REPORTED = 1 #=10						
SPECIES OF LESSER IMPORTANCE INCLUDED:						
AL2CL6	G, CCL3	G, CCL4	G, CHCL3	G, CH2CL2	G, C2	G
C2CL2	G, C2CL4	G, C2CL6	G, C2HCL	G, C2H4	G, C2H4O	G
C2H6	G, C2N	G, C2N2	G, C3	G, C3H8	G, C3O2	G
C4	G, C4N2	G, C5	G, HNO3	G, NO2CL	G, NO3	G
N2O	G, N2H4	G, N2O3	G, N2O4	G, N2O5	G,	

TABLE III. (Continued)

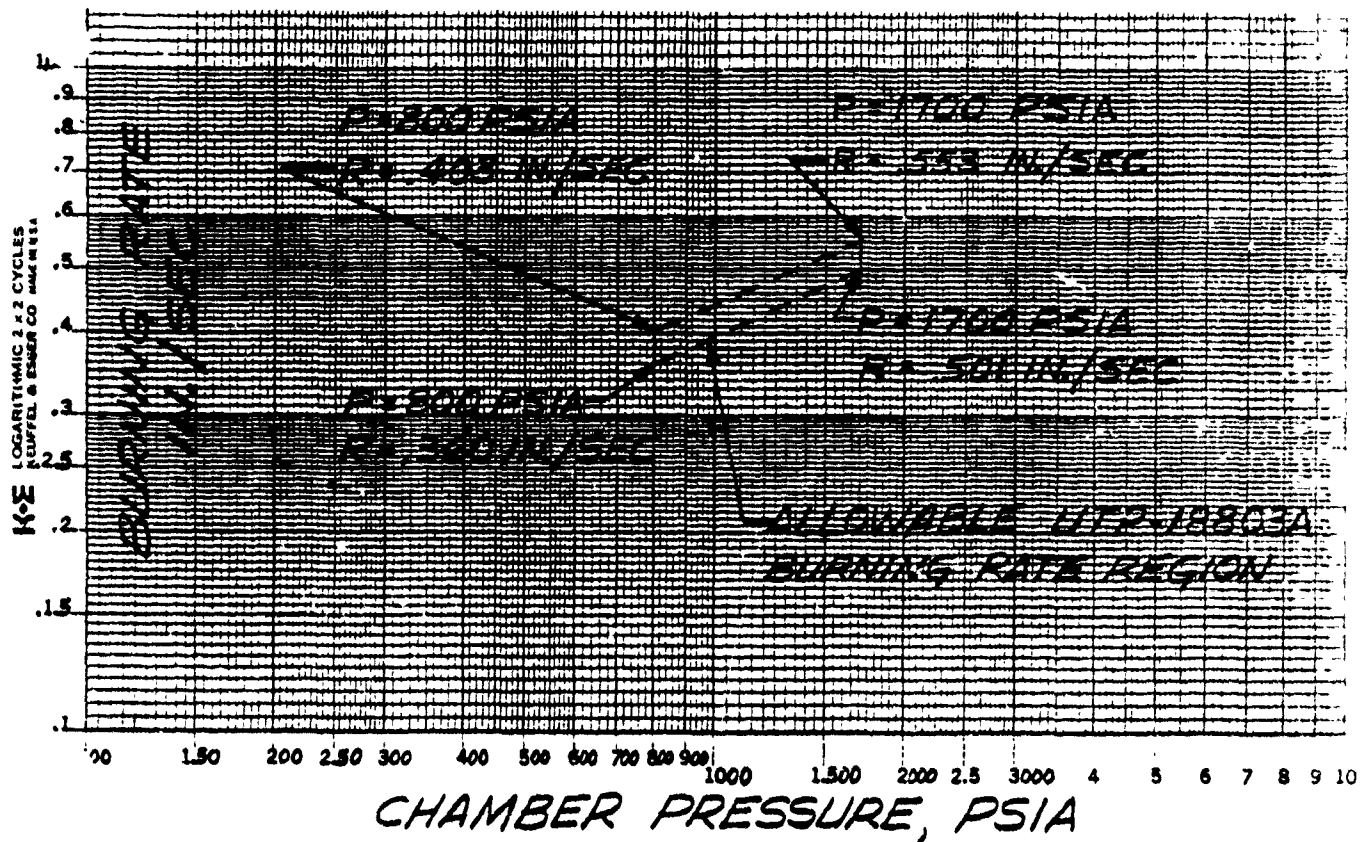


Figure 1. UTP-18803A 85°F Burning Rate

TABLE IV. UTP-18803A MECHANICAL PROPERTIES STRUCTURAL CRITERIA

70°F Property	Minimum
True elongation at max load, ϵ_m^c	20%
Tensile strength at max load, σ_m^c	50 psi
Bond-in-tension stress*	80 psi

* When tested, the bond-in-tension sample shall fail in the propellant. When the end use of the propellant is specifically for cartridges, failure may occur in either propellant or liner. The mode of failure and the tensile strength shall be reported to the Engineering Dept. project engineer.

3.4.2 Nominal JANNAF properties. The nominal 70°F UTP-18803A JANNAF Class B properties are presented in Table V.

TABLE V. NOMINAL UTP-18803A 70°F JANNAF PROPERTIES

<u>Property</u>	<u>Nominal</u>	<u>Expected Batch to Batch Range</u>
True elongation at max load, ϵ_m^c		
Tensile strength at max load, psi, σ_m^c		
Bond-in-tension stress, psi		
Propellant density, lb/in^3		

(Data will be supplied upon completion of 84-in. cartridge program.)

3.5 Environmental conditions.

3.5.1 Temperature and humidity. UTP-18803A propellant and propellant/liner system shall demonstrate the motor performance requirements over the operating temperature range of +60°F to +80°F after exposure to a maximum relative humidity of 50% and transportation and handling environments normally experienced during truck or railway shipment for a transportation temperature range of -20°F to +135°F.

3.6 Workmanship. The UTP-18803A propellant shall be free from foreign contamination, impurities, and other defects which could adversely affect its intended use.

3.7 Safety. UTP-18803A propellant shall have an explosive hazard classification of Class 2 in accordance with hazards tests and classification per AFTO 11A-1-47.

4.0 QUALITY ASSURANCE.

4.1 Classification of tests. The inspection and testing of UTP-18803A propellant shall be classified as preproduction and production tests.

4.1.1 Preproduction tests.

4.1.1.1 Propellant tests. The tests of UTP-18803A propellant shall consist of the tests specified in Table VI.

4.1.1.2 Material and mixer tests. The raw material lot qualification and mixer demonstration tests for UTP-18803A shall consist of the tests specified in Table VII.

TABLE VI. PREPRODUCTION TESTS

<u>Test</u>	<u>Requirement Paragraph</u>	<u>Test Paragraph/ Document</u>
Formulation	3.2.1	4.2.1.2
Chemical properties	3.2.2.1	4.2.2.6
Theoretical properties	3.2.2.2	4.2.2.6
Burning rate	3.3.1	4.2.2.5
Temperature sensitivity	3.3.2	4.2.2.5
JANNAF physical properties	3.4.2	4.2.2.1
Density	3.4.2	4.2.2.3
Workmanship	3.6	4.2.1.3
Safety	3.7	AFTO 11A-1-47

TABLE VII. RAW MATERIAL LOT QUALIFICATION AND MIXER DEMONSTRATION TESTS

<u>Test</u>	<u>Requirement Paragraph</u>	<u>Test Paragraph/ Table</u>
Raw material lot qualification	3.1.1	4.2.1.1, 4.2.1.2, 4.2.2.1, 4.2.2.5, and Table IV
Mixer demonstration	3.1.2	

4.1.2 Production tests. Production tests shall consist of (a) examinations and (b) sampling plan and tests.

4.1.2.1 Examinations. Examinations shall be as specified in Table VIII.

TABLE VIII

<u>Examination</u>	<u>Requirement</u>	<u>Examination Method</u>
Examination of applicable material certification	Table I	4.2.1.1
Examination of UTP-18803A propellant formulation	Table I	4.2.1.2
Examination of workmanship	3.6	4.2.1.3

4.1.2.2 Sampling plan and tests.

4.1.2.2.1 Samples. Samples shall be selected from each batch in quantities of sufficient size to enable performance of the tests specified in Table IX.

TABLE IX. SAMPLING TESTS

<u>Test</u>	<u>Requirement Paragraph</u>	<u>Test Paragraph</u>
Burning rate	3.3.1	4.2.2.5
True elongation at max load, ϵ_m^c	Tables IV and V	4.2.2.1
Tensile strength at max load, σ_m^c	Tables IV and V	4.2.2.1
Density	Table V	4.2.2.3

4.1.2.2.2 Bond-in-tension samples. A minimum of one propellant/liner/insulation and a minimum of one propellant/liner/cartridge bond-in-tension specimens shall be prepared for each ELSH and 84-in. cartridge. Bond-in-tension sample shall be tested in accordance with paragraph 4.2.2.2 and shall conform to the requirements of Table IV.

4.1.2.2.3 Biaxial endurance tests. The physical properties samples shall be selected and tested as specified in Table X. The purpose of these tests is to demonstrate structural integrity reproducibility. Biaxial endurance shall be tested in accordance with paragraph 4.2.2.4.

TABLE X. PHYSICAL PROPERTY REPRODUCIBILITY TESTS

<u>Test</u>	<u>Number of Tests</u>
Biaxial endurance	Four specimens per each of 29 batches

4.1.2.2.4 Sampling. Homogeneous samples shall be obtained from each batch of propellant in accordance with Procedure QC-K-402 of the CSD Quality Control Laboratory Methods and Procedures.

4.1.2.2.5 Batch. For the purpose of this specification, a batch shall consist of the propellant produced at one time by one set of equipment using the same process.

4.2 Tests and examinations.

4.2.1 Examinations.

4.2.1.1 Examination of material certification. The material certification shall be examined to determine conformance of the materials in Table I.

4.2.1.2 Examination of UTP-18803A formulation. The UTP-18803A propellant process weight records shall be examined to determine conformance to the formulation requirements of section 3.2.1.

4.2.1.3 Examination of workmanship. UTP-18803A shall be examined to determine conformance to section 3.6.

4.2.2 Tests and test methods.

4.2.2.1 Mechanical properties. The mechanical properties of UTP-18803A shall be determined in accordance with Procedure QC-N-603 of the CSD Quality Control Laboratory Methods and Procedures.

4.2.2.2 Insulation/liner/propellant and cartridge/liner/propellant test. Bond-tension tests shall be conducted in accordance with Procedure QC-N-616 of the CSD Quality Control Laboratory Methods and Procedures.

4.2.2.3 Cured propellant density. The cured propellant density test of UTP-18803A shall be conducted in accordance with Procedure QC-N-602 of the CSD Quality Control Laboratory Methods and Procedures.

4.2.2.4 Biaxial endurance. Biaxial endurance samples shall be tested in accordance with section 4.5.2-1 of ICRPG Solid Propellant Mechanical Behavior Manual.

4.2.2.5 Ballistic motor tests. Ballistic 4-lb motor tests shall be conducted in accordance with CSD Sunnyvale Development Lab Standard Operation Procedure No. 3.1.6. The ELSH and Char cartridge burning rate is identical to four-pound motor burning rate.

4.2.2.6 Chemical and theoretical properties. The chemical and theoretical properties of UTP-18803A propellant shall be verified by using JANNAF properties and by CSD shifting chemical equilibrium thermochemical computer program.

4.3 Acceptance.

4.3.1 Raw material lot qualification and mixer demonstration.

4.3.1.1 Raw material lot qualification. Raw material lots shall be considered qualified by production of one acceptable five-gallon batch as demonstrated by conformance to the true elongation and tensile strength requirements of Table IV.

4.3.1.2 Mixer demonstration. A mixer shall be considered qualified by the production of one acceptable batch (300 gallons or larger) of propellant as demonstrated by conformance to 3.2.1, 3.6, and Table IV.

4.3.2 Preproduction batch acceptance. Propellant acceptance shall be demonstrated by conformance to the requirements of 3.2.1, 3.6, and Table IV. The required number of bond-in-tension samples are specified in 4.1.2.2.2 for demonstrating conformance to Table IV.

4.3.3 Production batch acceptance. Propellant acceptance shall be demonstrated by conformance to the requirements of 3.2.1, 3.3.1, 3.6, and Table IV. The required number of bond-in-tension samples are specified in 4.1.2.2.2 for demonstrating conformance to Table IV.

5.0 PREPARATION FOR DELIVERY

None

6.0 NOTES

The recommended ignition and storage criteria of UTP-18803A are TBS.

APPENDIX C

SPECIFICATION - PROPELLANT, UTP-18803A, PROCESSING OF



UNITED
TECHNOLOGIES... CHEMICAL SYSTEMS DIVISION

CODE IDENT NO.
14134

Specification No. SE 0720A
29 June 1977

Supersedes:
SE0720
2 February 1976

SPECIFICATION

PROPELLANT, UTP-18803A, PROCESSING OF

Prepared by <i>J. H. Lee</i>	SPECIFICATIONS	Date
Reviewed by <i>J. H. Lee</i>	SPECIFICATIONS	Date 2-4-76
Reviewed by <i>J. H. Lee</i>	DESIGN ENGINEERING	Date 1-26-76
Approved by <i>J. H. Lee</i>	DESIGN ENG. SECTION CHIEF	Date 2/9/76
Approved by <i>P. A. J. Smith</i>	ENGINEERING MANAGEMENT	Date 2-11-76
Approved by	SYSTEMS DESIGN	Date
Approved by <i>J. H. Lee</i>	MATERIALS & PROCESSES	Date 2-10-76

Approved by <i>J. H. Lee</i>	PROGRAM MANAGEMENT	Date 2/9/76
Approved by <i>P. A. J. Smith</i>	QUALITY ASSURANCE	Date 2/11/76
Approved by	CONFIGURATION MANAGEMENT	Date
Approved by <i>J. H. Lee</i>	SAFETY	Date 2-10-76
Approved by <i>J. H. Lee</i>	STRESS	Date ?
Approved by		Date
Approved by		Date

Rev.	ECO No.	Prepared By	Approved by	Date
	19713, 19836,		<i>J. H. Lee</i>	6-30-77
A	19847, 19856,	<i>J. H. Lee</i> 6-30-77		
	& 20561			

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SPECIFICATION

PROPELLANT, UTP-18803A, PROCESSING OF

1.0 SCOPE.

1.1 Scope. This specification covers the preparation, casting and curing of UTP-18803A propellant for use in the AFRPL extended length Super HIPPO (ELSH) and 84-in. Char motor motors.

2.0 APPLICABLE DOCUMENTS.

2.1 Government documents. None

2.2 Other publications. Unless otherwise specified, the latest issue of the following documents form a part of this specification to the extent specified herein.

UNITED TECHNOLOGIES, CHEMICAL SYSTEMS DIVISION (CSD)

Specifications

SE0719

Propellant, UTP-18803A

Publications

Quality Assurance Manual

Quality Control Laboratory Methods and Procedures

Integrated Quality and Operations Procedures (IQOP)

1.43.1	ELSH (Configuration -01)
1.43.2	ELSH (Configuration -02)
1.43.3	ELSH (Configuration -03)
1.43.10	Oxidizer
1.43.11	Fuel Premix
1.43.12	Propellant Mixing
1.43.15	CHAR Motor (Configuration -11)
1.43.16	CHAR Motor (Configuration -10)
1.43.17	CHAR Motor (Configuration -09)

(Application for copies should be addressed to United Technologies,
CHEMICAL SYSTEMS DIVISION, Post Office Box 358, Sunnyvale, California 94088.
Attention: Purchasing Department.)

3.0 REQUIREMENTS.

3.1 General requirements.

3.1.1 Chemical processing equipment. Equipment used for mixing, transferring, and handling of chemical materials required for constructing the loaded components shall be checked for cleanliness and shall be cleaned, if necessary, before using.

3.1.2 Weighing equipment. The calibration and certification of weighing equipment used in conjunction with this specification shall be in accordance with the UTC Quality Assurance Manual.

3.1.3 Component handling and processing equipment. Processing equipment capable of supporting the total weight of the component shall be used in conjunction with suitable slings, lifting beams, and hoisting equipment, etc., while constructing and handling the component.

3.1.4 Handling of cleaned parts and components. Surfaces of parts and components, which have been cleaned and made ready for the application of UTP-18803A propellant, shall be protected from contaminants and moisture and shall not be touched or handled with bare hands.

3.1.5 Acceptance of raw materials for UTP-18803A propellant. The lots of raw materials to be used in the composition of UTP-18803A propellant for the loaded case assembly shall have been accepted in accordance with CSD Quality Control Laboratory Methods and Procedures and CSD Specification SE0719.

3.2 Propellant preparation.

3.2.1 General processing operation. Propellant processing operations include oxidizer preparation, fuel premix, propellant mixing, casting, and curing. The flow chart for these operations is shown in figure 1.

3.2.1.1 Formulation. The formulation for propellant UTP-18803A shall be in accordance with CSD Specification SE0719.

3.2.1.2 Raw material and premix weighout sheets. Raw material and premix weighout sheets shall be prepared for each propellant batch, utilizing the values expressed in CSD Specification SE0719.

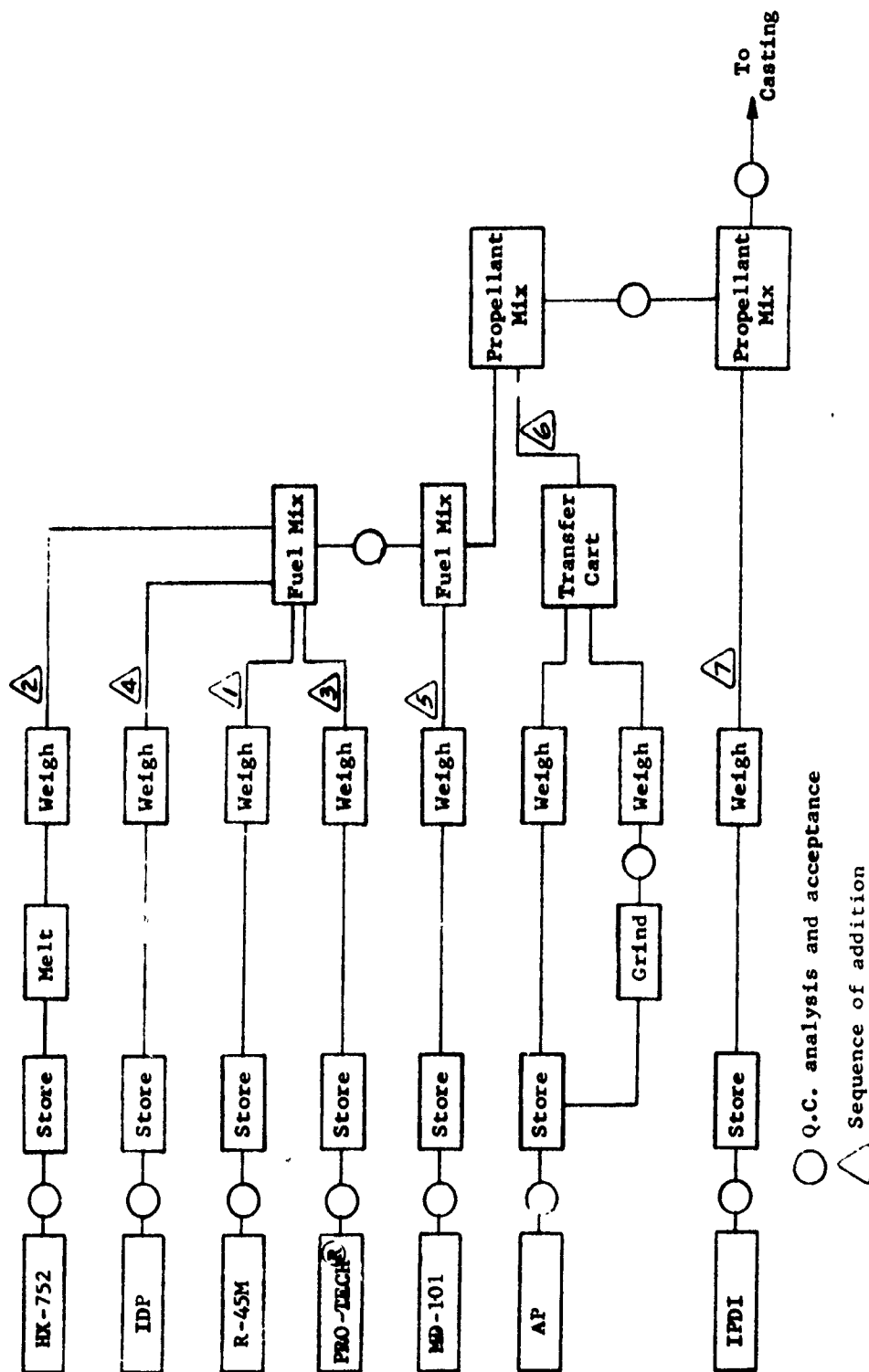


Figure 1. Process Flow Diagram for UTP-18803A Propellant

3.2.1.3 Ingredient weighing. All propellant ingredients shall be weighed on calibrated and certified weighing equipment to an accuracy of ± 0.25 percent.

3.3 Propellant processing.

3.3.1 Fuel premix A. The premix A shall consist of HX-752, IDP, BDR-45, and PRO-TECH 2705. The HX-752 concentration in the premix A should be 0.84 to 2.3% before the premix A is committed to the premix B. The premix A shall be agitated. This may be accomplished by mixing or circulation. Premix A shall be prepared in accordance with IQOP 1.43.11.

3.3.2 Fuel premix B. The fuel premix B shall consist of premix A and aluminum. Premix B shall be prepared in accordance with IQOP 1.43.11.

3.3.3 Ammonium perchlorate. The as-received lot shall conform to the requirements of specification SE0756 and shall be protected from moisture and contamination during storage and processing. The ground ammonium perchlorate shall be analyzed for water content and particle size. Preparation of ground ammonium perchlorate shall be in accordance with IQOP 1.43.10. The maximum water content shall be .12%. The ground ammonium perchlorate particle size shall be 5.9 to 11.7 μ . The ground ammonium perchlorate must be prepared within 5 days before processing in the UTP-18803A propellant.

3.3.4 Propellant mixing.

3.3.4.1 Propellant premix C. The fuel premix B and ammonium perchlorate shall be mixed to form the propellant premix C. Mixing shall be accomplished in accordance with IQOP 1.43.12. The propellant premix C mixing shall be in accordance with the limits specified in table I. After mixing, the propellant premix C shall conform to the requirements of table II.

Table II. Propellant Premix C Requirements

<u>Parameter</u>	<u>Limits</u>	
	<u>Minimum</u>	<u>Maximum</u>
Percent ammonium perchlorate	68.34	70.34
Percent aluminum	20.7	21.5
Liquid strand burning rate at 1,400 psig, in./sec	0.605	0.646

UNITED TECHNOLOGIES
CHEMICAL SYSTEMS DIVISION

SE0720 A

Table I. Propellant Premix C Mixing Conditions

<u>Operation</u>	<u>Mixer Jacket Temperature, °F</u>	<u>Propellant, Premix Temperature at End of Operation</u>	<u>Mix Time, Minutes</u>	<u>Pressure</u>
Add AP to mix bowl	135 $\pm$ 10°F	N/A		Atmospheric
Mix	135 $\pm$ 10°F	N/A	15 $\pm$ 10 0	Atmospheric
Vacuum mix	140 $\pm$ 20°F	N/A	13 minimum	Atmospheric to 10 mm Hg
Vacuum mix	140 $\pm$ 20°F	*140 $\pm$ 10°F	30 $\pm$ 10	10 mm Hg max.

* Determined by calibrated thermometer measurement of propellant premix.

3.3.4.2 In-process propellant. The in-process propellant shall consist of the mixed propellant premix C and IPDI. The in-process propellant shall be mixed in accordance with IQOP 1.43.12. The final 30 minutes of mixing shall be performed at a vacuum of 10 mm Hg or less. The in-process propellant shall conform to the requirements of Table III. The final propellant mix temperature shall be $140^{\circ}\text{F} \pm 10^{\circ}\text{F}$ as determined by a temperature probe of the propellant.

Table III. In-Process Propellant Requirements

Parameter	Limits	
	Minimum	Maximum
Liquid strand burning rate at 1,400 psig, in./sec	0.570	0.617
Percent IPDI at 60 ± 10 min after addition	0.34	0.48
Viscosity, kilopoise @ 5000 dynes/cm ²	-	40

3.3.5 Propellant casting.

3.3.5.1 ELSH cartridges. ELSH cartridges shall be cast under vacuum conditions. During the casting of UTP-18803A, the absolute pressure in the bell shall be maintained at 150 mm of mercury or less. Propellant casting shall be in accordance with IQOP 1.43.1, 1.43.2, and 1.43.3. The final portion of each batch may be cast under atmospheric conditions.

3.3.5.2 84-in. Char motor cartridges. 84-in. Char motor cartridges may be cast under atmospheric conditions. Propellant casting shall be in accordance with IQOPs 1.43.15, 1.43.16, and 1.43.17.

3.3.6 Propellant curing. The ELSH and 84-in. Char motor cartridges, propellant samples, and bond-in-tension samples cast with UTP-18803A shall be cured at an accumulative time of 10 days ± 12 hours at $140 \pm 10^{\circ}\text{F}$. At completion of the cure cycle, the cartridges shall be cooled for a minimum of 8 hours at ambient temperature before mandrel removal. Propellant curing shall be in accordance with IQOPs 1.43.1, 1.43.2, 1.43.3, 1.43.15, 1.43.16, and 1.43.17. Four-pound motors shall be cured for a minimum of six days at $140^{\circ} \pm 10^{\circ}\text{F}$.

3.3.7 Mandrel removal. The mandrel shall be removed from the cartridges in accordance with IQOPs 1.43.1, 1.43.2, 1.43.3, 1.43.15, 1.43.16, and 1.43.17. The maximum mandrel removal force shall be 20,000 lb_f for ELSH and 84-in. Char motor configurations C12185-02-01 and -03-01. The maximum mandrel removal force shall be 12,000 lb_f for 84-in. Char motor configuration C12185-01-01.

4.0 QUALITY ASSURANCE PROVISIONS.

4.1 Processing verification. Processing verification shall consist of the tests and examinations listed in table IV. These tests and examinations shall be performed for every propellant batch of UTP-18803A.

Table IV. Processing Verification

<u>Test or Examination</u>	<u>Requirement Paragraph</u>	<u>Test or Examination Paragraph</u>
Propellant preparation	3.2	4.2.1
Fuel premix A	3.3.1	4.2.2
Fuel premix B	3.3.2	4.2.2
Ammonium perchlorate	3.3.3	4.2.2
Propellant premix C	3.3.4.1	4.2.2
In-process propellant	3.3.4.2	4.2.2
Propellant casting	3.3.5	4.2.1
Propellant curing	3.3.6	4.2.1
Mandrel removal	3.3.7	4.2.1

4.2 Tests and examinations.

4.2.1 Examinations. Records shall be maintained which identify the ingredient lot numbers, propellant batch number, and weight of the material used. The records shall contain all of the tests and certifications as called out in the Quality Control Laboratory Methods and Procedures and IQOP procedures. These records shall include time, temperature, and vacuum conditions during casting; time and temperature during curing; and mandrel removal forces.

4.2.2 Tests. In-process control tests and analysis shall be conducted in accordance with procedure QC-N-518 of CSD Quality Control Laboratory Methods and Procedures, to assure compliance with the requirements of this specification.

4.3 Acceptance. Propellant acceptance shall be demonstrated by conformance to the requirements of 3.3.

5.0 PREPARATION FOR DELIVERY.

Safety considerations in machining and handling of UTP-18803A shall be in accordance with Air Force Manual AFM 127-100 and SE0720, UTP-18803A propellant processing specification.

6.0 NOTES. None.

APPENDIX D

OPERATIONS AND QUALITY RECORD/INTEGRATED QUALITY
AND OPERATIONS PROCEDURE - P/N C11479-01-01

OPERATIONS AND QUALITY RECORD

☒ O&QR

☐ CHANGE ORDER

☐ IDR PLAN

REL. NO.

PAGE 1

of 4

PART NO. C11479-01-01	TITLE LOADED CARTRIDGE - ELSH			QTY. 1	SERIAL NO.	PLAN REV. N/C
PLANNER	DATE	ENGINEER E. Sechura 4/1/76	DATE 4/1/76	QUALITY ASSURANCE DATE 4/1/76	NEXT ASSY-END ITEM N/A	
CONFIGURATION AUTHORITY N/A			CHANGE ORDER RECORD		WOR NO.	

OPER. NO.	OPERATIONS				COMPL. STAMP																																																				
	QR/IDR Record																																																								
<u>GENERAL INSTRUCTIONS</u> A. This O&QR provides the authority and attached documentation for processing a Loaded Cartridge P/N C11479-01-01 for Contract F04611-76-C-0010. B. APPLICABLE DOCUMENTS <u>Required</u> <table border="0"> <thead> <tr> <th><u>Drawings</u></th> <th><u>Rev.</u></th> <th><u>ECO</u></th> <th><u>Title</u></th> </tr> </thead> <tbody> <tr> <td>C11479</td> <td>A</td> <td>20159</td> <td>Loaded Cartridge</td> </tr> </tbody> </table> <u>Plans and Procedures</u> <table border="0"> <thead> <tr> <th><u>IQOP</u></th> <th><u>Rev.</u></th> <th><u>PCN</u></th> <th><u>Title</u></th> </tr> </thead> <tbody> <tr> <td>1.43.1 (PP0657)</td> <td>B</td> <td>None</td> <td>Loaded Cartridge - ELSH</td> </tr> <tr> <td><u>P.O.P.</u></td> <td><u>Rev.</u></td> <td><u>PCN</u></td> <td><u>Title</u></td> </tr> <tr> <td>2.7.1</td> <td>C</td> <td>None</td> <td>Styrofoam Cure Container</td> </tr> <tr> <td>2.7.1.1</td> <td>Basic</td> <td>Basic-1</td> <td>Start-Up</td> </tr> <tr> <td>2.9.1.5</td> <td>C</td> <td>None</td> <td>Contaminated Tool Cleaning and Solvent Reclamation Station 0650</td> </tr> <tr> <td>6.2.1</td> <td>A</td> <td>None</td> <td>Weighing Techniques</td> </tr> <tr> <td>6.9.2</td> <td>A</td> <td>None</td> <td>Abrasive Cleaning of Hardware</td> </tr> <tr> <td>6.14.1</td> <td>N/C</td> <td>None</td> <td>H-42 Heater Operation</td> </tr> </tbody> </table> <table border="0"> <thead> <tr> <th><u>Specifications</u></th> <th><u>Rev.</u></th> <th><u>ECO</u></th> <th><u>Title</u></th> </tr> </thead> <tbody> <tr> <td>40GS-90404</td> <td>G</td> <td>-</td> <td>Masking and Identification</td> </tr> </tbody> </table>						<u>Drawings</u>	<u>Rev.</u>	<u>ECO</u>	<u>Title</u>	C11479	A	20159	Loaded Cartridge	<u>IQOP</u>	<u>Rev.</u>	<u>PCN</u>	<u>Title</u>	1.43.1 (PP0657)	B	None	Loaded Cartridge - ELSH	<u>P.O.P.</u>	<u>Rev.</u>	<u>PCN</u>	<u>Title</u>	2.7.1	C	None	Styrofoam Cure Container	2.7.1.1	Basic	Basic-1	Start-Up	2.9.1.5	C	None	Contaminated Tool Cleaning and Solvent Reclamation Station 0650	6.2.1	A	None	Weighing Techniques	6.9.2	A	None	Abrasive Cleaning of Hardware	6.14.1	N/C	None	H-42 Heater Operation	<u>Specifications</u>	<u>Rev.</u>	<u>ECO</u>	<u>Title</u>	40GS-90404	G	-	Masking and Identification
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OPERATIONS AND QUALITY RECORD

CONTINUATION SHEET

REL. NO. PAGE 2
OF 4

PART NO. C11479-01-01 PLAN REV. N/C

OPCR.	OPERATIONS				COMPL. STAMP
	<u>Applicable Documents (continued)</u>				
	<u>IQOP</u>	<u>Rev.</u>	<u>PCN</u>	<u>Title</u>	
	1.43.8 (PP0664)	Basic	-	UTL-0040A Liner Premix	
	1.43.21 (PP0677)	Basic	-	UTL-0040A Liner Mix	
	1.43.10 (PP0666)	Basic	-	Oxidizer Prep - UTP-18803A	
	1.43.22 (PP0678)	A		Fuel Master Batch - UTP-18803A	
	1.43.12 (PP0668)	B	-	Propellant Mix - UTP-18803A	
	1.43.13 (PP0669)	A	-	Bond-In Tension (BIT) Specimens	
	<u>Reference</u>				
	<u>IQOP</u>	<u>Rev.</u>	<u>PCN</u>	<u>Title</u>	
	1.43.14 (PP0670)	Basic	-	AL-227-70	
	D. Station Foreman coordinate all parts and material requisitioning and transportation requirements through completion. E. Direction of rotation when taking measurements is clockwise, forward looking aft. F. All temperature recording charts are to be identified with P/N, S/N and Date. All Start and Stop times are to be clearly identified. All Charts are to be attached to O&QR upon completion. G. All operations performed shall be performed within the scope of the CSD Safety Manual. H. All parts, components and materials shall have evidence of Quality Assurance Acceptance prior to issue to Process Operations. J. Operator, Area Foreman or Quality Assurance, as applicable, shall stamp only those operations for which a circle  is indicated on the Completion Stamp column.				
	D-39				

OPERATIONS AND QUALITY RECORD

CONTINUATION SHEET

REL. NO. PAGE 3
OF 4

PART NO.
C11479-01-01

PLAN REV.
N/C

OPER.	OPERATIONS	COMPL. STAMP
	K. Area Foreman notify Quality Control at least two (2) hours prior to commencing all operation steps identified with AF/Customer Mandatory Symbol with the following exceptions. AFQC ☐ VERIFY 4 Hours notification prior to end of 1st shift for all second shift, weekend and Holiday operations. L. All weighing operations to be documented as called out in the body of IQOP. Upon completion of each weighing and recording verification of weights, Q.C. pull all copies but hardback of Form CSD-3311 and forward to Acceptance Center for distribution.	
10	(2210) Obtain Parts, Components and Materials, listed on Configured Parts List, from GPAO and/or Company Stores.	☐
20	(2210) Process Loaded Cartridge in accordance with IQOP 1.43.1 in its entirety.	☐
30	(2210) Process Engineer verify Loaded Cartridge P/N C11479-01-01 process was in accordance with IQOP 1.43.1 and is acceptable.	☐
40	(8110) Quality Assurance verify all acceptance data is complete and acceptable.	☐
50	(2210) Area Supervisor forward completed Planning Package to Process Engineering (Small Motor Programs), Building 1240.	☐
60	(2230) Upon completion of review forward complete Planning Package to Production Control, Building 1240.	☐
70	(2122) Production Control forward completed Planning Package to Data Acceptance Center, Building 0010.	☐

D-40



**UNITED
TECHNOLOGIES.. CHEMICAL SYSTEMS DIVISION**

INTEGRATED QUALITY AND OPERATIONS PROCEDURE

**LOADED CARTRIDGE PROCESSING EXTENDED LENGTH
SUPER HIPPO**

EFFECTIVITY:

NAME

DATE

Rel. No. _____

OPERATIONS PLANNER/WRITER:

[Signature] 2/8/77

APPROVED BY:

Safety Engineering:

[Signature] 2-11-77

Quality Assurance:

[Signature] 2/10/77

Project Engineer:

John E. Baldwin 20 Feb 77

Operations Engineer:

[Signature] 3/4/77

Program Management:

W.A. [Signature] 3/1/77

Operational Propellant Committee:

[Signature] 3/2/77

RELEASED BY:

CS Alshin 3-7-77

REVISION

DATE

DESCRIPTION

A

7/2/76

Incorporates PCN's Basic-1, Basic-2, Basic-3 and Process Improvements.

B

3/7/77

Incorporates PCN A-1, A-2, A-3, A-5 and A-6 for Process Improvements.

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1.0 SCOPE

1.1 This procedure provides detailed instructions for the processing of a Loaded Cartridge P/N C11479-01-01.

2.0 SUPPORT REQUIREMENTS

2.1 EQUIPMENT AND MATERIALS

<u>Name</u>	<u>Part No.</u>	<u>CSD Stores No.</u>	<u>Qty.</u>
Heater, Portable	H-42	-	2 each
Hardware Prep. Dolly	7000-596 or 913	-	3
1,1,1, Trichloroethane	-	80015	A/R
Kraft Paper	-	72562	A/R
Cheesecloth	-	36086	A/R
Lower Oven Stand	7000-784	-	1
Adjustable Oven Stand	7000-783	-	1
Intra-Station Dolly	-	-	1
Loaded Case Lift Fixture	C10294	-	1
Valve - Laddish	-	-	1
Extension Tube	7200-192-252	-	1
Tube-Casting 6.0" Dia.	-	-	1
Casting Tube Assembly	C01642/C01714	-	1
Hose Extension	7000-168	-	1
6" Black Rubber Hose	-	80895	A/R
Vinyl Tape	-	80031	A/R
RKL Valve Diaphram	-	80917	A/R
Perchloroethylene	-	-	A/R
Polyethylene Sheet	-	72761	A/R
Casting Tooling Complete	C12026	-	1
80 Grit Sandpaper	-	-	A/R
Straddle Carrier	7000-911	-	

2.2 DOCUMENTS

2.2.1 Required

Drawings

Title

C11479

Loaded Cartridge - ELSH

Specifications/Forms

Title

40GS-90404

Marking and Identification

Plans & Procedures

Title

P.O.P. 6.14.1

H-42 Heater Operation

P.O.P. 6.9.2

Abrasive Cleaning of Hardware

P.O.P. 2.71.1

Startup

P.O.P. 2.91.5

Contaminated Tool Cleaning and Solvent
Reclamation Station 0650

P.O.P. 6.2.1

Weighing Techniques

2.2.2 Reference

None

2.3 EXTERNAL SUPPORT

None

3.0 SPECIAL CONSIDERATIONS

3.1 Follow all Station Safety Procedures.

3.2 All parts and materials shall have evidence of Q.C. Acceptance prior to use.

3.3 All operations shall be performed in the sequence presented. All out-of-sequence operations shall be accomplished using a Procedure Change Notice (PCN).

3.4 Operator, Area Foreman or Quality Assurance, as applicable, shall stamp only those operations for which a circle  is indicated in the OPER. or Q.A. columns. The date the operation is performed shall be entered beneath each respective stamp.

- 3.5 Changes to this procedure shall be accomplished by issuance of appropriate PCN's. PCN's shall be annotated at the affected operation within the body of the procedure.
- 3.6 Record all data per requirements of IQOP.
- 3.7 WARNING/CAUTION inserts are followed by special or safety instructions to be accomplished.
- 3.8 Grain Protectors (7001-002) should remain installed when the cartridge is being worked on. Dust Cover (7000-837) shall be installed on the cartridge whenever it is not being worked on.

NOTE

When Grain Protectors are not in use,
stack so that RTV'd surfaces are protected.

- 3.9 All propellant Surface Spills Only shall be cleaned up immediately. In the event of a major spill, (i.e., propellant spilled onto oven floor), no attempt shall be made to clean up until cartridge has been removed from the area. Notify Health and Safety Engineering immediately of all major spills.
- 3.10 In raining or foggy weather, motor unit shall be covered with Polyethylene sheeting during outside operations, during installation in oven, and during casting tooling set-up.
- 3.11 A static electricity grounding cable shall be connected to mix bowl trainer while it is at oven area.

4.0 PREREQUISITES

- 4.1 Verify that all drawings specified as required for the accomplishment of this procedure are valid and available for the work area.
- 4.2 Ensure all hoisting and lifting equipment associated with this procedure displays evidence of current certification.
- 4.3 Ensure all precision measurement equipment associated with this procedure displays evidence of current calibration status at time of use.
- 4.4 Station Foreman shall ensure that liner cure oven is clean and free of debris.
- 4.5 Operator shall read Hazardous Material Bulletin on 1,1,1, Tri-chloroethane and Methylene Chloride and Perchloroethylene.
- 4.6 Operator shall read Safety Regulation No. 19 (Airless and Compressed Air Spray Painting Operation).

5.0 DETAILED OPERATIONS

5.1 CARTRIDGE PREPARATION (STATION 0210/0211)

5.1.1 Area Foreman verify receipt of Cartridge P/N _____ and record Serial Number _____. Visually check insulation for irregularities. Any irregularities noted at anytime during processing operations shall be reported to the cognizant Process Engineer immediately.

5.1.2 Using Lift Fixture (C10294) lift and place the empty cartridge onto the Hardware Preparation Dolly. Remove the Lift Fixture.

NOTE

Support Restrictor using 1" x 18" boards.

5.1.3 Using 60-120 grit abrasive cloth, lightly sand inside surfaces of the insulated cartridge to remove all gloss and surface contaminants.

5.1.4 Cover Restrictor with Kraft paper.

5.1.5 Using clean cheesecloth dampened with clean 1,1,1, Trichloroethane solvent, thoroughly wash a 4-6 square foot area on Insulation sidewall. Discard cheesecloth after wiping area. Rewipe area with a clean cloth dampened with 1,1,1, Trichloroethane. Repeat as necessary until cloth shows no sign of contamination. Sidewall insulation, and sidewall of the cartridge shall be cleaned from Aft to Forward, progressively by section, e.g., Aft insulation, Cartridge sidewall.

NOTE

A slight yellowish discoloration of cloth is normal and should not be considered contamination.

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- 5.1.6 Remove Kraft paper from restrictor.
- 5.1.7 If there are water spots on restrictor, remove by washing with detergent and rinse carefully with water prior to cleaning with solvent.
- 5.1.8 Wash restrictor with 1,1,1, Trichloroethane washing from O.D. to I.D. Wash a 4-6 square foot area, discard cheese-cloth after wiping area. Rewipe area with a clean cloth dampened with 1,1,1, Trichloroethane. Repeat as necessary until cloth shows no sign of contamination.

NOTE

A slight yellowish discoloration of cloth is normal and should not be considered contamination.

- 5.1.9 Visually inspect cleanliness of insulated surfaces.

5.2 LINER PREHEAT AND LINING (STATION 0210/0211)

- 5.2.1 Preheat cartridge at $215^{\circ}\text{F} \pm 10^{\circ}\text{F}$ for a minimum of 120 hours. Record below:

Time Started: _____ Temp: _____ $^{\circ}\text{F}$

Time Ended: _____ Temp: _____ $^{\circ}\text{F}$

- 5.2.2 Cool cartridge to a surface temperature of $115^{\circ} \pm 15^{\circ}\text{F}$ prior to applying UTL-0040A Liner. Record surface temperature.

Surface Temperature _____

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5.2.3 Q.C. verify the following application of UTL-0040A Liner is to be applied following the sequential continuous completion of the 120 hour min. pre-heat. Surface temperature of the cartridge is to be a minimum of 100°F to a maximum of 130°F, before the application of the UTL-0040A Liner.

5.2.4 Obtain Q.C. accepted UTL-0040A Liner and record Batch No. below.

Batch Number _____

5.2.5 Prepare all samples per IQOP 1.43.13.

5.2.6 Apply a coat of approximately 25 lbs. of UTL-0040A Liner to the entire inside surface of the cartridge and restrictor using new brushes as required (.020 liner of all surfaces).

NOTE

Keep the liner out of the lift holes.

5.2.7 Q.C. verify liner coat applied is between 20 to 30 lbs. and entire inside surface is completely covered.

Tare, Liner Gross Weight _____

Tare, Weighed Back _____

Net Liner Weight _____



5.3 CASTING TOOLING PREPARATION AND INSTALLATION (STATION 0210 0211)

5.3.1 Using the Lift Fixture (C10294) lift the lined cartridge to a convenient working height.

5.3.2 Ensure that the Plywood Ring (C12026-17-01) is in place.

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- 5.3.3 Lower the cartridge into the Baseplate (C12026-01-01).
- 5.3.4 Remove the Lift Fixture (C10294).
- 5.3.5 Wash down core with a clean white cloth dampened with 1,1,1, Trichloroethane. Spray or wipe the core with a solution of 25% Down Corning High Vacuum Grease and 75% Methylene Chloride. At completion of spraying operations using three legged sling raise the core and check that the Fwd edge of the core that mates with the forward restrictor is free of dirt, liner, oil, etc. Lower this core over the three (3) Alignment Pins located in the Baseplate. Do not lower the core completely at this time.
- 5.3.6 Install the three (3) each Hold Down Rods (C12026-14-01).
- NOTE
- Do not tighten the Hold Down Nuts at this time.
- 5.3.7 Lower core completely onto the restrictor. Remove the Three Legged Sling.
- 5.3.8 Lower the Rounding Ring into the Aft end of the motor case insuring that the three (3) holes in the core align with the three (3) lift holes in the rounding ring. These holes are used with the three (3) core alignment cables to center the core.
- 5.3.9 Remove the three (3) legged sling.
- 5.3.10 Install the three (3) each Turnbuckle assemblies items 59, 61 and 62 of Dwg. C12026, used to hold the top rounding ring in position.

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- 5.3.11 Install the three (3) each core centering cables item 42, 63 and 64 of Dwg. C12026.
- 5.3.12 Center the core within .060 inches and record below:
 0° _____ 120° _____ 240° _____
- 5.3.13 Tighten the three core hold down nuts to snug.
- 5.3.14 Weigh the completed casting tooling assembly and record weight below. See CWR No. _____.
 Weight _____
- 5.3.15 Cover cartridge using polyethylene. Also cover samples as required.
- 5.3.16 Area Foreman or Working Leader and Q.C. review Operations 5.0 through 5.3.15 for proper and complete entries on each operation.
- 5.3.17 Transport cartridge to Casting Oven (Station 0980) and samples to Station 0560, using 5,000 lb. capacity truck or trailer.
- 5.4 PREPARATION OF CASTING OVEN (STATION 0980)
- 5.4.1 OPEN door to oven shelter.
- 5.4.2 Move oven shelter away from oven.
- 5.4.3 Check oven and stands for cleanliness and clean as required.

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5.4.4 Adjust oven stand height to pin hole No. 11.

5.4.5 Ensure oven stand is level. Level as required.

5.4.6 Install work stands as required.

5.5 INSTALLATION IN OVEN (STATION 0980)

5.5.1 Center crane hook over cartridge. Place lifting eye over crane hook, lift the cartridge and place on the adjustable oven stand in designated area marked on stand. Disconnect and remove crane.

5.5.2 Ensure that core holddown rods are properly locked and the three (3) core centering cables are tight. Install core cover.

5.6 ASSEMBLY OF SIDE CASTING TOOLING (STATION 0980)

5.6.1 Install clean, assembled oven valve and Extension Tube (7200-192-252) as required.

5.6.1 Assemble the 360° Casting Spider (C10053-24-31) with 30" tubes and 90° elbows and install over the top of the core.

5.6.2 Install the interior casting tooling consisting of one (1) 6.0" SS pipe with a 90° bend on one end, and one (1) 6.0" SS pipe long enough to center the opening of the 90° bend over the center of the 360° casting spider.

5.6.3 Install casting line support under spider.

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- 5.6.4 Mask all clamps, nuts, and threaded portions of clamps, and core centering cables with vinyl tape as required to protect threaded areas.
- 5.6.5 Install casting height indicators (4) equally spaced around rounding ring.
- 5.6.6 Ensure that internal casting tooling is secure.
- 5.6.7 Install 6" diameter metal cap on inlet of oven valve and secure.
- 5.6.8 Ensure that oven/oven lid mating interfaces are free of foreign particles.
- 5.6.9 Clean both sides of each oven lid sight glasses with glass cleaner.
- 5.6.10 Q.C. check centering of core at three (3) equally spaced angular locations and record.
- 0° _____
- 120° _____
- 240° _____
- 5.6.11 Immediately prior to oven lid installation, Area Foreman make inspection of the lined cartridge for visible signs of contamination. Area Foreman or Working Leader to record oven being used, time and date when the lined cartridge was installed in the oven. Notify Project Engineer if contamination exists.

OVEN NO. _____

TIME _____ DATE _____

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- 5.6.12 Install oven lid, checking position of guide lugs. Allow slings to go slack.
- 5.6.13 Disconnect hoist from oven lid and position hoist away from oven.
- 5.6.14 Connect oven lamp system and turn oven lamps ON.
- 5.7 PREHEAT AND LINER CURE (STATION 0980)
- 5.7.1 CLOSE vent valves.
- 5.7.2 Turn air circulation fan ON.
- 5.7.3 Install oven recorder charts and mark significant start and stop times as they occur. Record cartridge serial number and data on recorder chart. Change charts daily. Add appropriate completed oven charts to this IQOP.
- 5.7.4 For preheat set temperature controller to 140°F. Set temperature control on In-Line Heater to 200°F.
- 5.7.5 Preheat cartridge for 15-17 hours to cure the UTL-0040A Liner at 140° ± 10°F. Hold in oven at 130°F-150°F for no more than 24 hours prior to casting propellant. Liner cure and preheat to start at time oven reaches 140° ± 10°F.

IN OUT

TIME: DATE: TIME: DATE:

OVEN TEMP: _____ °F _____ °F

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- 5.7.6 Assure no foreign objects on liner or restrictor. Notify Project Engineer of any objects.

NOTE

Casting must start within 24 hours of completion cure.

- 5.7.7 Turn oven fan OFF, prior to start of vacuum.

- 5.7.8 Close oven valve.

- 5.7.9 OPEN oven vacuum valve.

- 5.7.10 Turn vacuum pump ON.

- 5.7.11 Pull vacuum in oven to a minimum of 75 mm Hg (or less) and record _____.

- 5.7.12 Project Engineer examine lined cartridge while under vacuum to determine if unbonds exist as demonstrated by bubbles under the sidewall insulation. If bubbles exist, DOCUMENT the event.

- 5.8 CASTING OPERATION (STATION 0980)

NOTE

Absolute pressure shall be at or below 75 mm Hg for casting. Completion of casting the final batch may be cast at ambient pressure.

NOTE

Notify Area Foreman and Process Engineer of any unusually long casting times (over 40 minutes).

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5.8.1 Prepare mix bowl and propellant samples per IQOP and P.O.P. 6.8.1.

5.8.2 Remove the 6" diameter metal cap from oven valve and install black rubber hose assembly consisting of 2 each 6" Laddish Ferrule and _____" of rubber hose clamped to ferrule.

5.8.3 Install the 6" diameter metal cap on open end of black rubber hose assembly.

5.8.4 Position mix bowl adjacent to oven to allow connection of casting line.

NOTE

Install grounding strap.

5.8.5 Remove 6" diameter metal cap from black rubber hose assembly and mix bowl discharge tube. Connect casting line to mix bowl.

5.8.6 Receive Q.C. Lab acceptance of each propellant batch from Area Foreman prior to casting. After Q.C. Batch Acceptance is received, begin casting. Record propellant batch data below.

WARNING

Do not exceed 15 psi on 400 gallon mix bowl.

Batch No.	Q.C. Time	Acceptance Date	Badge	Start Cast	Finish Cast	Vacuum MM of Hg	Pot Pressure	Oper.
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OPER	Q.A.
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5.8.13.1 Lock mix bowl discharge valve.

OPER	Q.A.
	

OPER	Q.A.
	
	

- 5.8.14 CLOSE oven valve.
- 5.8.15 On final batch complete Step No. 5.9.3 before disconnecting propellant pot.
- 5.8.16 Disconnect air line from mix bowl pressure lid and open vent valve.
- 5.8.17 Disconnect casting line from mix bowl discharge tube.
- 5.8.17.1 Disconnect grounding strap.
- 5.8.18 Install 6" diameter metal cap on casting line.
- 5.8.19 Install 6" diameter metal cap on mix bowl discharge tube and send mix bowl to Station 0560 and recycle per P.O.P. 2.91.5.
- 5.8.20 Repeat Steps 5.8.1 through 5.8.19 until cartridge unit is cast to bottom of casting height indicator.

Retain last mix bowl at oven for possible propellant top-off requirements.

5.9 POST-CASTING OPERATIONS (STATION 0980)

- 5.9.1 Close vacuum valve. Turn vacuum pump OFF. OPEN oven vent valve.

NOTE

Hand operated vent valve at oven may be used to vent oven.

CAUTION

Prior to removing oven lid, vacuum must be released and oven light cord must be disconnected.

NOTE

When removing oven lid during rain, protect cartridge by raising lid sufficiently to allow a sheet of plastic tarp (clean and dry) to be placed over the component. After the grain is protected, remove the lid and move the shelter over the oven. Conduct all finishing operations under the protection of the shelter. Use only conductive plastic sheeting to cover loaded components.

- 5.9.2 Remove oven lid. Position oven lid on wooden blocks adjacent to oven in designated area.

- 5.9.3 Ensure that propellant is cast to _____ + _____ inches below the top of the cartridge rounding ring. If more propellant is required add, using side casting system. Do not use propellant that has been scraped from the sides of the pot or the casting lines. Disconnect mix bowl.

NOTE

Remove excess propellant using non-metallic tools.

OPER	Q.A.
	
	

5.9.5.1 Install 10" dia. metal cap on oven casting line port.

To avoid trapping air when troweling propellant, jiggle the trowel as it moves over the propellant surface. Do not drag the trowel to cause folding of the propellant.

5.10 CURING IN OVEN (STATION 0980)

For those operations steps not complied with (due to different types of cure) N/A operation step circle.

5.10.2 Start up oven per Station P.O.P. 2.71.1.

OPER	Q.A.
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(PP0657)

- 5.10.3 Cure propellant a total of 240 ± 12 hours at $140^{\circ}\text{F} \pm 10^{\circ}\text{F}$.
(Cure time starts when oven temperature reaches a minimum of 130°F .)

OVEN USED: _____

TIME IN: _____ TEMP: _____ °F

TIME OUT: _____ **TEMP:** _____ °F

5.11 CARTRIDGE REMOVAL FROM OVEN (STATION 0980)

- 5.11.1 Using crane, remove oven lid as required.**

CAUTION

When removing oven lid during rain, protect cartridge by raising lid sufficiently to allow a sheet of plastic tarp (clean and dry) to be placed over component. After the grain is protected, remove the lid and move the oven shelter over the oven for protection. Conduct all finishing operations under the protection of the shelter. Use only conductive plastic sheeting to cover loaded components.

- 5.11.2 Check lifting eye for propellant. Clean if required.

- 5.11.3 Center crane hook over cartridge. Place lifting eye over crane hook. Lift and remove cartridge from oven.

5.12 CURING IN CURE CONTAINER (STATION 0980)

- 5.12.1 Transfer segment to cure container immediately after casting and troweling propellant if cartridge is to be container cured.

- 5.12.2 Connect oven thermocouple and verify proper operation of thermocouple and temperature recording equipment.
- 5.12.3 Install cartridge in cure and shipping container base. Disconnect and remove crane. Level cartridge with 6 foot carpenter level. Retrowel propellant surface to a smooth, level finish as required. Using 7000-923 Lift Fixture and crane install container side on base with an outlet 180° from air inlet on base. Remove lift fixture.
- 5.12.4 Hook-up and operate H-42 heater per P.O.P. 6.14.1.
- 5.12.5 Cure a total of 240 ± 12 hours at $140^{\circ}\text{F} \pm 10^{\circ}\text{F}$. Cure starts when container temperature reaches 130°F .
- CONTAINER LOCATION: _____
- TIME START: _____ TEMP: _____ °F
- TIME COMPLETED: _____ TEMP: _____ °F
- 5.12.6 Remove cure container sides with 7000-923 Lift Fixture and crane and place approximately one-half way between ovens 0981 and 0982.
- 5.12.7 Q.C. review records and assure that propellant was cured 240 ± 12 hours at $140^{\circ}\text{F} \pm 10^{\circ}\text{F}$.
- 5.13 COOL DOWN (STATION 0980)
- 5.13.1 Cool down starts when temperature controller is changed to a 75°F setting or cartridge is removed from oven or Cure Container.

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5.13.2 Total cartridge cool down cycle is 8 hours min.

TIME START: _____ TEMP: _____ °F

TIME COMPLETE: _____ TEMP: _____ °F

5.14 WEIGHING OPERATIONS (STATION 0211)

5.14.1 Using a crane lift the Loaded Cartridge to a sufficient height so that a low boy trailer may be positioned under the Loaded Cartridge. Lower the cartridge onto the trailer and secure. Remove crane.

CAUTION

Lift to be straight and vertical
so as to minimize side load forces
on the lift pin bolts.

5.14.2 Transport the loaded cartridge to Station 0211 between 1630 - 0700 hours on normal working days. Non-working days, transportation may be accomplished at Area Foreman's request.

5.14.3 Using a crane lift the loaded cartridge straight up to a sufficient height so that the low boy trailer may be removed. Move and position the cartridge over the floor scale and lower. Remove crane.

5.14.4 Place in center of scale and disconnect cartridge from crane. Weigh loaded cartridge rounding ring, casting base and core assembly attached. Q.C. observe weighing and verify configuration is same as in Operation 5.3.14. Concur on weight. Area Foreman or Working Leader and Q.C. complete CWR and verify the following:

Record weight below:

CWR No. _____ Propellant Weight _____ LBS.

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5.14.5 Using crane lift the loaded cartridge and move to a location where the trailer may be positioned.

5.14.6 Lift the loaded cartridge to a sufficient height so that a low boy trailer may be positioned under the loaded cartridge. Lower the cartridge onto the trailer and secure. Remove crane.

CAUTION

Lift to be straight and vertical
so as to minimize side load forces
on the lift pin bolts.

5.14.7 Transport the loaded cartridge to stripping pad at Station 0453.

5.14.8 Using a crane lift the loaded cartridge straight up to a sufficient height so that the low boy trailer may be removed. Lower the cartridge. Remove crane.

5.15 STRIPPING, TRIMMING, INSPECTION (STATION 0453)

WARNING

A maximum of 5 personnel allowed
during core removal, stripping
and trimming operations. Only
1 unit at one time on Strip Pad
0453.

5.15.1 Remove propellant from the threaded ends of the three each core stabilizer cables before removing nuts. Remove all tape and propellant splatter.

5.15.2 Remove three each core stabilizer cables.

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5.15.3 Back off the three (3) each core hold down nuts (C12026-51)

5.15.4 Raise the core hold down rods approximately 4.0" by turning counter clockwise and hold in place with the core hold down nuts.

5.15.5 Remove the pins from the core hold down rods and tape to rods.

CAUTION

Do not exceed 9,000 pounds, If core does not come loose at 9,000 pounds proceed with Step 5.15.7.

5.15.6 Using crane with a crane scale plus 3-legged handling sling with a 9,000 pound capacity, remove the core.

NOTE

If core comes free N/A Step 5.15.7 through 5.15.14.

5.15.7 Attach hydraulic cylinder assembly (composed of items C12026-66 and C12026-33) over the 3 hold down rods and secure in place using 3 core hold nuts (C12026-51).

5.15.8 Attach hydraulic power unit to hydraulic fitting on hydraulic cylinder.

5.15.8.1 Make gauge mark on core at grain level.

CAUTION

Do not exceed a hydraulic pressure of 6,000 psig during core removal operation. If the core does not release after 15 minutes, contact Process Engineer.

OPER	Q.A.
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- 5.15.9 Slowly apply hydraulic pressure to the core in steps of 500 psig. Holding for 15 minutes between steps until a hydraulic pressure of 6,000 psig is obtained. Release hydraulic pressure and again slowly increase pressure to 6,000 psig. When core comes loose, gauge mark will be approximately $1\frac{1}{2}$ " to $2\frac{1}{2}$ " above the grain surface. Record PSI force required to release the core from the propellant and the time.

PSI _____ TIME _____

CAUTION

Care must be exercised to prevent contamination by hydraulic fluid.

- 5.15.10 Release hydraulic pressure by moving fluid directional flow selector to opposite position.
- 5.15.11 Disconnect hydraulic lines and replace cap protectors in snap-tite fittings.
- 5.15.12 Coil hydraulic lines and replace on rack for future use.
- 5.15.13 Remove 3 core hold down nuts securing the hydraulic cylinder assembly. Remove the hydraulic cylinder assembly.
- 5.15.14 Using the overhead crane with a crane scale, 3-legged handling sling, remove the core.

CAUTION

Do not exceed 9,000 pounds with sling attached. If core does not come loose at 9,000 pounds notify Process Engineer.

- 5.15.15 Secure core on core pallet. Remove crane and handling sling.
- 5.15.16 Record the following:

CORE REMOVED: DATE: _____ TIME: _____

OPER	Q.A.
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CAUTION

Extreme care must be exercised to prevent damage to teflon coating.

NOTE

Rounding ring, baseplate, "O" Ring and core cleaning and storage may be completed at any time prior to completion of Step 5.16.5.

- 5.15.17 Using non-metallic scrapers and 1,1,1, Trichloroethane, remove all propellant from core and wipe clean with cheesecloth dampened with 1,1,1, Trichloroethane. Return core to CPAO or Station 0211 for storage.
- 5.15.17.1 Release turnbuckles on 3 each cables securing rounding ring to baseplate. Remove cables at rounding ring.
- 5.15.18 Using overhead crane with 3-legged sling, lift and remove the top rounding ring (C12026-12-01), clean rounding ring, and return to Station 0210 or storage.
- 5.15.19 Clean off propellant splashings on case insulation.
- 5.15.20 Trim flashings from bore interface until level with aft propellant surface.
- 5.15.21 Install Lift Fixture (C10294) on crane. Center lift fixture cartridge and lower until pins will engage holes in cartridge. Lock pins in place. Lift cartridge until it clears center post of baseplate.
- 5.15.22 Position 6 each 18" x 24" blocks, double stacked in 3 equal spaces under cartridge. Lower until cartridge touches blocks.

OPER	Q.A.

5.15.23 Remove rubber restrictor .3" $\pm$.1" inboard of propellant bore using Boring Knife and upward strokes. Clean as required. Cognizant Engineer to be present during operation.

5.15.24 Examine all exposed propellant surfaces for raised or depressed areas. Areas 1.0" or less in diameter are to be left undisturbed. All raised or depressed areas of greater than 1.0" in diameter are to be explored, trimmed, and blended.

5.15.25 Visually inspect for bonding separation between propellant and liner.



5.15.26 Visually inspect for cracking or voids. No cracks allowed. No voids with a dimension greater than 1.0 inch allowed.



5.15.27 Measure and record:

Bore DIA: 0° 90° Fwd
Center
Aft
0° 90° 180° 270°
Grain Length _____

5.16 STORAGE (STATION 0451)

5.16.1 Place loaded cartridge on a C10295 Shipping Base. Install four (4) each tie down cables and tighten turn buckles until cables are snug.

OPER	Q.A.
	
	
	
	
	
	

- 5.16.2 Lift and place cartridge with shipping base attached on a 26,000 min. capacity trailer. Disconnect crane from lift fixture. Secure cartridge to trailer. Move trailer to pad 0451.
- 5.16.3 Center crane over lift fixture and attach crane to shackle on lift fixture. Lift and remove cartridge from trailer and place on pad. Release lift fixture from cartridge and remove with the crane. Move lift fixture to designated area and disconnect from crane.
- 5.16.4 Cover top of cartridge with a 10' x 10' sheet of velostat. Secure with tape. Place plywood shipping cover on top of cartridge and cover with a 12' x 12' poly sheet. Secure with tape.

6.0

SECURING

6.1

Area Foreman, Q.C. and Process Engineer review entire procedure. Verify all operations have been completed, proper and complete entries have been made, all items on associated paperwork have completed action of dispositions and acceptance.

Q.C. INSPECTION: _____ DATE: _____

AREA FOREMAN: _____ DATE: _____

PROCESS ENGINEER: _____ DATE: _____

7.0

APPENDIX

OPER	Q.A.
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APPENDIX E

OPERATIONS AND QUALITY RECORD/INTEGRATED QUALITY
AND OPERATIONS PROCEDURE - P/N C11479-02-01

☒ O&QR☐ CHANGE ORDER☐ IDR PLANPage 1
of 4

PART NO. C11479-02-01	TITLE LOADED CARTRIDGE - ELSH		QTY. 1	SERIAL AC.	P. NO. REV. N/C
PLANNER	DATE	ENGINEER <i>E. Seckman</i>	DATE <i>4/1/76</i>	QUALITY ASSURANCE <i>P. C. Reed</i>	DATE <i>4/2/76</i>
CONFIGURATION AUTHORITY N/A			CHANGE ORDER RECORD 0		

OPER. NO.	OPERATIONS	COMPL. STAMP																																																			
	QR/IDR RECORD																																																				
	GENERAL INSTRUCTIONS A. This O&QR provides the authority and attached documentation for processing a Loaded Cartridge P/N C11479-02-01 for Contract F04611-76-C-0010. B. APPLICABLE DOCUMENTS <u>Required</u> <table><thead><tr><th><u>Drawings</u></th><th><u>Rev.</u></th><th><u>ECO</u></th><th><u>Title</u></th></tr></thead><tbody><tr><td>C11479</td><td>A</td><td>20159</td><td>Loaded Cartridge</td></tr></tbody></table> <u>Plans and Procedures</u> <table><thead><tr><th><u>IQOP</u></th><th><u>Rev.</u></th><th><u>PCN</u></th><th><u>Title</u></th></tr></thead><tbody><tr><td>1.43.2 (PP0658)</td><td>B</td><td>None</td><td>Loaded Cartridge - ELSH</td></tr></tbody></table> <table><thead><tr><th><u>P.O.P.</u></th><th><u>Rev.</u></th><th><u>PCN</u></th><th><u>Title</u></th></tr></thead><tbody><tr><td>2.7.1</td><td>C</td><td>None</td><td>Styrofoam Cure Container</td></tr><tr><td>2.7.1.1</td><td>Basic</td><td>Basic-1</td><td>Start-Up</td></tr><tr><td>2.91.5</td><td>C</td><td>None</td><td>Contaminated Tool Cleaning and Solvent Reclamation Station 0650</td></tr><tr><td>6.2.1</td><td>A</td><td>None</td><td>Weighing Techniques</td></tr><tr><td>6.9.2</td><td>A</td><td>None</td><td>Abrasive Cleaning of Hardware</td></tr><tr><td>6.14.1</td><td>N/C</td><td>None</td><td>H-42 Heater Operation</td></tr></tbody></table> <u>Specifications</u> <table><thead><tr><th><u>Rev.</u></th><th><u>ECO</u></th><th><u>Title</u></th></tr></thead><tbody><tr><td>40GS-90404</td><td>G</td><td>-</td><td>Marking and Identification</td></tr></tbody></table>	<u>Drawings</u>	<u>Rev.</u>	<u>ECO</u>	<u>Title</u>	C11479	A	20159	Loaded Cartridge	<u>IQOP</u>	<u>Rev.</u>	<u>PCN</u>	<u>Title</u>	1.43.2 (PP0658)	B	None	Loaded Cartridge - ELSH	<u>P.O.P.</u>	<u>Rev.</u>	<u>PCN</u>	<u>Title</u>	2.7.1	C	None	Styrofoam Cure Container	2.7.1.1	Basic	Basic-1	Start-Up	2.91.5	C	None	Contaminated Tool Cleaning and Solvent Reclamation Station 0650	6.2.1	A	None	Weighing Techniques	6.9.2	A	None	Abrasive Cleaning of Hardware	6.14.1	N/C	None	H-42 Heater Operation	<u>Rev.</u>	<u>ECO</u>	<u>Title</u>	40GS-90404	G	-	Marking and Identification	
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	E-71																																																				

CONTINUATION SHEET

PART NO.

C11479-02-01

OF 4

PLAN REV.

N/C

OPER. NO.	OPERATIONS				COMPL. STAMP
<u>Applicable Documents (continued)</u>					
<u>IQOP</u>	<u>Rev.</u>	<u>PCN</u>	<u>Title</u>		
1.43.8 (PP0664)	Basic	-	UTL-0040A Liner Premix		
1.43.21 (PP0677)	Basic	-	UTL-0040A Liner Mix		
1.43.10 (PP0666)	Basic	-	Oxidizer Prep - UTP-18803A		
1.43.22 (PP0678)	A	-	Fuel Master Batch - UTP-18803A		
1.43.12 (PP0668)	B	-	Propellant Mix - UTP-18803A		
1.43.13 (PP0669)	A	-	Bond-In Tension (BIT) Specimens		
<u>Reference</u>					
<u>IQOP</u>	<u>Rev.</u>	<u>PCN</u>	<u>Title</u>		
1.43.14 (PP0670)	Basic	-	AL-227-70		
D.	Station Foreman coordinate all parts and materials requisitioning and transportation requirements through completion.				
E.	Direction of rotation when taking measurements is clockwise, forward looking aft.				
F.	All temperature recording charts are to be identified with P/N, S/N and Date. All Start and Stop times are to be clearly identified. All Charts are to be attached to O&QR upon completion.				
G.	All operations performed shall be performed within the scope of CSD Safety Manual.				
H.	All parts, components and materials shall have evidence of Quality Assurance Acceptance prior to issue to Process Operations.				
J.	Operator, Area Foreman or Quality Assurance, as applicable, shall stamp only those operations for which a circle  is indicated on the Completion Stamp column.				
E-72					

CONTINUATION SHEET

PART NO. ...	OF 4
C11479-02-01	PLAN REV. N/C

OPER. NO.	OPERATIONS	COMPL. STAMP
	K. Area Foreman notif/ Quality Control at least two (2) hours prior to commencing all operation steps identified with AF/Customer Mandatory Symbol with the following exceptions. AFO. ☐ VERIFY 4 Hours notification prior to end of 1st shift for all second shift, weekend and Holiday operations. L. All weighing operations to be documented as called out in the body of IQOP. Upon completion of each weighing and recording verification of weights, Q.C. pull all copies but hardback of Form CSD-3311 and forward to Acceptance Center for distribution	
10	(2210) Obtain Parts, Components and Materials, listed on Configured Parts List, from GPAO and/or Company Stores.	☐
20	(2210) Process Loaded Cartridge in accordance with IQOP 1.43.2 in its entirety.	☐
30	(2210) Process Engineer verify Loaded Cartridge P/N C11479-02-01 process was in accordance with IQOP 1.43.2 and is acceptable.	☐
40	(8110) Quality Assurance verify all acceptance data is complete and acceptable.	☐
50	(2210) Area Supervisor forward completed Planning Package to Process Engineering (Small Motor Programs), Building 1240.	☐
60	(2230) Upon completion of review forward complete Planning Package to Production Control, Building 1240.	☐
70	(2122) Production Control forward completed Planning Package to Data Acceptance Center, Building 0010.	☐

CONFIGURED PARTS LIST

PART NO. C11479-02-01		TITLE LOADED CARTRIDGE - ELSH		SERIAL NO.	OF 4 PLAN REV.	
QTY TO MAKE 1	ACCT. NO.	ORGN. NO.	W.O.R. NO.	DELIVER TO	BLOS. 0210	ROOM N/C
MAT'L ISSUE BY		MAT'L ISSUE BY		MAT'L ISSUE BY		MAT'L REC BY
SR CONT NO.		SR CONT NO.		SR CONT NO.		OPER. VER.
		N/A		N/A		
		N/A		N/A		

STORE RM/LOC.	QTY REQ	U/I	STOCK NO./PART NO.	MAJOR NOUN/DESCRIPTION	DWG SPEC REV.	ECO'S	SERIAL/LOT Q TRACE NO.	EXT. QTY	QTY ISS.
	1	EA	C10279-02-01	Cartridge					
	AR		UTL-0040A	Liner					
	AR		UTP-18803A	Propellant					
	AR		AL-227-70	Liner (SE0250)					



**UNITED
TECHNOLOGIES.. CHEMICAL SYSTEMS DIVISION**

INTEGRATED QUALITY AND OPERATIONS PROCEDURE

**LOADED CARTRIDGE PROCESSING EXTENDED LENGTH
SUPER HIPPO**

EFFECTIVITY:

NAME

DATE

Rel. No. _____

OPERATIONS PLANNER/WRITER:

[Signature] 2-11-77

APPROVED BY:

Safety Engineering:

[Signature] 2-11-77

Quality Assurance:

[Signature] 2/14/77

Project Engineer:

John C. Baldwin 20 Feb 77

Operations Engineer:

E. Sachara 3/4/77

Program Management:

W. A. [Signature] 3/1/77

Operational Propellant Committee:

[Signature] 3/2/77

RELEASED BY:

CS Obshin 3-7-77

REVISION

DATE

DESCRIPTION

A

7/2/76

Incorporated PCN Basic-1 and Basic-2 and engineering improvements.

B

3/7/77

Incorporates PCN A-1, A-2, A-3, A-4 and A-5 for process improvements.

E-75

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1.43.2 REV. B
(PP0658)

Rel. No. _____

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1.0 SCOPE

1.1 This procedure provides detailed instructions for the processing of a Loaded Cartridge P/N C11479-02-01.

2.0 SUPPORT REQUIREMENTS

2.1 EQUIPMENT AND MATERIALS

<u>Name</u>	<u>Part No.</u>	<u>CSD Stores No.</u>	<u>Qty.</u>
Heater, Portable	H-42	-	2 each
Hardware Prep. Dolly	7000-596 or 913	-	3
1,1,1, Trichloroethane	-	80015	A/R
Kraft Paper	-	72562	A/R
Cheesecloth	-	36086	A/R
Lower Oven Stand	7000-784	-	1
Adjustable Oven Stand	7000-783	-	1
Intra-Station Dolly	-	-	1
Loaded Case Lift Fixture	C10294	-	1
Valve - Laddish	-	-	1
Casting Tube Assembly	C01642/C01714	-	1
Hose Extension	7000-168	-	1
6" Black Rubber Hose	-	80895	A/R
Vinyl Tape	-	80031	A/R
Valve Diaphragm	-	80917	A/R
Perchloroethylene	-	-	A/R
Polyethylene Sheet	-	72761	A/R
Casting Tooling Complete	C12026	-	1
80 Grit Sandpaper	-	-	A/R
Straddle Carrier	7000-911	-	1
Lift Fixture	7000-508	-	1

2.2 DOCUMENTS

2.2.1 Required

Drawings

Title

C11479

Loaded Cartridge - ELSH

Specifications/Forms

Title

40GS-90404

Marking and Identification

Plans and Procedures

Title

P.O.P. 6.14.1

H-42 Heater Operation

P.O.P. 6.9.2

Abrasive Cleaning of Hardware

P.O.P. 2.71.1

Start-Up

P.O.P. 2.91.5

Contaminated Tool Cleaning and Solvent
Reclamation - Station 0560

P.O.P. 6.2.1

Weighing Techniques

2.2.2 Reference

None

2.3 EXTERNAL SUPPORT

None

3.0 SPECIAL CONSIDERATIONS

3.1 Follow all Station Safety Procedures.

3.2 All parts and materials shall have evidence of Q.C. Acceptance prior to use.

3.3 All operations shall be performed in the sequence presented. All out-of-sequence operations shall be accomplished using a Procedure Change Notice (PCN).

3.4 Operator, Area Foreman or Quality Assurance, as applicable, shall stamp only those operations for which a circle  is indicated in the OPER. or Q.A. columns. The date the operation is performed shall be entered beneath each respective stamp.

- 3.5 Changes to this procedure shall be accomplished by issuance of appropriate PCN's. PCN's shall be annotated at the affected operation within the body of the procedure.
- 3.6 Record all data per requirements of IQOP.
- 3.7 WARNING/CAUTION inserts are followed by special or safety instructions to be accomplished.
- 3.8 Grain Protectors (7001-002) should remain installed when the cartridge is being worked on. Dust Cover (7000-837) shall be installed on the cartridge whenever it is not being worked on.

NOTE

When Grain Protectors are not
in use, stack so that RTV'd
surfaces are protected.

- 3.9 All propellant Surface Spills Only shall be cleaned up immediately. In the event of a major spill, (i.e., propellant spilled onto oven floor), no attempt shall be made to clean up until cartridge has been removed from the area. Notify Health and Safety Engineering immediately of all major spills.
- 3.10 In raining or foggy weather, motor unit shall be covered with Polyethylene sheeting during outside operations, during installation in oven, and during casting tooling set-up.
- 3.11 A static electricity grounding cable shall be connected to mix bowl trailer while it is at oven area.

PREREQUISITES

- 4.0
- 4.1 Verify that all drawings specified as required for the accomplishment of this procedure are valid and available for the work area.
- 4.2 Ensure all hoisting and lifting equipment associated with this procedure displays evidence of current certification.
- 4.3 Ensure all precision measurement equipment associated with this procedure displays evidence of current calibration status at time of use.
- 4.4 Station Foreman shall ensure that liner cure oven is clean and free of debris.
- 4.5 Operator shall read Hazardous Material Bulletin on 1,1,1, Tri-chloroethene and Methylene Chloride and Perchloroethylene.
- 4.6 Operator shall read Safety Regulation No. 19. (Airless and Compressed Air Spray Painting Operation.)

5.0

DETAILED OPERATIONS

5.1

CARTRIDGE PREPARATION (STATION 0210/0211)

5.1.1

Area Foreman verify receipt of cartridge P/N _____ and record Serial Number _____. Visually check insulation for irregularities. Any irregularities noted at anytime during processing operations shall be reported to the cognizant Process Engineer immediately.

5.1.2

Using Lift Fixture (C10294) lift and place the empty cartridge onto the Hardware Preparation Dolly. Remove the Lift Fixture.

NOTE

Support Restrictor using 1" x 18" boards.

5.1.3

Using 60-120 grit abrasive cloth, lightly sand inside surfaces of the insulated cartridge to remove all gloss and surface contaminants.

5.1.4

Cover Restrictor with Kraft paper.

5.1.5

Using clean cheesecloth dampened with clean 1,1,1, Trichloroethane solvent, thoroughly wash a 4-6 square foot area on Insulation sidewall. Discard cheesecloth after wiping area. Rewipe area with a clean cloth dampened with 1,1,1, Trichloroethane. Repeat as necessary until cloth shows no sign of contamination. Sidewall insulation, and sidewall of the cartridge shall be cleaned from Aft to Forward, progressively by section, e.g., Aft insulation, cartridge sidewall.

NOTE

A slight yellowish discoloration of cloth is normal and should not be considered contamination.

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- 5.1.6 Remove Kraft paper from restrictor.
- 5.1.7 If there are water spots on restrictor, remove by washing with detergent and rinse carefully with water prior to cleaning with solvent.
- 5.1.8 Wash restrictor with 1,1,1, Trichloroethane washing from O.D. to I.D. Wash a 4-6 square foot area, discard cheese-cloth after wiping area. Rewipe area with a clean cloth dampened with 1,1,1, Trichloroethane. Repeat as necessary until cloth shows no sign of contamination.
- NOTE**

A slight yellowish discoloration of cloth is normal and should not be considered contamination.
- 5.1.9 Visually inspect cleanliness of insulated surfaces.
- 5.2 LINER PREHEAT AND LINING (STATION 0210/0211)
- 5.2.1 Preheat cartridge at $215^{\circ}\text{F} - 0^{\circ}\text{F} + 10^{\circ}\text{F}$ for a minimum of 120 hours. Record below:
- Time Started: _____ Temp: _____ $^{\circ}\text{F}$
- Time Ended: _____ Temp: _____ $^{\circ}\text{F}$
- 5.2.2 Cool cartridge to a surface temperature of $115^{\circ} \pm 15^{\circ}\text{F}$ prior to applying UTL-0040A Liner. Record surface temperature.
- Surface Temperature _____

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5.2.3 Q.C. verify the following application of UTL-0040A Liner is to be applied following the sequential continuous completion of the 120 hour minimum pre-heat. Surface temperature of the cartridge is to be a minimum of 100°F to a maximum of 130°F, before the application of the UTL-0040A Liner.

5.2.4 Obtain Q.C. accepted UTL-0040A Liner and record batch No. below.

Batch Number _____

5.2.6 Apply a coat of approximately 25 lbs. of UTL-0040A Liner to the entire inside surface of the cartridge and restrictor using new brushes as required (.020 liner on all surfaces).

NOTE

Keep the liner out of the lift holes.

5.2.7 Q.C. verify liner coat applied is between 20 to 30 lbs. and entire inside surface is completely covered.

Tare, Liner Gross Weight _____

Tare, Weighed Back _____

Net Liner Weight _____

AFOC



VERIFY

5.3 CASTING TOOLING PREPARATION AND INSTALLATION (STATION 0210/0211)

5.3.1 Using the Lift Fixture (C10294) lift the lined cartridge to a convenient working height.

5.3.2 Ensure that the Plywood Ring (C12026-17-01) is removed from the Baseplate (C12026-01-01).

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- 5.3.3 Lower the cartridge into the Baseplate (C12026-01-01).
- 5.3.4 Remove the Lift Fixture (C10294).
- 5.3.5 Wash down core with a clean white cloth dampened with 1,1,1, Trichloroethane. Spray or wipe the core with a solution of 25% Dow Corning High Vacuum Grease and 75% Methylene Chloride. At completion of spraying operations using three legged sling raise the core and check that the Fwd edge of the core that mates with the forward restrictor is free of dirt, liner, oil, etc. Lower this core over the three (3) alignment pins located in the Baseplate. Do not lower the core completely at this time.
- 5.3.6 Install the three (3) each Hold Down Rods (C12026-14-01).
- NOTE
- Do not tighten the Hold Down Nuts at this time.
- 5.3.7 Lower core completely onto the restrictor. Remove the Three Legged Sling.
- 5.3.8 Lower the rounding ring into the Aft end of the motor case insuring that the three (3) holes in the core align with the three (3) lift holes in the rounding ring. These holes are used with the three (3) core alignment cables to center the core.
- 5.3.9 Remove the three (3) legged sling.
- 5.3.10 Install the three (3) each Turnbuckle assemblies items 59, 61 and 62 of Dwg. C12026, used to hold the top rounding ring in position.

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- 5.3.11 Install the three (3) each core centering calbes item 42, 63 and 64 of Dwg. C12026.
- 5.3.12 Center the core within .060 inches and record below:
0° _____ 120° _____ 240° _____
- 5.3.13 Tighten the three core hold down nuts to snug.
- 5.3.14 Weigh the completed casting tooling assembly and record weight below. See CWR No. _____
Weight _____
- 5.3.15 Cover cartridge using polyethylene. Also cover samples as required.
- 5.3.16 Area Foreman or Working Leader and Q.C. review Operations 5.0 through 5.3.15 for proper and complete entries on each operation.
- 5.3.17 Transport cartridge to casting oven (Station 0980) and samples to Station 0650, using 5,000 lb. capacity truck or trailer.
- 5.4 PREPARATION OF CASTING OVEN (STATION 0980)
- 5.4.1 OPEN door to oven shelter.
- 5.4.2 Move oven shelter away from oven.
- 5.4.3 Check oven and stands for cleanliness and clean as required.

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5.4.4	Adjust oven stand height to pin hole No. 12.	☐	
5.4.5	Ensure oven stand is level. Level as required.	☐	
5.4.6	Install work stands as required.		
5.5	INSTALLATION IN OVEN (STATION 0980)		
5.5.1	Center crane hook over cartridge. Place lifting eye over crane hook, lift the cartridge and place on the adjustable oven stand in designated area marked on stand. Disconnect and remove crane.	☐	
5.5.2	Ensure that core holddown rods are properly locked and the three (3) core centering cables are tight. Install core cover.	☐	
5.6	ASSEMBLY OF SIDE CASTING TOOLING (STATION 0980)		
	Install clean, assembled oven valve and Extension Tube (7200-192-252) as required.	☐	
5.6.1	Assemble the 360° Casting Spider (C10053-24-31) with 30" tubes and 90° elbows and install over the top of the core.	☐	
5.6.2	Install the interior casting tooling consisting of one (1) 6.0" SS pipe with a 90° bend on one end, and one (1) 6.0" SS pipe long enough to center the opening of the 90° bend over the center of the 360° casting spider.	☐	
5.6.3	Install casting line support under spider.	☐	

- 5.6.4 Mask all clamps, nuts, and threaded portions of clamps, and core centering cables with vinyl tape as required to protect threaded areas.
- 5.6.5 Install casting height indicators (4) equally spaced around rounding ring.
- 5.6.6 Ensure that internal casting tooling is secure.
- 5.6.7 Install 6" diameter metal cap on inlet of oven valve and secure.
- 5.6.8 Ensure that oven/oven lid mating interfaces are free of foreign particles.
- 5.6.9 Clean both sides of each oven lid sight glasses with glass cleaner.
- 5.6.10 Q.C. check centering of core at three (3) equally spaced angular locations and record.
 0° _____
 120° _____
 240° _____
- 5.6.11 Immediately prior to oven lid installation, Area Foreman make inspection of the lined cartridge for visible signs of contamination. Area Foreman or Working Leader to record oven being used, time and date when the lined cartridge was installed in the oven. Notify Project Engineer if contamination exists.

OVEN NO. _____

TIME _____ DATE _____

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- 5.6.12 Install oven lid, checking position of guide lugs. Allow slings to go slack.
- 5.6.13 Disconnect hoist from oven lid and position hoist away from oven.
- 5.6.14 Connect oven lamp system and turn oven lamps ON.
- 5.7 PREHEAT AND LINER CURE (STATION 0980)
- 5.7.1 CLOSE vent valves.
- 5.7.2 Turn air circulation fan ON.
- 5.7.3 Install oven recorder charts and mark significant start and stop times as they occur. Record cartridge serial number and data on recorder chart. Change charts daily. Add appropriate completed oven charts to this IQOP.
- 5.7.4 For preheat set temperature controller to 140°F. Set temperature control on In-Line Heater to 200°F.
- 5.7.5 Preheat cartridge for 15-17 hours to cure the UTL-0040A Liner at 140° ± 10°F. Hold in oven at 130°F-150°F for no more than 24 hours prior to casting propellant. Liner cure and preheat to start at time oven reaches 140° ± 10°F. Record the following:
- | | | | |
|-------|-------|-------|-------|
| | IN | | OUT |
| TIME: | DATE: | TIME: | DATE: |
- OVEN TEMP: _____ °F _____ °F
- 5.7.6 Assure no foreign objects on liner or restrictor. Notify Project Engineer of any objects.

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NOTE

Casting must start within 24 hours of completion cure.

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5.8.2 Remove the 6" diameter metal cap from oven valve and install black rubber hose assembly consisting of 2 each 6" Laddish ferrule and _____" of rubber hose clamped to ferrule.

5.8.3 Install the 6" diameter metal cap on open end of black rubber hose assembly.

5.8.4 Position mix bowl adjacent to oven to allow connection of casting line.

NOTE

Install grounding strap.

5.8.5 Remove 6" diameter metal cap from black rubber hose assembly and mix bowl discharge tube. Connect casting line to mix bowl.

5.8.6 Receive Q.C. Lab acceptance of each propellant batch from Area Foreman prior to casting. After Q.C. Batch Acceptance is received, begin casting. Record propellant batch data below.

WARNING

Do not exceed 15 psi on 400 gallon mix bowl.

Batch No.	Q.C. Time	Acceptance Date	Acceptance Badge	Start Cast	Finish Cast	Vacuum MM of Hg	Pot Pressure	Oper.
								
								
								
								
								
								

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- 5.8.14 CLOSE oven valve.
- 5.8.15 On final batch complete Step No. 5.9.3 before disconnecting propellant pot.
- 5.8.16 Disconnect air line from mix bowl pressure lid and open vent valve.
- 5.8.17 Disconnect casting line from mix bowl discharge tube.
- 5.8.17.1 Disconnect grounding strap.
- 5.8.18 Install 6" diameter metal cap on casting line.
- 5.8.19 Install 6" diameter metal cap on mix bowl discharge tube and send mix bowl to Station 0560 and recycle per P.O.P. 2.91.5.
- 5.8.20 Repeat Steps 5.8.1 through 5.8.19 until cartridge unit is cast to bottom of casting height indicator.

Retain last mix bowl at oven for possible propellant top-off requirements.

5.9 POST-CASTING OPERATIONS (STATION 0980)

- 5.9.1 Close vacuum valve. Turn vacuum pump OFF. OPEN oven vent valve.

NOTE

Hand operated vent valve at oven may be used to vent oven.

CAUTION

Prior to removing oven lid, vacuum must be released and oven light cord must be disconnected.

NOTE

When removing oven lid durin rain, protect cartridge by raising lid sufficiently to allow a sheet of plastic tarp (clean and dry) to be placed over the component. After the grain is protected, remove the lid and move the shelter over the oven. Conduct all finishing operations under the protection of the shelter. Use only conductive plastic sheeting to cover loaded components.

- 5.9.2 Remove oven lid. Position oven lid on wooden blocks adjacent to oven in designated area.

- 5.9.3 Ensure that propellant is cast to _____ $\pm$ _____ inches below the top of the cartridge rounding ring. If more propellant is required add, using side casting system. Do not use propellant that has been scraped from the sides of the pot or the casting lines. Disconnect mix bowl.

NOTE

Remove excess propellant using non-metallic tools.

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- 5.9.4 OPEN valve.

- 5.9.5 Remove casting tube assembly, oven valve, open extension tube, casting height indicator, core cover, 360° casting spider, and masking on core centering cables.
 - 5.9.5.1 Install 10" diameter metal cap on oven casting line port.

To avoid trapping air when troweling propellant, jiggle the trowel as it moves over the propellant surface. Do not drag the trowel to cause folding of the propellant.

- 5.9.6 Trowel propellant surface smooth and level to _____ + _____ inches below the top surface of the cartridge rounding ring. Provide 360° propellant fillet $\frac{1}{4}$ " high minimum at sidewall interface.

- ### 5.10 CURING IN OVEN (STATION 0980)

For those operation steps not
complied with (due to different
types of cure) N/A operation
step circle.

- 5.10.1 Install oven lid, checking position of guide lugs.
- 5.10.2 Start up oven per Station P.O.P. 2.71.1.

- 5.10.3 Cure propellant a total of 240 ± 12 hours at $140^{\circ}\text{F} \pm 10^{\circ}\text{F}$.
(Cure time starts when oven temperature reaches a minimum of 130°F .)

OVEN USED: _____

TIME IN: _____ TEMP: _____ $^{\circ}\text{F}$

TIME OUT: _____ TEMP: _____ $^{\circ}\text{F}$

- 5.11 CARTRIDGE REMOVAL FROM OVEN (STATION 0980)

- 5.11.1 Using crane, remove oven lid as required.

CAUTION

When removing oven lid during rain, protect cartridge by raising lid sufficiently to allow a sheet of plastic tarp (clean and dry) to be placed over component. After the grain is protected, remove the lid and move the oven shelter over the oven for protection. Conduct all finishing operations under the protection of the shelter. Use only conductive plastic sheeting to cover loaded components.

- 5.11.2 Check lifting eye for propellant. Clean if required.

- 5.11.3 Center crane hook over cartridge. Place lifting eye over crane hook. Lift and remove cartridge from oven.

- 5.12 CURING IN CURE CONTAINER (STATION 0980)

- 5.12.1 Transfer segment to cure container immediately after casting and troweling propellant if cartridge is to be container cured.

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5.12.2	Connect oven thermocouple and verify proper operation of thermocouple and temperature recording equipment.	☐	
5.12.3	Install cartridge in cure and shipping container base. Disconnect and remove crane. Level cartridge with 6 foot carpenter level. Retrowel propellant surface to a smooth, level finish as required. Using 7000-923 lift fixture and crane install container side on base with an outlet 180° from air inlet on base. Remove lift fixture.	☐	
5.12.4	Hook-up and operate H-42 heater per P.O.P. 6.14.1.	☐	
5.12.5	Cure a total of 240 ± 12 hours at $140^{\circ}\text{F} \pm 10^{\circ}\text{F}$. Cure starts when container temperature reaches 130°F . CONTAINER LOCATION: _____ TIME START: _____ TEMP: _____ °F TIME COMPLETED: _____ TEMP: _____ °F	☐	
5.12.6	Remove cure container sides with 7000-923 lift fixture and crane and place approximately one-half way between ovens 0961 and 0982.	☐	
5.12.7	Q.C. review records and assure that propellant was cured 240 ± 12 hours at $140^{\circ}\text{F} \pm 10^{\circ}\text{F}$.	☐	
5.13	COOL DOWN (STATION 0980)		
5.13.1	Cool down starts when temperature controller is changed to a 75°F setting or cartridge is removed from oven or Cure Container.	☐	

5.13.2 Total cartridge cool down cycle is 8 hours minimum.

TIME START: _____ TEMP: _____ °F

TIME COMPLETE: _____ TEMP: _____ °F

5.14 WEIGHING OPERATIONS (STATION 0211)

5.14.1 Using a crane lift the loaded cartridge to a sufficient height so that a low boy trailer may be positioned under the loaded cartridge. Lower the cartridge onto the trailer and secure. Remove crane.

CAUTION

Lift to be straight and vertical
so as to minimize side load forces
on the lift pin bolts.

5.14.2 Transport the loaded cartridge to Station 0211 between 1630 - 0700 hours on normal working day. Non-working days, transportation may be accomplished at Area Foreman's request.

5.14.3 Using a crane lift the loaded cartridge straight up to a sufficient height so that the low boy trailer may be removed. Move and position the cartridge over the floor scale and lower. Remove crane.

5.14.4 Place in center of scale and disconnect cartridge from crane. Weigh loaded cartridge rounding ring, casting base and core assembly attached. Q.C. observe weighing and verify configuration is same as in Operation 5.3.14. Concur on weight. Area Foreman or Working Leader and Q.C. complete CWR and verify the following:

Record Weight Below:

CWR No. _____ Propellant Weight _____ LBS.

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5.14.5 Using crane lift the loaded cartridge and move to a location where the trailer may be positioned.

5.14.6 Lift the loaded cartridge to a sufficient height so that a low boy trailer may be positioned under the loaded cartridge. Lower the cartridge onto the trailer and secure. Remove crane.

CAUTION

Lift to be straight and vertical
so as to minimize side load forces
on the lift pin bolts.

5.14.7 Transport the loaded cartridge to stripping pad at Station 0453.

5.14.8 Using a crane lift the loaded cartridge straight up to a sufficient height so that the low boy trailer may be removed. Lower the cartridge. Remove crane.

5.15 STRIPPING, TRIMMING, INSPECTION AND STORAGE (STATION 0453)

WARNING

A maximum of 5 personnel allowed
during core removal, stripping and
trimming operations. Only 1 unit
at one time on strip pad 0543.

5.15.1 Remove propellant from the threaded ends of the three each core stabilizer cables before removing nuts. Remove all tape and propellant splatter.

5.15.2 Remove three each core stabilizer cables.

5.15.3 Back off the three (3) each core hold down nuts (C12026-51).

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- 5.15.4 Raise the core hold down rods approximately 4.0" by turning counter clockwise and hold in place with the core hold down nuts.

- 5.15.5 Remove the pins from the core hold down rods and tape to rods.

CAUTION

Do not exceed 9,000 pounds. If core does not come loose at 9,000 pounds proceed with Step 5.15.7.

- 5.15.6 Using crane with a crane scale plus 3-legged handling sling with a 9,000 pound capacity, remove the core.

NOTE

If core comes free N/A Step 5.15.7 through 5.15.14.

- 5.15.7 Attach hydraulic cylinder assembly (composed of items C12026-66 and C12026-33) over the 3 hold down rods and secure in place using 3 core hold down nuts (C12026-51).

- 5.15.8 Attach hydraulic power unit to hydraulic fitting on hydraulic cylinder.

- 5.15.8.1 Make gauge mark on core at grain level.

CAUTION

Do not exceed a hydraulic pressure of 6,000 psig during core removal operation. If the core does not release after 15 minutes, contact Process Engineer.

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- 5.15.9 Slowly apply hydraulic pressure to the core in steps of 500 psig. Holding for 15 minutes between steps until a hydraulic pressure of 6,000 psig is obtained. Release hydraulic pressure and again slowly increase pressure to 6,000 psig. When core comes loose, gauge mark will be approximately $1\frac{1}{2}$ " to $2\frac{1}{2}$ " above the grain surface. Record PSI force required to release the core from the propellant and the time.

PSI _____ TIME _____

CAUTION

Care must be exercised to prevent contamination by hydraulic fluid.

- 5.15.10 Release hydraulic pressure by moving fluid directional flow selector to opposite position.
- 5.15.11 Disconnect hydraulic lines and replace cap protectors in snap-tite fittings.
- 5.15.12 Coil hydraulic lines and replace on rack for future use.
- 5.15.13 Remove the 3 core hold down nuts securing the hydraulic cylinder assembly. Remove the hydraulic cylinder assembly.
- 5.15.14 Using the overhead crane with a crane scale, 3-legged handling sling, remove the core.

CAUTION

Do not exceed 9,000 pounds with sling attached. If core does not come loose at 9,000 pounds notify Process Engineer.

- 5.15.15 Secure core on core pallet. Remove crane and handling sling.

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5.15.16 Record the following:

CORE REMOVED: DATE: _____ TIME: _____

CAUTION

Extreme care must be exercised to prevent damage to teflon coating.

NOTE

Rounding ring, baseplate, "O" Ring and core cleaning and storage may be completed at any time prior to completion of Step 5.16.5.

5.15.17 Using non-metallic scrapers and 1,1,1, Trichloroethane, remove all propellant from core and wipe clean with cheese-cloth dampened with 1,1,1, Trichloroethane. Return core to GPAO or Station 0211 for storage.

5.15.17.1 Release turnbuckles on 3 each cables securing rounding ring to baseplate. Remove cables at rounding ring.

5.15.18 Using overhead crane with 3-legged sling, lift and remove the top rounding ring (C12026-12-01), clean rounding ring, and return to Station 0210 or storage.

5.15.19 Clean off propellant splashings on case insulation.

5.15.20 Trim flashings from bore interface until level with aft propellant surface.

5.15.21 Install Lift Fixture (C10294) on crane. Center lift fixture cartridge and lower until pins will engage holes in cartridge. Lock pins in place. Lift cartridge until it clears center post of baseplate.

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5.15.22 Position 6 each 18" x 24" blocks, double stacked in 3 equal spaces under cartridge. Lower until cartridge touches blocks.

5.15.23 Remove rubber restrictor .3" $\pm$.1" inboard of propellant bore using Boning Knife and upward strokes. Clean as required. Cognizant Engineer to be present during operation

5.15.24 Examine all exposed propellant surfaces for raised or depressed areas. Areas 1.0" or less in diameter are to be left undisturbed. All raised or depressed areas of greater than 1.0" in diameter are to be explored, trimmed, and blended.

5.15.25 Visually inspect for bonding separation between propellant and liner.

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VERIFY

5.15.26 Visually inspect for cracking or voids. No cracks allowed. No voids with a dimension greater than 1.0 inch allowed.

AFQC



VERIFY

5.15.27 Measure and record:

0° 90°
 Bore DIA: _____ Fwd
 _____ Center
 _____ Aft
 0° 90° 180° 270°
 Grain Length _____

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5.16 STORAGE (STATION 0451)

5.16.1 Place loaded cartridge on a C10295 Shipping Base. Install four (4) each tie down cables and tighten turn buckles until cables are snug.

5.16.2 Lift and place cartridge with shipping base attached on a 26,000 minimum capacity trailer. Disconnect crane from lift fixture. Secure cartridge to trailer. Move trailer to pad 0451.

5.16.3 Center crane over lift fixture and attach crane to shackle. on lift fixture. Lift and remove cartridge from trailer and place on pad. Release lift fixture from cartridge and remove with the crane. Move lift fixture to designated area and disconnect from crane.

5.16.4 Cover top of cartridge with a 10' x 10' sheet of velostat. Secure with tape. Place plywood shipping cover on top of cartridge and cover with a 12' x 12' poly sheet. Secure with tape.

6.0 SECURING

6.1 Area Foreman, Q.C. and Process Engineer review entire procedure. Verify all operations have been completed, proper and complete entries have been made, all items and associated paperwork have completed action of dispositions and acceptance.

Q.C. INSPECTION: _____ DATE: _____

AREA FOREMAN: _____ DATE: _____

PROCESS ENGINEER: _____ DATE: _____

7.0 APPENDIX

APPENDIX F

OPERATIONS AND QUALITY RECORD/INTEGRATED QUALITY
AND OPERATIONS PROCEDURE - P/N C11479-03-01

☒ O&QR☐ CHANGE ORDER☐ IDR PLAN

REL. NO.

PAGE 1
of 4

PART NO. C11479-03-01		TITLE LOADED CARTRIDGE - ELSH		QTY. 1	SERIAL NO.	P. & REV. N/C
PLANNER	DATE	ENGINEER	DATE	QUALITY ASSURANCE DATE	NEXT ASSY-END ITEM	
		E. Snelson	4/1/76	E. Snelson	4/2/76	
CONFIGURATION AUTHORITY N/A			CHANGE ORDER RECORD			WOR NO.
OPER. NO.	OPERATIONS					COMPL. STAMP
	QR/IDR RECORD					
<u>GENERAL INSTRUCTIONS</u>						
A. This O&QR provides the authority and attached documentation for processing a Loaded Cartridge P/N C11479-03-01 for Contract F04611-76-C-0010.						
B. APPLICABLE DOCUMENTS						
<u>Required</u>						
<u>Drawings</u>						
	<u>Rev.</u>	<u>ECO</u>	<u>Title</u>			
C11479	A	20159	Loaded Cartridge			
<u>Plans and Procedures</u>						
<u>IQOP</u>						
	<u>Rev.</u>	<u>PCN</u>	<u>Title</u>			
1.43.3 (PP0659)	B	None	Loaded Cartridge - ELSH			
<u>P.O.P.</u>						
	<u>Rev.</u>	<u>PCN</u>	<u>Title</u>			
2.7.1	C	None	Styrofoam Cure Container			
2.7.1.1	Basic	Basic-1	Start-Up			
2.91.5	C	None	Contaminated Tool Cleaning and Solvent Reclamation Station 0650			
6.2.1	A	None	Weighing Techniques			
6.9.2	A	None	Abrasive Cleaning of Hardware			
6.14.1	N/C	None	H-42 Heater Operation			
<u>Specifications</u>						
	<u>Rev.</u>	<u>ECO</u>	<u>Title</u>			
40GS-90404	G	-	Marking and Identification			

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CONTINUATION SHEET

PART NO.

C11479-03-01

OF 4

PLAN REV.

N/C

OPER. NO.	OPERATIONS			COMPL. STAMP
<u>Applicable Documents (continued)</u>				
<u>IQOP</u>	<u>Rev.</u>	<u>PCN</u>	<u>Title</u>	
1.43.8 (PP0664)	Basic	-	UTL-0040A Liner Premix	
1.43.21 (PP0677)	Basic	-	UTL-0040A Liner Mix	
1.43.10 (PP0666)	Basic	-	Oxidizer Prep - UTP-18803A	
1.43.22 (PP0678)	A	-	Fuel Master Batch -UTP-18803A	
1.43.12 (PP0668)	C	-	Propellant Mix - UTP-18803A	
1.43.13 (PP0669)	A	-	Bond-In Tension (BIT) Specimens	
<u>Reference</u>				
<u>IQOP</u>	<u>Rev.</u>	<u>PCN</u>	<u>Title</u>	
1.43.14 (PP0670)	Basic	-	AL-227-70	
D.	Station Foreman coordinate all parts and materials requisitioning and transportation requirements through completion.			
E.	Direction of rotation when taking measurements is clockwise, forward looking aft.			
F.	All temperature recording charts are to be identified with P/N, S/N and Date. All Start and Stop times are to be clearly identified. All Charts are to be attached to O&QR upon completion.			
G.	All operations performed shall be performed within the scope of CSD Safety Manual.			
H.	All parts, components and materials shall have evidence of Quality Assurance Acceptance prior to issue to Process Operations.			
J.	Operator, Area Foreman or Quality Assurance, as applicable, shall stamp only those operations for which a circle  is indicated on the Completion Stamp column.			
F-106				

CONTINUATION SHEET

PART NO.
C11479-03-01OF 43
PLAN-REV
N/C

OPER. NO.	OPERATIONS	COMPL. STAMP
	K. Area Foreman notify Quality Control at least two (2) hours prior to commencing all operation steps identified with AF/Customer Mandatory Symbol with the following exceptions. AFQC ☐ VERIFY 4 Hours notification prior to end of 1st shift for all second shift, weekend and Holiday operations. L. All weighing operations to be documented as called out in the body of IQOP. Upon completion of each weighing and recording verification of weights, Q.C. pull all copies but hardback of Form CSD-3311 and forward to Acceptance Center for distribution.	
10	(2210) Obtain Parts, Components and Materials, listed on Configured Parts List, from GPAO and/or Company Stores.	☐
20	(2210) Process Loaded Cartridge in accordance with IQOP 1.43.3 in its entirety.	☐
30	(2210) Process Engineer verify Loaded Cartridge P/N C11479-03-01 process was in accordance with IQOP 1.43.3 and is acceptable.	☐
40	(8110) Quality Assurance verify all acceptance data is complete and acceptable.	☐
50	(2210) Area Supervisor forward completed Planning Package to Process Engineering (Small Motor Programs), Building 1240.	☐
60	(2230) Upon completion of review forward complete Planning Package to Production Control, Building 1240.	☐
70	(2122) Production Control forward completed Planning Package to Data Acceptance Center, Building 0010.	☐
	F-107	

CONFIGURED PARTS LIST

PART NO. C11479-03-01		TITLE LOADED CARTRIDGE - ELSH		SERIAL NO.	PLAN REV. S/C
QTY TO MAKE 1	ACCT NO.	ORGN. NO.	W.O.R. NO.	DELIVER TO BLOG 0210	ROOM MINT
MAT'L ISSUE BY		MAT'L ISSUE BY N/A		MAT'L REC BY	
SR CONT NO.		SR CONT NO. N/A		OPER. VER. N/A	

STORE RM/LOC	QTY REQ	U/I	STOCK NO./PART NO.	MAJOR NOUN/DESCRIPTION	DWG SPEC REV.	ECO'S	SERIAL/LOT OCTRACE NO.	EXT. QTY	QTY ISS
	1	EA	C10279-03-01	Cartridge					
	AR		UTL-0040A	Liner					
	AR		UTP-18803A	Propellant					
	AR		AL-227-70	Liner (SE0250)					

UTC 3408D (11/73)



**UNITED
TECHNOLOGIES.. CHEMICAL SYSTEMS DIVISION**

INTEGRATED QUALITY AND OPERATIONS PROCEDURE

**LOADED CARTRIDGE PROCESSING EXTENDED LENGTH
SUPER HIPPO**

<u>EFFECTIVITY:</u>	<u>NAME</u>	<u>DATE</u>
Rel. No. _____		
OPERATIONS PLANNER/WRITER:	<u>[Signature]</u>	<u>2-10-77</u>
APPROVED BY:		
Safety Engineering:	<u>[Signature]</u>	<u>2-11-77</u>
Quality Assurance:	<u>[Signature]</u>	<u>2/14/77</u>
Project Engineer:	<u>John E. Baldwin</u>	<u>20 Feb 77</u>
Operations Engineer:	<u>[Signature]</u>	<u>3/4/77</u>
Program Management:	<u>[Signature]</u>	<u>3/1/77</u>
Operational Propellant Committee:	<u>[Signature]</u>	<u>3/2/77</u>
RELEASED BY:	<u>C S Alshin</u>	<u>3-7-77</u>

<u>REVISION</u>	<u>DATE</u>	<u>DESCRIPTION</u>
A	7/2/76	Incorporates PCN's Basic-1, Basic-2, and Basic-3 and process improvements.
B	3/7/77	Incorporates PCN's A-2, A-3, A-4, A-6, A-8 and A-9 for process improvements.

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1.0 SCOPE

1.1 This procedure provides detailed instructions for the processing of a Loaded Cartridge P/N C11479-03-01.

2.0 SUPPORT REQUIREMENTS

2.1 EQUIPMENT AND MATERIALS

<u>Name</u>	<u>Part No.</u>	<u>CSD Stores No.</u>	<u>Qty.</u>
Heater, Portable	H-42	-	2 each
Hardware Prep. Dolly	7000-596 or 913	-	3
1,1,1, Trichloroethane	-	80015	A/R
Kraft Paper	-	72562	A/R
Cheesecloth	-	36086	A/R
Lower Oven Stand	7000-784	-	1
Adjustable Oven Stand	7000-783	-	1
Intra-Station Dolly	-	-	1
Loaded Case Lift Fixture	C10294	-	1
Valve - Laddish	-	-	1
Extension Tube	7200-192-252	-	1
Tube - Casting 6.0" Dia.	-	-	1
Casting Tube Assembly	C01642/C01714	-	1
Hose Extension	7000-168	-	1
6" Black Rubber Hose	-	80895	A/R
Vinyl Tape	-	80031	A/R
Valve Diaphragm	-	80917	A/R
Perchloroethylene	-	-	A/R
Polyethylene Sheet	-	72761	A/R
Casting Tooling Complete	C12026	-	1
80 Grit Sandpaper	-	-	A/R
Straddle Carrier	7000-911	-	1

2.2 DOCUMENTS

2.2.1 RequiredDrawingsTitle

C11479

Loaded Cartridge - ELSH

Specifications/FormsTitle

40GS-90404

Marking and Identification

Plans and ProceduresTitle

P.O.P. 6.14.1

H-42 Heater Operation

P.O.P. 6.9.2

Abrasive Cleaning of Hardware

P.O.P. 2.71.1

Start-Up

P.O.P. 2.91.5

Contaminated Tool Cleaning and Solvent
Reclamation Station 0650

P.O.P. 6.2.1

Weighing Techniques

2.2.2 Reference

None

2.3 EXTERNAL SUPPORT

None

3.0 SPECIAL CONSIDERATIONS

3.1 Follow all Station Safety Procedures.

3.2 All parts and materials shall have evidence of Q.C. Acceptance prior to use.

3.3 All operations shall be performed in the sequence presented. All out-of-sequence operations shall be accomplished using a Procedure Change Notice (PCN).

3.4 Operator, Area Foreman or Quality Assurance, as applicable, shall stamp only those operations for which a circle  is indicated in the OPER. or Q.A. columns. The date the operation is performed shall be entered beneath each respective stamp.

- 3.5 Changes to this procedure shall be accomplished by issuance of appropriate PCN's. PCN's shall be annotated at the affected operation within the body of the procedure.
- 3.6 Record all data per requirements of IQOP.
- 3.7 WARNING/CAUTION inserts are followed by special or safety instructions to be accomplished.
- 3.8 Grain Protectors (7001-002) should remain installed when the cartridge is being worked on. Dust Cover (7000-837) shall be installed on the cartridge whenever it is not being worked on.

NOTE

When Grain Protectors are not
in use, stack so that RTV'd
surfaces are protected.

- 3.9 All propellant Surface Spills Only shall be cleaned up immediately. In the event of a major spill, (i.e., propellant spilled onto oven floor), no attempt shall be made to clean up until cartridge has been removed from the area. Notify Health and Safety Engineering immediately of all major spills.
- 3.10 In raining or foggy weather, motor unit shall be covered with Polyethylene sheeting during outside operations, during installation in oven, and during casting tooling set up.
- 3.11 A static electricity grounding cable shall be connected to mix bowl trailer while it is at oven area.

4.0 PREREQUISITES

- 4.1 Verify that all drawings specified as required for the accomplishment of this procedure are valid and available for the work area.
- 4.2 Ensure all hoisting and lifting equipment associated with this procedure displays evidence of current certification.
- 4.3 Ensure all precision measurement equipment associated with this procedure displays evidence of current calibration status at time of use.
- 4.4 Station Foreman shall ensure that liner cure oven is clean and free of debris.
- 4.5 Operator shall read Hazardous Material Bulletin on 1,1,1, Trichloroethane and Methylene Chloride and Perchloroethylene.
- 4.6 Operator shall read Safety Regulation No. 19. (Airless and Compressed Air Spray Painting Operation.)

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5.1 CARTRIDGE PREPARATION (STATION 0210/0211)

- 5.1.2 Using Lift Fixture (CI0294) lift and place the empty cart-
ridge onto the Hardware Preparation Dolly. Remove the
Lift Fixture.

NOTE

5.1.3 Using 60-120 grit abrasive cloth, lightly sand inside surfaces of the insulated cartridge to remove all gloss and surface contaminants.

- 5.1.4 Cover Restrictor with Kraft paper.

- 5.1.5 Using clean cheesecloth dampened with clean 1,1,1, Trichloroethane solvent, thoroughly wash a 4-6 square foot area on insulation sidewall. Discard cheesecloth after wiping area. Rewipe area with a clean cloth dampened with 1,1,1, Trichloroethane. Repeat as necessary until cloth shows no sign of contamination. Sidewall insulation, and sidewall of the cartridge shall be cleaned from Aft to Forward, progressively by section, e.g., Aft insulation, cartridge sidewall.

NOTE

A slight yellowish discoloration of cloth is normal and should not be considered contamination.

- 5.1.6 Remove Kraft paper from restrictor.
- 5.1.7 If there are water spots on restrictor, remove by washing with detergent and rinse carefully with water prior to cleaning with solvent.
- 5.1.8 Wash restrictor with 1,1,1, Trichloroethane washing from O.D. to I.D. Wash a 4-6 square foot area, discard cheese-cloth after wiping area. Rewipe area with a clean cloth dampened with 1,1,1, Trichloroethane. Repeat as necessary until cloth shows no sign of contamination.

NOTE

A slight yellowish discoloration of cloth is normal and should not be considered contamination.

- 5.1.9 Visually inspect cleanliness of insulated surfaces.
- 5.2 LINER PREHEAT AND LINING (STATION 0210/0211)
- 5.2.1 Preheat cartridge at $215^{\circ}\text{F} \pm 10^{\circ}\text{F}$ - 0°C for a minimum of 120 hours. Record below:
- Time Started: _____ Temp: _____ $^{\circ}\text{F}$
- Time Ended: _____ Temp: _____ $^{\circ}\text{F}$
- 5.2.2 Cool cartridge to a surface temperature of $115^{\circ} \pm 15^{\circ}\text{F}$ prior to applying UTL-0040A Liner. Record surface temperature.
- Surface Temperature _____

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5.2.3 Q.C. verify the following application of UTL-0040A liner is to be applied following the sequential continuous completion of the 120 hour minimum pre-heat. Surface temperature of the cartridge is to be a minimum of 100°F to a maximum of 130°F, before the application of the UTL-0040A Liner.

5.2.4 Obtain Q.C. accepted UTL-0040A Liner and record Batch No. below.

Batch Number _____

5.2.5 Prepare all samples per IQOP 1.43.13.

5.2.6 Apply a coat of approximately 25 lbs. of UTL-0040A Liner to the entire inside surface of the cartridge and restrictor using new brushes as required (.020 liner on all surfaces).

NOTE

Keep the liner out of the lift holes.

5.2.7 Q.C. verify liner coat applied is between 20 to 30 lbs. and entire inside surface is completely covered.

Tare, Liner Gross Weight _____

Tare, Weighed Back _____

Net Liner Weight _____

AFQC



VERIFY

5.3 CASTING TOOLING PREPARATION AND INSTALLATION (STATION 0210/0211)

5.3.1 Using the Lift Fixture (C10794) lift the lined cartridge to a convenient working height.

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- 5.3.2 Ensure that the Plywood Ring (C12026-17-01) is removed from the Baseplate (C12026-01-01).
- 5.3.3 Lower the cartridge into the Baseplate (C12026-01-01).
- 5.3.4 Remove the Lift Fixture (C10294).
- 5.3.5 Wash down core with a clean white cloth dampened with 1,1,1, Trichloroethane. Spray or wipe the core with a solution of 25% Dow Corning High Vacuum Grease and 75% Methylene Chloride. At completion of spraying operations using three legged sling raise the core and check that the Fwd edge of the core that mates with the forward restrictor is free of dirt, liner, oil, etc. Lower this core over the three (3) alignment pins located in the Baseplate. Do not lower the core completely at this time.
- 5.3.6 Install the three (3) each Hold Down Rods (C12026-14-01).
- NOTE
- Do not tighten the Hold Down Nut at this time.
- 5.3.7 Lower core completely onto the restrictor. Remove the Three Legged Sling.
- 5.3.8 Lower the rounding ring into the Aft end of the motor case insuring that the three (3) holes in the core align with the three (3) lift holes in the rounding ring. These holes are used with the three (3) core alignment cables to center the core.
- 5.3.9 Remove the three (3) legged sling.

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5.3.10	Install the three (3) each Turnbuckle assemblies items 59, 61 and 62 of Dwg. C12026, used to hold the top rounding ring in position.	☐	
5.3.11	Install the three (3) each core centering cables item 42, 63 and 64 of Dwg. C12026.	☐	
5.3.12	Center the core within .060 inches and record below: 0° _____ 120° _____ 240° _____	☐	☐
5.3.13	Tighten the three core hold down nuts to snug.	☐	
5.3.14	Weigh the completed casting tooling assembly and record weight below. See CWR No. _____. Weight _____	☐	☐
5.3.15	Cover cartridge using polyethylene. Also cover samples as required.	☐	
5.3.16	Area Foreman or Working Leader and Q.C. review Operations 5.0 through 5.3.15 for proper and complete entries on each operation.	☐	☐
5.3.17	Transport cartridge to casting oven (Station 0980) and samples to Station 0560, using 5,000 lb. capacity truck or trailer.	☐	
5.4	PREPARATION OF CASTING OVEN (STATION 0980)		
5.4.1	OPEN door to oven shelter.		

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5.4.2	Move oven shelter away from oven.		
5.4.3	Check oven and stands for cleanliness and clean as required.	☐	
5.4.4	Adjust oven stand height to pin hole No. 11.	☐	
5.4.5	Ensure oven stand is level. Level as required.	☐	
5.4.6	Install work stands as required.		
5.5	INSTALLATION IN OVEN (STATION 0980)		
5.5.1	Center crane hook over cartridge. Place lifting eye over crane hook, lift the cartridge and place on the adjustable oven stand in designated area marked on stand. Disconnect and remove crane.	☐	
5.5.2	Ensure that core holddown rods are properly locked and the three (3) core centering cables are tight. Install core cover.	☐	
5.6	ASSEMBLY OF SIDE CASTING TOOLING (STATION 0980)		
	Install clean, assembled oven valve and Extension Tube (7200-192-252) as required.		
5.6.1	Assemble the 360° Casting Spider (C10053-24-31) with 30" tubes and 90° elbows and install over the top of the core.		

(PP0659)

- 5.6.2 Install the interior casting tooling consisting of one (1) 6.0" SS pipe with a 90° bend on one end, and one (1) 6.0" SS pipe long enough to center the opening of the 90° bend over the center of the 360° Casting Spider.
- 5.6.3 Install casting line support under spider.
- 5.6.4 Mask all clamps, nuts, and threaded portions of clamps, and core centering cables with vinyl tape as required to protect threaded areas.
- 5.6.5 Install casting height indicators (4) equally spaced around rounding ring.
- 5.6.6 Ensure that internal casting tooling is secure.
- 5.6.7 Install 6" diameter metal cap on inlet of oven valve and secure.
- 5.6.8 Ensure that oven/oven lid mating interfaces are free of foreign particles.
- 5.6.9 Clean both sides of each oven lid sight glasses with glass cleaner.
- 5.6.10 Q.C. check centering of core at three (3) equally spaced angular locations and record.

0° _____

120° _____

240° _____

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- 5.6.11 Immediately prior to oven lid installation, Area Foreman make inspection of the lined cartridge for visible signs of contamination. Area Foreman or Working Leader to record oven being used, time and date when the lined cartridge was installed in the oven. Notify Project Engineer if contamination exists.

OVEN NO: _____

TIME _____ DATE _____

- 5.6.12 Install oven lid, checking position of guide lugs. Allow slings to go slack.

- 5.6.13 Disconnect hoist from oven lid and position hoist away from oven.

- 5.6.14 Connect oven lamp system and turn oven lamps ON.

- 5.7 PREHEAT AND LINER CURE (STATION 0980)

- 5.7.1 CLOSE vent valves.

- 5.7.2 Turn air circulation fan ON.

- 5.7.3 Install oven recorder charts and mark significant start and stop times as they occur. Record cartridge serial number and data on recorder chart. Change charts daily. Add appropriate completed oven charts to this IQOP.

- 5.7.4 For preheat set temperature controller to 140°F. Set temperature control on In-Line Heater to 200°F.

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- 5.7.5 Preheat cartridge for 15-17 hours to cure the UTL-0040A Liner at $140^{\circ} \pm 10^{\circ}\text{F}$. Hold in oven at 130°F - 150°F for no more than 24 hours prior to casting propellant. Liner cure and preheat to start at time oven reaches $140^{\circ} \pm 10^{\circ}\text{F}$. Record the following:

<u>IN</u>		<u>OUT</u>	
TIME:	DATE:	TIME:	DATE:

OVEN TEMP: _____

- 5.7.6 Assure no foreign objects on liner or restrictor. Notify Project Engineer of any objects.

NOTE

Casting must start within 24 hours of completion cure.

- 5.7.7 Turn oven fan OFF, prior to start of vacuum.
- 5.7.8 Close oven valve.
- 5.7.9 OPEN oven vacuum valve.
- 5.7.10 Turn vacuum pump ON.
- 5.7.11 Pull vacuum in oven to a minimum of 75 mm Hg (or less) and record _____.
- 5.7.12 Project Engineer examine lined cartridge while under vacuum to determine if unbonds exist as demonstrated by bubbles under the sidewall insulation. If bubbles exist, DOCUMENT the event.

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NOTE

NOTE

5.8.1 Prepare mix bowl and propellant samples per IQOP and P.O.P
6.8.1.

5.8.2 Remove the 6" diameter metal cap from oven valve and install black rubber hose assembly consisting of 2 each 6" Laddish ferrule and _____" of rubber hose clamped to ferrule.

5.8.3 Install the 6" diameter metal cap on open end of black rubber hose assembly.

5.8.4 Position mix bowl adjacent to oven to allow connection of casting line.

NOTE

Install grounding strap.

F-124

(PP0695)

5.8.6 Receive Q.C. Lab acceptance of each propellant batch from Area Foreman prior to casting. After Q.C. Batch Acceptance is received, begin casting. Record propellant batch data below.

WARNING

Do not exceed 15 psi on 400 gallon
mix bowl.

[illegible]

5.8.7 Connect station air line to mix bowl pressure lid and slowly pressurize mix bowl to approximately 15 psig. Do not exceed allowable pressure of 15 psig.

5.8.8 Connect station air line to mix bowl discharge valve air motor open line fitting.

5.8.8.1 Disengage lock on discharge valve located under bowl.

5.8.9 OPEN oven valve.

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- 5.8.10 OPEN mix bowl discharge valve.

NOTE

Do not turn on air at this time.

- 5.8.12 Observe propellant flow and cast until mix bowl is empty or until propellant reaches the bottom of the casting level indicator.

NOTE

Rubber hose will collapse when bowl is empty.

- 5.8.13 CLOSE mix bowl discharge valve. Remove air line.

- 5.8.13.1 Lock mix bowl discharge valve.

- 5.8.14 CLOSE oven valve.

- 5.8.15 On final batch complete Step No. 5.9.3 before disconnecting propellant pot.

- 5.8.16 Disconnect air line from mix bowl pressure lid and open vent valve.

- 5.8.17 Disconnect casting line from mix bowl discharge tube.

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- 5.8.18 Install 6" diameter metal cap on casting line.

- 5.8.19 Install 6" diameter metal cap on mix bowl discharge tube and send mix bowl to Station 0650 and recycle per P.O.P. 2.91.5.

- 5.8.20 Repeat Steps 5.8.1 through 5.8.19 until cartridge unit is cast to bottom of casting height indicator.

NOTE

Retain last mix bowl at oven for possible propellant top-off requirements.

- ## 5.9 POST-CASTING OPERATIONS (STATION 0980)

- 5.9.1 Close vacuum valve. Turn vacuum pump OFF. OPEN oven vent valve.

NOTE

Hand operated vent valve at oven
may be used to vent oven.

CAUTION

Prior to removing oven lid, vacuum must be released and oven light cord must be disconnected.

NOTE

When removing oven lid during rain, protect cartridge by raising lid sufficiently to allow a sheet of plastic tarp (clean and dry) to be placed over the component. After the grain is protected, remove the lid and move the shelter over the oven. Conduct all finishing operations under the protection of the shelter. Use only conductive plastic sheeting to cover loaded components.

(PP0659)

- 5.9.2 Remove oven lid. Position oven lid on wooden blocks adjacent to oven in designated area.
- 5.9.3 Ensure that propellant is cast to + _____ + _____ inches below the top of the cartridge rounding ring. If more propellant is required add, using side casting system. Do not use propellant that has been scraped from the sides of the pot or the casting lines. Disconnect mix bowl.

NOTE

Remove excess propellant using non-metallic tools.

- 5.9.4 OPEN RKL valve.
- 5.9.5 Remove casting tube assembly, oven valve, open extension tube, casting height indicator, core cover, 360° casting spider, and masking on core centering cables.
 - 5.9.5.1 Install 10" diameter metal cap on oven casting line port.

CAUTION

To avoid trapping air when troweling propellant, jiggle the trowel as it moves over the propellant surface. Do not drag the trowel to cause folding of the propellant.

- 5.9.6 Trowel propellant surface smooth and level to _____ + _____" below the top surface of the cartridge rounding ring. Provide 360° propellant fillet ½" high minimum at sidewall interface.

5.10 CURING IN OVEN (STATION 0980)

NOTE

For those operation steps not complied with (due to different types of cure) N/A operation step circle.

5.10.1 Install oven lid, checking position of guide lugs.

5.10.2 Start up oven per Station P.O.P. 2.71.1.

5.10.3 Cure propellant a total of 240 ± 12 hours at $140^{\circ}\text{F} \pm 10^{\circ}\text{F}$.
(Cure time starts when oven temperature reaches a minimum of 130°F .)

OVEN USED: _____

TIME IN: _____ TEMP: _____ $^{\circ}\text{F}$ TIME OUT: _____ TEMP: _____ $^{\circ}\text{F}$

5.11 CARTRIDGE REMOVAL FROM OVEN (STATION 0980)

5.11.1 Using crane, remove oven lid as required.

CAUTION

When removing oven lid during rain, protect cartridge by raising lid sufficiently to allow a sheet of plastic tarp (clean and dry) to be placed over component. After the grain is protected, remove the lid and move the oven shelter over the oven for protection. Conduct all finishing operations under the protection of the shelter. Use only conductive plastic sheeting to cover loaded components.

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- 5.11.2 Check lifting eye for propellant. Clean if required.
- 5.11.3 Center crane hook over cartridge. Place lifting eye over crane hook. Lift and remove cartridge from oven.
- 5.12 CURING IN CURE CONTAINER (STATION 0980)
- 5.12.1 Transfer segment to cure container immediately after casting and troweling propellant if cartridge is to be container cured.
- 5.12.2 Connect oven thermocouple and verify proper operation of thermocouple and temperature recording equipment.
- 5.12.3 Install cartridge in cure and shipping container base. Disconnect and remove crane. Level cartridge with 6 foot carpenter level. Retrowel propellant surface to a smooth, level finish as required. Using 7000-923 lift fixture and crane install container side on base with an outlet 180° from air inlet on base. Remove lift fixture.
- 5.12.4 Hook-up and operate H-42 heater per P.O.P. 6.14.1.
- 5.12.5 Cure a total of 240 ± 12 hours at $140^{\circ}\text{F} \pm 10^{\circ}\text{F}$. Cure starts when container temperature reaches 130°F .
- CONTAINER LOCATION: _____
- TIME START: _____ TEMP: _____ °F
- TIME COMPLETED: _____ TEMP: _____ °F
- 5.12.6 Remove cure container sides with 7000-923 lift fixture and crane and place approximately one-half way between ovens 0981 and 0982.

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- 5.12.7 Q.C. review records and assure that propellant was cured
240 $\pm$ 12 hours at 140°F $\pm$ 10°F.
- 5.13 COOL DOWN (STATION 0980)
- 5.13.1 Cool down starts when temperature controller is changed to
a 75°F setting or cartridge is removed from oven or Cure
Container.
- 5.13.2 Total cartridge cool down cycle is 8 hours minimum.
TIME START: _____ TEMP: _____ °F
TIME COMPLETE: _____ TEMP: _____ °F
- 5.14 WEIGHING OPERATIONS (STATION 0211)
- 5.14.1 Using a crane lift the loaded cartridge to a sufficient
height so that a low boy trailer may be positioned under
the loaded cartridge. Lower the cartridge onto the
trailer and secure. Remove crane.
- CAUTION**
- Lift to be straight and vertical
so as to minimize side load forces
on the lift pin bolts.
- 5.14.2 Transport the loaded cartridge to Station 0211 between
1630 - 0700 hours on normal working days. Non-working
days, transportation may be accomplished at Area Fore-
man's request.
- 5.14.3 Using a crane lift the loaded cartridge straight up to a
sufficient height so that the low boy trailer may be
removed. Move and position the cartridge over the floor
scale and lower. Remove crane.

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- 5.14.4 Place in center of scale and disconnect cartridge from crane. Weigh loaded cartridge rounding ring, casting base and core assembly attached. Q.C. observe weighing and verify configuration is same as in Operation 5.3.16. Concur on weight. Area Foreman or Working Leader and Q.C. complete CWR and verify the following:

Record Weight below:

CWR No. _____ Propellant Weight _____ LBS.

- 5.14.5 Using crane lift the loaded cartridge and move to a location where the trailer may be positioned.

- 5.14.6 Lift the loaded cartridge to a sufficient height so that a low boy trailer may be positioned under the loaded cartridge. Lower the cartridge onto the trailer and secure. Remove crane.

CAUTION

Lift to be straight and vertical
so as to minimize side load forces
on the lift pin bolts.

- 5.14.7 Transport the loaded cartridge to stripping pad at Station 0453.

- 5.14.8 Using a crane lift the loaded cartridge straight up to a sufficient height so that the low boy trailer may be removed. Lower the cartridge. Remove crane.

- 5.15 STRIPPING, TRIMMING, INSPECTION AND STORAGE (STATION 0453)

WARNING

A maximum of 5 personnel allowed
during core removal, stripping and
trimming operations. Only 1 unit
at one time on strip pad 0453.

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- 5.15.1 Remove propellant from the threaded ends of the three each core stabilizer cables before removing nuts. Remove all tape and propellant splatter.
- 5.15.2 Remove three each core stabilizer cables.
- 5.15.3 Back off the three (3) each core hold down nuts (C12026-51).
- 5.15.4 Raise the core hold down rods approximately 4.0" by turning counter clockwise and hold in place with the core hold down nuts.
- 5.15.5 Remove the pins from the core hold down rods and tape to rods.
- CAUTION**
- Do not exceed 9,000 pounds. If core does not come loose at 9,000 pounds proceed with Step 5.15.7.
- 5.15.6 Using crane with a crane scale plus 3-legged handling sling with a 9,000 pound capacity, remove the core.
- NOTE**
- If core comes free N/A Step 5.15.7 through 5.15.14.
- 5.15.7 Attach hydraulic cylinder assembly (composed of items C12026-66 and C12026-33) over the 3 hold down rods and secure in place using 3 core hold down nuts (C12026-51).
- 5.15.8 Attach hydraulic power unit to hydraulic fitting on hydraulic cylinder.

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5.15.8.1 Make gauge mark on core at grain level.

CAUTION

Do not exceed a hydraulic pressure of 6,000 psig during core removal operation. If the core does not release after 15 minutes, contact Process Engineer.

5.15.9 Slowly apply hydraulic pressure to the core in steps of 500 psig. Holding for 15 minutes between steps until a hydraulic pressure of 6,000 psig is obtained. Release hydraulic pressure and again slowly increase pressure to 6,000 psig. When core comes loose, gauge mark will be approximately $1\frac{1}{2}$ " to $2\frac{1}{2}$ " above the grain surface. Record PSI force required to release the core from the propellant and the time.

PSI _____ TIME _____

CAUTION

Care must be exercised to prevent contamination by hydraulic fluid.

5.15.10 Release hydraulic pressure by moving fluid directional flow selector to opposite position.

5.15.11 Disconnect hydraulic lines and replace cap protectors in snap-tite fittings.

5.15.12 Coil hydraulic lines and replace on rack for future use.

5.15.13 Remove the 3 core hold down nuts securing the hydraulic cylinder assembly. Remove the hydraulic cylinder assembly.

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- 5.15.14 Using the overhead crane with a crane scale, 3-legged handling sling, remove the core.

CAUTION

Do not exceed 9,000 pounds with sling attached. If core does not come loose at 9,000 pounds notify Process Engineer.

- 5.15.15 Secure core on core pallet. Remove crane and handling sling.

- 5.15.16 Record the following:

CORE REMOVED: DATE: _____ TIME: _____

CAUTION

Extreme care must be exercised to prevent damage to teflon coating.

NOTE

Rounding ring, baseplate, "O" Ring and core cleaning and storage may be completed at anytime prior to completion of Step 5.16.5.

- 5.15.17 Using non-metallic scrapers and 1,1,1, Trichloroethane, remove all propellant from core and wipe clean with cheese cloth dampened with 1,1,1, Trichloroethane. Return core to GPAO or Station 0211 for storage.

- 5.15.17.1 Release turnbuckles on 3 each cables securing rounding ring to baseplate. Remove cables at rounding ring.

- 5.15.18 Using overhead crane with 3-legged sling, lift and remove the top rounding ring (C12026-12-01), clean rounding ring, and return to Station 0210 or storage.

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- 5.15.19 Clean off propellant splashings on case insulation.
- 5.15.20 Trim flashings from bore interface until level with aft propellant surface.
- 5.15.21 Install Lift Fixture (C10294) on crane. Center lift fixture cartridge and lower until pins will engage holes in cartridge. Lock pins in place. Lift cartridge until it clears center post of baseplate.
- 5.15.22 Position 6 each 18" x 24" blocks, double stacked in 3 equal spaces under cartridge. Lower until cartridge touches blocks.
- 5.15.23 Remove rubber restrictor .3" $\pm$.1" inboard of propellant bore using Boning Knife and upward strokes. Clean as required. Cognizant Engineer to be present during operation.
- 5.15.24 Examine all exposed propellant surfaces for raised or depressed areas. Areas 1.0" or less in diameter are to be left undisturbed. All raised or depressed areas of greater than 1.0" in diameter are to be explored, trimmed, and blended.
- 5.15.25 Visually inspect for bonding separation between propellant and liner.
- 5.15.26 Visually inspect for cracking or voids. No cracks allowed. No voids with a dimension greater than 1.0 inch allowed.

AFQC



VERIFY

AFQC



VERIFY

OPER	Q.A.

5.15.27 Measure and record:

	<u>0°</u>	<u>90°</u>	
Bore DIA:	_____	_____	Fwd
	_____	_____	Center
	_____	_____	Aft
	<u>0°</u>	<u>90°</u>	<u>180°</u> <u>270°</u>
Grain Length	_____	_____	_____

5.16 POTTING AFT RESTRICTOR AND STORAGE (STATION 0451)

5.16.1 Place loaded cartridge on a C10295 Shipping Base. Install four (4) each tie down cables and tighten turnbuckles until cables are snug.,

5.16.2 Using a 6' carpenter level cartridge shim between shipping base and pad as required to level cartridge. Release and remove lift fixture with crane. Move lift fixture to a designated area.

5.16.3 Install Zinc Chromate putty at the top surface of the propellant at the Bore interface. Using crane with 3-legged sling, install the C12031-01-01 core into the Aft propellant perforation. Remove the crane and excess Zinc Chromate putty as required.

5.16.4 Clean the top surface of the propellant and the sidewall installation using clean cheesecloth dampened with clean 1,1,1, Trichloroethane. Repeat as necessary until cloth shows no sign of contamination.

5.16.4 Prepare sufficient batches of AL-227-70 Potting Compound in the Ross Mixer per 1.43.14.

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- 5.16.6 Pour the Potting Compound onto the top of the propellant until a depth of 7.25 to 7.45 below the top of the cartridge is reached.

NOTE

Pour so that a minimum of splatter occurs.

Record Batch Numbers of the AL-227-70.

Date _____ Batch No. _____

Date _____ Batch No. _____

Date _____ Batch No. _____

Date _____ Batch No. _____

Date _____ Batch No. _____

Date _____ Batch No. _____

Cure the AL-227-70 Potting Compound for a minimum of eight (8) hours at $70^{\circ}\text{F} \pm 30^{\circ}\text{F}$.

Time Start: _____ Date: _____

Time Complete: _____ Date: _____

- 5.16.7 At completion of cure, lift and remove the core. Clean the core of all AL-227-70 and Zinc Chromate putty. Remove all the Zinc Chromate putty from the propellant surface as required.
- 5.16.8 Secure the core on the core handling pallet and return to Station 0210.
- 5.16.9 Install the Plywood Disk Dam onto the top of the cured AL-227-70 and center as required. Place weight on top of the plywood disk.

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- 5.16.10 Prepare sufficient batches of AL-227-70 Potting Compound in the Ross Mixer per 1.43.14.

- 5.16.11 Pour the Potting Compound between the case insulating and the plywood disk until the level of the AL-227-70 reaches the top of the plywood disk.

Record Batch Number of the AL-227-70.

Date _____ Batch No. _____

Date _____ Batch No. _____

- 5.16.12 At completion of cure lift and remove the plywood disk. Clean as required to remove all cured AL-227-70 Potting Compound.

- 5.16.13 Lift and center C010294 lift fixture over cartridge and lower until pins will engage holes in cartridge. Lock pins in place. Lift and place cartridge with shipping base attached on a 26,000 lb. min. capacity trailer. Disconnect crane from lift fixture. Secure cartridge to trailer. Move trailer to pad 0451.

- 5.16.14 Center crane over lift fixture and attach crane to shackle on lift fixture. Lift and remove cartridge from trailer and place on pad. Release lift fixture from cartridge and remove with crane. Move lift fixture to designated area and disconnect from crane.

- 5.16.15 Cover top of cartridge with a 10' x 10' sheet of velostat. Secure with tape. Place plywood shipping cover on top of cartridge and cover with a 12' x 12' poly sheet. Secure with tape.

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SECURING

Area Foreman, Q.C. and Process Engineer review entire procedure. Verify all operations have been completed, proper and complete entries have been made, all items and associated paperwork have completed action of dispositions and acceptance.

APPENDIX

APPENDIX G

OPERATIONS AND QUALITY RECORD/INTEGRATED QUALITY
AND OPERATIONS PROCEDURE - P/N C12185

OPERATIONS AND QUALITY RECORD

☒ O&QR

☐ CHANGE ORDER

☐ IDR PLAN

REL. NO.

PAGE 1

of 4

PART NO. C12185-01-01	TITLE LOADED CARTRIDGE - 84" CHAR MOTOR	QTY. 1	SERIAL NO.	PLAN REV. N/C
PLANNER	DATE	ENGINEER	DATE	QUALITY ASSURANCE DATE
		E. Sackman 4/2/76		E. Sackman 4/2/76
CONFIGURATION AUTHORITY N/A	CHANGE ORDER RECORD			NEXT ASSY-END ITEM N/A
			WOR NO.	

OPER. NO.	OPERATIONS	COMPL. STAMP
	QR/IDR Record	

GENERAL INSTRUCTIONS

A. This O&QR provides the authority and attached documentation for processing a 84" Char Motor P/N C12185-01-01 for Contract F04611-76-C-0010.

B. APPLICABLE DOCUMENTS

<u>Drawings</u>	<u>Rev.</u>	<u>ECO</u>	<u>Title</u>
C12185	N/C	19832,19837 19858,19894	84" Char Motor - Loaded
<u>Plans and Procedures</u>		20017,20124 20121,20161	
<u>IQOP</u>	<u>Rev.</u>	<u>PCN</u>	<u>Title</u>
1.43.16 (PP0672)	B	None	Loaded Cartridge - 84" Char Motor
<u>P.O.P.</u>	<u>Rev.</u>	<u>PCN</u>	<u>Title</u>
2.91.5	C	None	Contaminated Tool Cleaning and Solvent Reclamation Station 0650
6.2.1	A	None	Weighing Techniques
6.9.2	A	None	Abrasive Cleaning of Hardware
<u>Specifications</u>	<u>Rev.</u>	<u>ECO</u>	<u>Title</u>
40GS-90404	G	None	Marking and Identification
<u>Reference</u>			
<u>IQOP</u>	<u>Rev.</u>	<u>PCN</u>	<u>Title</u>
1.43.22 (PP0678)	A	None	Fuel Master Batch UTP-18803A
1.43.12 (PP0668)	C	None	UTP-18803A Propellant Mixing (400 Gallon Mix)

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OPERATIONS AND QUALITY RECORD

CONTINUATION SHEET

REL NO.	PAGE 2
	OF 4

PART NO. C12185-01-01	PLAN REV. N/C
--------------------------	------------------

OPER. NO.	OPERATIONS	COMPL. STAMP
	C. Station Foreman coordinate all parts and material requisitioning and transportation requirements through completion. D. All temperature recording charts are to be identified with P/N, S/N and Date. All Start and Stop times are to be clearly identified. All Charts are to be attached to O&QR upon completion. E. All operations performed shall be performed within the scope of the CSD Safety Manual. F. All parts, components and materials shall have evidence of Quality Assurance Acceptance prior to issue to Process Operations. G. Operator, Area Foreman or Quality Assurance, as applicable shall stamp only those operations for which a circle  is indicated on the Completion Stamp column. H. Area Foreman notify Quality Control at least two (2) hours prior to commencing all operation stamps identified with AF/Customer Mandatory Symbol with the following exceptions. AFOG  VERIFY 4 Hours notification prior to end of 1st shift for all second shift, weekend and Holiday operations J. All weighing operations to be documented as called out in the body of IQOP.	

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OPERATIONS AND QUALITY RECORD

CONTINUATION SHEET

REL. NO.	PAGE 3 OF 4
PART NO. C12185-01-01	PLAN REV. N/C

PER. O.	OPERATIONS	COMPL. STAMP
10	(2210) Obtain Parts, Components and Materials, listed on Configured Parts List, from GPAO and/or Company Stores.	☐
20	(2210) Process Loaded Cartridge in accordance with IQOP 1.43.16 in its entirety.	☐
30	(2210) Process Engineer verify Loaded Cartridge P/N C12185-01-01 process was in accordance with IQOP 1.43.16 and is acceptable.	☐
40	(8110) Quality Assurance verify all acceptance data is complete and acceptable.	☐
50	(2210) Area Supervisor forward completed Planning Package to Process Engineering (Small Motor Programs), Building 1240.	☐
60	(2230) Upon completion of review forward complete Planning Package to Production Control, Building 1240.	☐
70	(2122) Production Control forward completed Planning Package to Data Acceptance Center, Building 0010.	☐

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REL NO	REL DATE	PAGE 4 OF 4
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PART NO		TITLE		SERIAL NO		PLAN REV.	
C12185-01-01		LOADED CARTRIDGE - 84" CHAR MOTOR				N/C	
QTY TO MAKE	ACCT NO	ORGN. NO.	W.O.R. NO.	DELIVER TO	BLDG.	ROOM	M C INIT
1							
MAT'L ISSUE BY		MAT'L ISSUE BY		MAT'L ISSUE BY		MAT'L REC BY	
		N/A		N/A			
SR CONT NO.		SR CONT NO		SR CONT NO		OPER. VER.	
		N/A		N/A			

STORE RM/LOC	QTY REQ	U/I	STOCK NO./PART NO.	MAJOR NOUN/DESCRIPTION	DWG SPEC REV	ECO'S	SERIAL/LOT QCTRACE NO.	EXT. QTY	QTY ISS
	1	EA	C08702-02-01	Cartridge - Insulated	B	-			
	AR		UTL-0040A	Liner (SE0721)					
	AR		UTP-18803A	Propellant (SE0719)					
	AR		AL-60	Potting Compound					
	AR		M-47-4	Cloth, Tape 9 oz.					
	AR		M-22	Resin, Polyster ISOPHTHALIC					



**UNITED
TECHNOLOGIES.. CHEMICAL SYSTEMS DIVISION**

INTEGRATED QUALITY AND OPERATIONS PROCEDURE

LOADED CARTRIDGE PROCESSING - 84" CHAR

EFFECTIVITY:	<u>NAME</u>	<u>DATE</u>
Rel. No. _____		
OPERATIONS PLANNER/WRITER:	<u><i>[Signature]</i></u>	<u>2/9/77</u>
APPROVED BY:		
Safety Engineering:	<u><i>[Signature]</i></u>	<u>2-11-77</u>
Quality Assurance:	<u><i>[Signature]</i></u>	<u>2/10/77</u>
Project Engineer:	<u><i>John C Baldwin</i></u>	<u>20 Feb 77</u>
Operations Engineer:	<u><i>E. Sacchara</i></u>	<u>3/4/77</u>
Program Management:	<u><i>W.A. Stephens</i></u>	<u>3/1/77</u>
Operational Propellant Committee:	<u><i>[Signature]</i></u>	<u>3/4/77</u>
RELEASED BY:	<u><i>C.S. [Signature]</i></u>	<u>3-7-77</u>

<u>REVISION</u>	<u>DATE</u>	<u>DESCRIPTION</u>
A	7/20/76	Completely revised for processing improvements and tooling.
B	3/7/77	Incorporates PCN's A-1, A-2, A-3, A-4, and A-8 for process improvements.

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1.0 SCOPE

1.1 This procedure provides detailed instructions for the processing of a Loaded Cartridge P/N C12185-01-01.

2.0 SUPPORT REQUIREMENTS

2.1	<u>Name</u>	<u>Part No.</u>	<u>CSD Stores No.</u>	<u>Qty.</u>
	Heater, Portable	H-42	-	2 each
	Hardware Prep. Dolly	7000-596 or 913	-	3
	1,1,1, Trichloroethane	-	80015	A/R
	Kraft Paper	-	72562	A/R
	Cheesecloth	-	36086	A/R
	Lower Oven Stand	7000-784	-	1
	Adjustable Oven Stand	7000-783	-	1
	Intra-Station Dolly	-	-	1
	Loaded Case Lift Fixture	C09489	-	1
	Valve	7200-168	-	1
	Tube-Casting 6.0" Dia.	-	-	1
	Casting Tube Assembly	C06142/C01714	-	1
	Hose Extension	7000-168	-	1
	6" Black Rubber Hose	-	80895	A/R
	Vinyl Tape	-	-	A/R
	Perchloroethylene	-	-	A/R
	Polyethylene Sheet	-	72761	A/R
	Casting Tooling Complete	C12239	-	1
	80 Grit Sandpaper	-	-	A/R
	Straddle Carrier	7000-911	-	1
	Lift Fixture	7000-508	-	1

2.2 DOCUMENTS

2.2.1 RequiredDrawingsTitle

C12185

Loaded Cartridge - CHAR

Specifications/FormsTitle

SEO 719

Propellant - UTP-18803A

SEO 721

Liner, UTL-0040A

40CS-90404

Marking and Identification

Plans and ProceduresTitle

P.O.P. 6.14.1

H-42 Heater Operation

P.O.P. 6.9.2

Abrasive Cleaning of Hardware

P.O.P. 2.71.1

Start-Up

P.O.P. 2.91.5

Contaminated Tool Cleaning and Solvent
Reclamation Station 0650

P.O.P. 6.2.1

Weighing Techniques

P.O.P. 2.1.2

Straddle Carrier Operation

2.2.2 Reference

None

2.3 EXTERNAL SUPPORT

None

3.0 SPECIAL CONSIDERATIONS

3.1 Follow all Station Safety Procedures.

3.2 All parts and materials shall have evidence of Q.C. Acceptance
prior to use.3.3 All operations shall be performed in the sequence presented. All
out-of-sequence operations shall be accomplished using a Procedure
Change Notice (PCN).3.4 Operator, Area Foreman or Quality Assurance, as applicable, shall
stamp only those operations for which a circle  is indicated
in the OPER. or Q.A. columns. The date the operation is
performed shall be entered beneath each respective stamp.

- 3.5 Changes to this procedure shall be accomplished by issuance of appropriate PCN's. PCN's shall be annotated at the affected operation within the body of the procedure.
- 3.6 Record all data per requirements of IQOP.
- 3.7 WARNING/CAUTION inserts are followed by special or safety instructions to be accomplished.
- 3.8 Grain Protectors (7001-002) should remain installed with the cartridge is being worked on. Dust Cover (7000-837) shall be installed on the cartridge whenever it is not being worked on.

NOTE

When Grain Protectors are not in use, stack so that RTV'd surfaces are protected.

- 3.9 All propellant Surface Spills Only shall be cleaned up immediately. In the event of a major spill, (i.e., propellant spilled onto oven floor), no attempt shall be made to clean up until cartridge has been removed from the area. Notify Health and Safety Engineering immediately of all major spills.
- 3.10 In raining or foggy weather, motor unit shall be covered with Polyethylene sheeting during outside operations, during installation in oven, and during casting tooling set-up.
- 3.11 A static electricity grounding cable shall be connected to mix bowl trailer while it is at oven area.

4.0

PREREQUISITES

- 4.1 Verify that all drawings specified as required for the accomplishment of this procedure are valid and available for the work area.
- 4.2 Ensure all hoisting and lifting equipment associated with this procedure displays evidence of current certification.
- 4.3 Ensure all precision measurement equipment associated with this procedure displays evidence of current calibration status at time of use.
- 4.4 Station Foreman shall ensure that liner cure oven is clean and free of debris.
- 4.5 Operator shall read Hazardous Material Bulletin on 1,1,1, Trichloroethane and Methylene Chloride and Perchloroethylene.
- 4.6 Operator shall read Safety Regulation No. 19. (Airless and Compressed Air Spray Painting operation.)

5.0 DETAILED OPERATIONS

5.1 CARTRIDGE PREPARATION

- 5.1.1 Area Foreman verify receipt of Cartridge P/N C08702-02-01 and record Serial Number _____. Visually check insulation for irregularities. Any irregularities noted at anytime during processing operations shall be reported to the cognizant Process Engineer immediately.
- 5.1.2 Install the Liner Table (7000-847) on Hardware Preparation Dolly. Cover the outside diameter of the table with Mylar Sheet.
- 5.1.3 Using Lift Fixture (C09489) lift and place the empty cartridge onto the Liner Table. Remove the Lift Fixture.
- 5.1.4 Using 60-120 grit abrasive cloth, lightly sand inside surfaces of the insulated cartridge to remove all gloss and surface contaminant.
- 5.1.5 Using clean cheesecloth dampened with clean 1,1,1, Trichloroethane solvent, thoroughly wash a 4-6 square foot area on Insulation sidewall. Discard cheesecloth after wiping area. Rewipe area with a clean cloth dampened with 1,1,1, Trichloroethane. Repeat as necessary until cloth shows no sign of contamination. Sidewall insulation, and sidewall of the cartridge shall be cleaned from Aft to Forward, progressively by section, e.g., Aft insulation, cartridge sidewall.

NOTE

A slight yellowish discoloration of cloth is normal and should not be considered contamination.

- 5.1.6 Visually inspect cleanliness of insulated surfaces with cartridge on Liner Baseplate.

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- 5.1.7 Allow Case to dry at room temperature for a minimum of 30 minutes.

NOTE

Avoid contaminating with Polyester Resin all surfaces not involved in bonding.

- 5.1.8 Weigh out 907 grams of Polyester Resin (M-22) into a clean container. Add 14 grams of MEKP Catalyst and mix thoroughly.
- 5.1.9 Carefully brush resin on inner wall of Cartridge in area where cloth tape will be bonded. Bonded surface will be $1.75 \pm .25$ inches in length from lower end of Cartridge.
- 5.1.10 Press cloth tape into place, then brush surface of tape with resin, removing excess with clean cloth.
- 5.1.11 Cure polyester bond for 2 hours minimum at $140^{\circ} \pm 30^{\circ}\text{F}$. Record below:
- Time In: _____ Temp: _____ $^{\circ}\text{F}$
- Time Out: _____ Temp: _____ $^{\circ}\text{F}$
- 5.1.12 Upon completion of cure, roughen resin surface on tape using 180 grit paper.
- 5.1.13 Wipe roughened surface with clean cloth dampened with 1,1,1, Trichloroethane.
- 5.1.14 Allow to dry for a minimum of 30 minutes at room temperature.

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5.1.15 Q.C. visually inspect. Verify no evidence of contamination and/or foreign material.

5.1.16 Rubber stamp part number of Motor (C12185-01-01) longitudinally on exterior of Case approximately 28" from Aft end using $\frac{1}{2}$ " high characters. (Ref:  of Dwg. C12185.)

5.2 LINER PREHEAT AND LINING

5.2.1 Preheat cartridge at 210°F $+10^{\circ}\text{F}$ - 0°F for a minimum of 120 hours. Record below:

Time Started: _____ Temp: _____ °F

Time Ended: _____ Temp: _____ °F

5.2.2 Cool cartridge to a surface temperature of 115° $\pm$ 15°F prior to applying UTL-0040A Liner. Record surface temperature.

Surface Temperature _____

5.2.3 Q.C. verify the following application of UTL-0040A liner is to be applied following the sequential continuous completion of the 120 hour min. pre-heat. Surface temperature of the cartridge is to be a minimum of 100°F to a maximum of 130°F, before the application of the UTL-0040A Liner.

5.2.4 Obtain Q.C. accepted UTL-0040A liner and record batch no. below.

Batch Number _____

5.2.5 Prepare all samples per IQOP 1.43.13.

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- 5.2.6 Apply a coat of approximately 20 lbs. of UTL-0040A liner to the entire inside surface of the cartridge and restrictor using new brushes as required (.020 liner on all surfaces).

NOTE

Keep the liner out of the lift holes.

- 5.2.7 Q.C. verify liner coat applied is between 10 to 25 lbs. and entire inside surface is completely covered.

Tare, Liner Gross Weight _____

Tare, Weighed Back _____

Net Liner Weight _____

- 5.2.8 Using Lift Fixture (C09489) lift the cartridge to a convenient working height.

- 5.2.9 Apply a continuous strip of vinyl tape to the bottom surface of the cartridge only.

- 5.2.10 Apply a continuous bead of Silicone Rubber (RTV-102) to the bottom surface of the Vinyl Tape. Allow the Silicone Rubber to become partially set.

- 5.2.11 Install four (4) each $\frac{1}{2}$ -12 Pipe Plugs into the four (4) holes located in the baseplate. (Install the plugs from the bottom side of the Baseplate.)

- 5.2.12 Install a continuous bead of Silicone Rubber to the base of Item 69 (AL-60 Casting Mandrel). Install the Mandrel onto the Casting Base and secure using 4 each 1-8 bolts. Remove all excess Silicone Rubber out from around the Mandrel.

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- 5.2.13 Lift and lower the cartridge into the C12239 Baseplate. Remove the lift fixture.
- 5.2.14 Using a three legged sling lift the Top Rounding Ring (C12239-15-01) and install over the Aft end of the cartridge insuring that the three (3) lift holes align with the three (3) eye bolts in the Baseplate. Remove the three legged sling.
- 5.2.15 Install the three (3) each Turnbuckle Assemblies Items 59, 63, 61 and 62 of Dwg. C12239, used to hold the Top Rounding Ring in position.
- 5.3 RESTRICTOR POTTING AND CORE INSTALLATION
- 5.3.1 Prepare sufficient batches of AL-60 Potting Compound in the Ross Mixer.
- 5.3.2 Pour the Potting Compound onto the Baseplate until a minimum thickness of 1.0 inch is recorded.

NOTE

Pour so that a minimum of splatter occurs on the existing Liner.

Record Batch Numbers of the AL-60 Liner.

DATE _____	BATCH NO.	_____
DATE _____	BATCH NO.	_____
DATE _____	BATCH NO.	_____
DATE _____	BATCH NO.	_____
DATE _____	BATCH NO.	_____

- 5.3.3 Cure the AL-60 Potting Compound for a minimum of eight (8) hours at 100°F + 10°F. Record below:
- 0°F

Time Start: _____ Temp: _____ °F

Time Complete: _____ Temp: _____ °F

- 5.3.4 Lift and remove the AL-60 casting mandrel.

- 5.3.5 Using a long handled brush, apply a Sealing Coat of UTL-0040A Liner to the top surface of the AL-60 Restrictor.

Record Batch No. _____

Record Amount Used _____

- 5.3.6 Wash down core with a clean white cloth dampened with 1,1,1 Trichloroethane. Spray or wipe the core with a solution of 25% Dow Corning High Vacuum Grease and 95% Methylene Chloride. At completion of spraying operations using 3 legged sling raise the core and check that the Fwd edge of the core that mates with the forward restrictor is free of dirt, liner, oil, etc. Lower this core over the three (3) alignment pins located in the Baseplate. Do not lower the core completely at this time.

- 5.3.7 Install the three (3) each Hold Down Rods (C12239-15-01).

NOTE

Do not tighten the Hold Down Nuts at this time.

- 5.3.7.1 Lower Core (P/N C12239-11-01) (Dia. 21.29) completely onto the restrictor. Remove the three legged sling.

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- 5.3.8 Install the three (3) each core centering calbes item 50, and 51 of Dwg. C12239.
- 5.3.9 Center the core within .060 inches and record below:
 0° _____ 120° _____ 240° _____
- 5.3.10 Tighten the three core hold down nuts to snug.
- 5.3.11 Remove the four (4) each ½-14 pipe plugs from the bottom of the baseplate.
- 5.3.12 Weigh the completed casting tooling assembly and record weight below. CWR No. _____
 Weight _____
- 5.3.13 Preheat Cartridge for 15-17 hours at $140^{\circ} \pm 10^{\circ}\text{F}$ at Station 0210 to cure the UTL-0040A Liner. Record below:
 Time In: _____ Temp: _____ °F
 Time Out: _____ Temp: _____ °F
- 5.3.14 Cover cartridge using polyethylene. Also cover samples as required.
- 5.3.15 Area Foreman or Working Leader and Q.C. review Operations 5.0 through 5.3.14 for proper and complete entries on each operation.
- 5.3.16 Transport cartridge to casting oven and samples to Station 0980 using 5,000 pound capacity trailer or truck.

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5.4	PREPARATION OF CASTING OVEN (STATION 0980)		
5.4.1	OPEN door to oven shelter.		
5.4.2	Move oven shelter away from oven.		
5.4.3	Check oven and stands for cleanliness and clean as required.	☐	
5.4.4	Adjust oven stand height to pin hole No. 12.	☐	
5.4.5	Ensure oven stand is level. Level as required.	☐	
5.4.6	Install work stands as required.		
5.5	INSTALLATION IN OVEN (STATION 0980)		
5.5.1	Center crane hook over cartridge. Place lifting eye over crane hook, lift the cartridge and place on the adjustable oven stand in designated area marked on stand. Disconnect and remove crane.	☐	
5.5.2	Ensure that core hold down rods are properly locked and the three (3) core centering cables are tight. Install core cover.	☐	
5.6	ASSEMBLY OF SIDE CASTING TOOLING (STATION 0980)		
5.6.1	Assemble the 360° Casting Spider (C10053-24-31) with 30" tubes and 90° elbows and install over the top of the core.	☐	
5.6.2	Install the interior casting tooling consisting of one (1) 6.0" SS pipe with a 90° bend on one end, and one (1) 6.0" SS pipe long enough to center the opening of the 90° bend over the center of the 360° casting spider.	☐	

- 5.6.3 Install casting line support under spider.
- 5.6.4 Mask all clamps, nuts, and threaded portions of clamps, and core centering cables with vinyl tape as required to protect threaded areas.
- 5.6.5 Install casting height indicators (4) equally spaced around rounding ring.
- 5.6.6 Ensure that internal casting tooling is secure.
- 5.6.7 Install 6" diameter metal cap on inlet of oven valve and secure.
- 5.6.8 Ensure that oven/oven lid mating interfaces are free of foreign particles.
- 5.6.9 Clean both sides of each oven lid sight glasses with glass cleaner.
- 5.6.10 Q.C. check centering of core at three (3) equally spaced angular locations and record.
- 0° _____
- 120° _____
- 240° _____
- 5.6.11 Immediately prior to oven lid installation, Area Foreman make inspection of the lined cartridge for visible signs of contamination. Area Foreman or Working Leader to record oven being used, time and date when the lined cartridge was installed in the oven. Notify Project Engineer if contamination exists.

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OVEN NO.: _____

TIME _____ DATE _____

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5.8.2 Remove the 6" diameter metal cap from oven valve and install black rubber hose assembly consisting of 2 each 6" Laddish ferrule and _____" of rubber hose clamped to ferrule.

5.8.3 Install the 6" diameter metal cap on open end of black rubber hose assembly.

5.8.4 Position mix bowl adjacent to oven to allow connection of casting line.

NOTE

Install grounding strap.

5.8.5 Remove 6" diameter metal cap from black rubber hose assembly and mix bowl discharge tube. Connect casting line to mix bowl.

5.8.6 Receive Q.C. Lab acceptance of each propellant batch from Area Foreman prior to casting. After Q.C. Batch Acceptance is received, begin casting. Record propellant batch data below.

WARNING

Do not exceed 15 psi on 400 gallon mix bowl.

Batch No.	Q.C. Time	Acceptance Date	Badge	Start Cast	Finish Cast	Vacuum MM of Hg	Pot Pressure	Oper.
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- 5.8.7 Connect station air line to mix bowl pressure lid and slowly pressurize mix bowl to approximately 15 psig. Do not exceed allowable pressure of 15 psig.
- 5.8.8 Connect station air line to mix bowl discharge valve air motor open line fitting.
- 5.8.9 Disengage lock on discharge valve located under bowl.
- 5.8.10 OPEN oven valve.
- 5.8.11 OPEN mix bowl discharge valve.
- 5.8.12 Remove station air line from the open line fitting and re-connect to the mix bowl discharge valve air motor close line fitting.

NOTE

Do not turn on air at this time.

- 5.8.13 Observe propellant flow and cast until mix bowl is empty or until propellant reaches the bottom of the casting level indicator.

NOTE

Rubber hose will collapse when bowl is empty.

- 5.8.14 CLOSE mix bowl discharge valve. Remove air line.
- 5.8.14.1 Lock mix bowl discharge valve.

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- 5.8.15 CLOSE oven valve.
- 5.8.16 On final batch complete Step No. 5.9.3 before disconnecting propellant pot.
- 5.8.17 Disconnect air line from mix bowl pressure lid and open vent valve.
- 5.8.18 Disconnect casting line from mix bowl discharge tube.
- 5.8.18.1 Disconnect grounding strap.
- 5.8.19 Install 6" diameter metal cap on casting line.
- 5.8.20 Install 6" diameter metal cap on mix bowl discharge tube and send mix bowl to Station 0650 and recycle per P.O.P. 2.91.5.
- 5.8.21 Repeat Steps 5.8.1 through 5.8.20 until cartridge unit is case to bottom of casting height indicator.

NOTE

Retain last mix bowl at oven for possible propellant top-off requirement.

5.9 POST-CASTING OPERATIONS (STATION 0980)

- 5.9.1 Close vacuum valve. Turn vacuum pump OFF. OPEN oven vent valve.

NOTE

Hand operated vent valve at oven may be used to vent oven.

CAUTION

Prior to removing oven lid, vacuum must be released and oven light cord must be disconnected.

NOTE

When removing oven lid during rain, protect cartridge by raising lid sufficiently to allow a sheet of plastic tarp (clean and dry) to be placed over the component. After the grain is protected, remove the lid and move the shelter over the oven. Conduct all finishing operations under the protection of the shelter.

- 5.9.2 Remove oven lid. Position oven lid on wooden blocks adjacent to oven in designated area.

- 5.9.3 Ensure that propellant is cast to _____ $\pm$ _____ inches below the top of the cartridge rounding ring. If more propellant is required add, using side casting system. Do not use propellant that has been scraped from the sides of the pot or the casting lines. Disconnect mix bowl.

NOTE

Remove excess propellant using non-metallic tools.

- 5.9.4 OPEN valve.

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5.9.5.1 Install 10" diameter metal cap on oven casting line port.

1.) avoid trapping air when troweling propellant, jiggle the trowel as it moves over the propellant surface. Do not drag the trowel to cause folding of the propellant.

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5.10.2 Start up oven per Station P.O.P. 2.71.1.

- 5.10.3 Cure propellant a total of 240 ± 12 hours at $140^{\circ}\text{F} \pm 10^{\circ}\text{F}$.
(Cure time starts when oven temperature reaches a minimum of 130°F .)

OVEN USED: _____

TIME IN: _____ TEMP: _____ $^{\circ}\text{F}$

TIME OUT: _____ TEMP: _____ $^{\circ}\text{F}$

- 5.11 CARTRIDGE REMOVAL FROM OVEN (STATION 0980)

- 5.11.1 Using crane, remove oven lid as required.

CAUTION

When removing oven lid during rain, protect cartridge by raising lid sufficiently to allow a sheet of plastic tarp (clean and dry) to be placed over component. After the grain is protected, remove the lid and move the oven shelter over the oven for protection. Conduct all finishing operations under the protection of the shelter.

- 5.11.2 Check lifting eye for propellant. Clean if required.

- 5.11.3 Center crane hook over cartridge. Place lifting eye over crane hook. Lift and remove cartridge from oven.

- 5.12 CURING IN CURE CONTAINER (STATION 0980)

- 5.12.1 Transfer segment to cure container immediately after casting and troweling propellant if cartridge is to be container cured.

- 5.12.2 Connect cure container thermocouple and verify proper operation of thermocouple and temperature recording equipment.

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- 5.15.17 Remove tie downs from baseplate.
- 5.15.18 Install shipping base on a 26,000 pound min. capacity trailer.
- 5.15.19 Lift and place cartridge on shipping base trailer. Disconnect crane from lift fixture. Secure cartridge to trailer. Move trailer to pad 0451.
- 5.15.20 Attach crane to lift fixture and remove cartridge from shipping base.
- 5.15.21 Remove shipping base from trailer and place on storage pad. Place cartridge on shipping base. Release lift fixture and from cartridge and remove with crane. Move lift fixture to a designated area and remove from crane.
- 5.15.22 Drape Electrically Conductive Plastic film over the top of the cartridge and down the sides approximately 12 inches and secure with pressure sensitive tape.
- 5.15.23 Install the wooden shipping cover and hold in storage at Station 0451.
- 6.0 SECURING
- 6.1 Perform Station Shutdown (as required).
- 6.2 Area Foreman, Q.C. and Process Engineer review entire procedure. Verify all operations have been completed, proper and complete entries have been made, all items on associated paperwork have completed action of disposition and acceptance.

Q.C. INSPECTION: _____ DATE: _____

AREA FOREMAN: _____ DATE: _____

PROCESS ENGINEER: _____ DATE: _____

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APPENDIX

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5.12.3 Install cartridge in cure and shipping container base. Disconnect and remove crane. Level cartridge with 6 foot carpenter level. Retrowel propellant surface to a smooth, level finish as required. Using 7000-923 lift fixture and crane install container side on base with an outlet 180° from air inlet on base. Remove lift fixture.

5.12.4 Hook-up and operate H-42 heater per P.O.P. 6.14.1.

5.12.5 Cure a total of 240 ± 12 hours at $140^{\circ}\text{F} \pm 10^{\circ}\text{F}$. Cure starts when container temperature reaches 130°F .

CONTAINER LOCATION: _____

TIME START: _____ TEMP: _____ °F

TIME COMPLETED: _____ TEMP: _____ °F

5.12.6 Remove cure container sides with 7000-923 lift fixture and crane and place approximately one-half way between ovens 0981 and 0982.

5.12.7 Q.C. review records and assure that propellant was cured 240 ± 12 hours at $140^{\circ}\text{F} \pm 10^{\circ}\text{F}$.

5.13 COOL DOWN (STATION 0980)

5.13.1 Cool down starts when temperature controller is changed to a 75°F setting or cartridge is removed from oven or Cure Container.

5.13.2 Total cartridge cool down cycle is 8 hours minimum.

TIME START: _____ TEMP: _____ °F

TIME COMPLETE: _____ TEMP: _____ °F

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5.14 WEIGHING OPERATIONS (STATION 0211)

- 5.14.1 Using a crane lift the Loaded Cartridge to a sufficient height so that a low boy trailer may be positioned under the Loaded Cartridge. Lower the cartridge onto the trailer and secure. Remove crane.

CAUTION

Lift to be straight and vertical
so as to minimize side load forces
on the lift pin bolts.

- 5.14.2 Transport the loaded cartridge to Station 0211 between 1630 - 0700 hours on normal working days. Non-working days, transportation may be accomplished at Area Foreman's request.

- 5.14.3 Using a crane lift the loaded cartridge straight up to a sufficient height so that the low boy trailer may be removed. Move and position the cartridge over the floor scale and lower. Remove crane.

- 5.14.4 Place in center of scale and disconnect cartridge from crane. Weigh loaded cartridge rounding ring, casting base and core assembly attached. Q.C. observe weighing and verify configuration is same as in Operation 5.3.12. Concur on weight. Area Foreman or Working Leader and Q.C. complete CWR and verify the following:

Record Weight Below:

CWR No. _____ Propellant Weight _____ LBS.

- 5.14.5 Using crane lift the loaded cartridge and move to a location where the trailer may be positioned.

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- 5.14.6 Lift the loaded cartridge to a sufficient height so that a low boy trailer may be positioned under the loaded cartridge. Lower the cartridge onto the trailer and secure. Remove crane.

CAUTION

Lift to be straight and vertical
so as to minimize side load forces
on the lift pin bolts.

- 5.14.7 Transport the loaded cartridge to stripping pad at Station 0453.

- 5.14.8 Using a crane lift the loaded cartridge straight up to a sufficient height so that the low boy trailer may be removed. Lower the cartridge. Remove crane.

- 5.14.9 Using eye bolts and 3/4" turnbuckles connect and secure the baseplate to the inground tie down fixture.

- 5.15 STRIPPING, TRIMMING AND INSPECTION (STATION 0453)

WARNING

A maximum of 5 personnel allowed
during core removal, stripping and
trimming operations. Only 1 unit
at one time on strip pad 0453.

- 5.15.1 Back off the three (3) each core hold down nuts (C12239-56).

- 5.15.2 Raise the core hold down rods approximately 4.0" by turning counter clockwise and hold in place with the core hold down nuts.

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- 5.15.3 Remove the pins from the core hold down rods and tape to rods.

WARNING

A maximum of 5 personnel allowed during core loosening operations.

- 5.15.4 Remove propellant from the threaded ends of the three each core stabilizer cables before removing nuts. Remove all tape and propellant splatter.

- 5.15.5 Remove three each core stabilizer cables.

- 5.15.6 Using the overhead crane with the crane scale, three legged handling sling with a 9,000 pound capacity remove the core.

CAUTION

Do not exceed 9,000 pounds with leveling sling attached. If core does not come loose at 9,000 pounds notify Process Engineer.

- 5.15.7 Secure core on shipping pallet. Remove crand and handling sling.

CAUTION

Extreme care must be exercised to prevent damage to teflon coating.

NOTE

Rounding ring, baseplate and core cleaning and storage may be completed at anytime prior to completion of Step 6.1.

- 5.15.8 Using non-metallic scrapers and 1,1,1, Trichloroethane, remove all propellant from core and wipe clean with cheese-cloth dampened with 1,1,1, Trichloroethane. Return core to GPAO or Station 0211 for storage.

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5.15.8.1 Remove three (3) cables securing rounding ring to baseplate.

5.15.9 Using overhead crane with 3-legged sling, lift and remove the Top Rounding Ring (C12239-15-01), clean Rounding Ring, and return to Station 0210 or storage.

5.15.10 Clean off propellant splashings on case insulation.

5.15.11 Trim flashings from bore interface until level with aft propellant surface.

5.15.12 Examine top propellant surface for raised or depressed areas. Areas 1.0" or less in diameter are to be left undisturbed. All raised or depressed areas of greater than 1.0" in diameter are to be explored, trimmed, and blended.

5.15.13 Install Lift Fixture (C09489) on crane. Center lift fixture over cartridge and lower until pins will engage holes in cartridge. Lock pins in place. Lift cartridge until it clears center post of baseplate. Position cartridge over 4 equally spaced 18" x 24" plywood blocks. Lower until cartridge touches blocks.

5.15.14 Visually inspect for bonding separations between propellant and liner, and for cracks and voids in propellant in accordance with Notes  and  of Drawing C12185.

5.15.15 Q.C.  verify bonding and propellant integrity per  and  of Drawing C12185.

5.15.16 Measure and Record:

	<u>0°</u>	<u>90°</u>
BORE DIA "D"	_____	_____
GRAIN HEIGHT "L"	_____	_____

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APPENDIX H
PRODUCT ACCEPTANCE RECORDS - ELSH

S/N 479-1

PRODUCT ACCEPTANCE RECORD

DATA SUMMARY

P/N C11479-01-01

<u>Propellant Batch</u>	<u>4# Motor Pressure (psi)</u>	<u>Burning Rate (in/sec)</u>	<u>Physical Properties</u>	
			<u>True Elongation %</u>	<u>Tensile Strength (psi)</u>
400-1458	1046	.410	29	90
	1633	.524		
400-1459	1001	.3994	38	113
	1570	.4977		
400-1460	1054	.4161	41	131
	1622	.5170		
400-1461	1083	.4137	39	131
	1572	.4991		
400-1462	1058	.4162	41	120
	1706	.5287		

1 PART NUMBER	2 PART NAME	3 SEE ALSO SEE LOT NUMBER	4 SPECIFICATION	5 (11-79 N/C) ECCS	6 SPECIAL OPERATIONS REFERENCE
C11479	ELSH MOTOR	2579-2	-02-1	18978, 19704, 19727, 19846, 19857	Q&QR 33603
7 PVP REF	8 QUALITY REQUIREMENT DESCRIPTION (FEATURE)	9 FEATURE	10 ATTENTION	11 MEASURED RESULTS	12 VERIFICATION STAMP
2579/2-2	After curing propellant, visually inspect for cracks or voids.	NO CRACKS ALL voids voids > 1.0"	VAR	None	<i>E. E. and 5/12/78</i>
2579/2-3	Bore Dia.	NO CRACKS ALL voids voids > 1.0"	VAR	None	<i>E. E. and 5/12/78</i>
2579/2-7	Propellant physical properties (UTP-13803A) True Elongation % Tensile Strength psi	Min. Values 30% 80 psi	VAR	Summary Attached	<i>E. E. and 5/12/78</i>
2579/2-8	Propellant bond system SE0719 Cartridge/liner/propellant	Min. Value 80 psi	VAR	106 psi, 112 psi, 137 psi	<i>E. E. and 5/12/78</i>
2579/2-9	Propellant bond system test SE0719 Insulation/liner/propellant	Min. Value 80 psi	VAR	107 psi, 112 psi, 115 psi	<i>E. E. and 5/12/78</i>
2579/2-10	Propellant ballistic batch Check test per SE0616, Rev. 3	SE0719 19857	VAR	Summary Attached	<i>E. E. and 5/12/78</i>

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P/N C11479-02-01

PROJECT AGO P/P RECORD

DATA SUMMARY

S/N 2579-2

<u>Propellant Batch</u>	<u>4# Motor Pressure (psi)</u>	<u>Questionable Pc Data #</u>	<u>Burning Rate (in/sec)</u>	<u>Physical Properties</u>	
				<u>True Elongation (%)</u>	<u>Tensile Strength (psi)</u>
1400-1454				44	126
1400-1455	1062	.4036		41	128
	1469	.4633			
1400-1456	1061	.4011		42	123
	1556	.4831			
1400-1457	1021	.3943		38	115
	1403	.4612			
1400-1458	1046	.410		29	90
	1633	.524			

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* Instrumentation malfunction resulted in questionable data. A review of in-process LSBR's and four pound motor deviation and grain geometry correlation indicates the actual burn rates would be in the "burn rate box" (spec. SE0719, + ECO 19857). Discrepancy documented on IDR 038331.



5/12/76

PRODUCT ACCEPTANCE RECORD

1 PART NUMBER C11479	2 PART NAME ELSH Motor	3 SERIAL NUMBER/ LOT NUMBER 2579-7	4 CONFIGURATION 01-01	5 C11479 N/C & 19832, 19837, 19858, 19894	6 OPERATIONS PLANNING REFERENCE 35782
7 PVP REF	3	QUALITY REQUIREMENT DESCRIPTION (FEATURE)	9 FEATURE TOLERANCE	10 ATT/ VAR	11 MEASURED RESULTS
2579/ 2-2	After curing propellant, visually inspect for cracks or voids.	No cracks allowed. No voids 1.0"	VAR	None	Anne Evans 8-10-76
2579/ 2-3	Bore diameter	Engineering Information	VAR	FWD 0° 90° CENTER 24.37 24.33 APT 24.48 24.47 24.51	Anne Evans 8-10-76
2579/ 2-7	Propellant physical properties True Elongation % Tensile Strength psi	Min. Values 20% 50 psi	VAR	SUMMARY ATTACHED	Anne Evans 8-10-76
2579/ 2-8	Propellant bond system test SE0719 Cartridge/liner/propellant	Min. value 20 psi	VAR	124 psi, 118 psi IDR # 040354 (attached)	Anne Evans 8-10-76
2579/ 2-9	Propellant bond system SE0719 Insulation/liner/propellant	Min. Value 20 psi	VAR	129 psi, 123 psi, 110 psi, 148 psi	Anne Evans 8-10-76
2579/ 2-10	Propellant ballistic batch check test per SE0616, Rev. B	SE0719 & ECO 19857	VAR	Summary attached	Anne Evans 8-10-76

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13 ORIGINATOR A. B. Evans	14 QA ACCEPTANCE Anne Evans 8-10-76	15 CUSTOMER ACCEPTANCE [Signature] 8-10-76
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P/N C11479-01-01

DATA SUMMARY

Propellant Batch	4# Motor Pressure		Burning Rate (In/Sec)	Physical Properties	
	PSI			True Elongation %	Tensile Strength (PSI)
1495	1000		.423	26	172
	1400		.503		
	1700		.563		
1496	1000		.426	24	169
	1400		.508		
	1700		.563		
1497	1000		.419	24	166
	1400		.502		
	1700		.557		
1498	1000		.416	29	179
	1400		.499		
	1700		.554		
1499	1000		.413	28	181
	1400		.488		
	1700		.537		

INTEGRATED DATA REPORT

No. 0490

6. ANALYSIS SECTION

Page 1 of 1

1. Item No.	2. Proj. No.	3. Div. No.	4. Inv. No.	5. Date
4022 07	2579	0700	36	N/A
6. Part No.	7. PO No.	8. Unit Mess	9. Lot Size	10. No. Specimens
UTP 1000A	N/A	N/A	1	1
11. Div. No.	12. Zone	13. Specimen	14. Propellant	15. Bond
4022 07	3.4.2	N/A	Propellant	124 psi.

DESCRIPTION OF NON-CONFORMANCE

One (1) of the six (6) Bond in Tension specimens failed in the live end at 124 psi.

The other specimens failed in the propellant at 118, 129, 123, 110 and 148 psi.

H-183

21. Originator	22. Date
D. J. Murphy	8/22/76

DISPOSITION INSTRUCTIONS

Accept as is. All other specimens failed significantly above specification minimum and in the propellant. The fact that the discrepant specimen failed at 124 psi shows that the propellant-liner-insulation interfaces are adequate for motor performance.

30. Supporting Documents:

81	82	83	84	85	86	87	94	102
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31. Engineer's Signature	32. Operations	33. Quality Assurance	34. Date
<i>J. E. Ballin</i>	9 Aug 76	<i>P. W. F. Linn</i>	9/4/76

PRODUCT ACCEPTANCE RECORD

1 PART NUMBER	2 PART NAME	3 SERIAL NUMBER LOT NUMBER	4 CONFIGURATION	5 CIL479 I/C & 19832, 19837, 19858, 19894	6 OPERATIONS PLANNING REFERENCE O&QR 35783
CIL479	ELSE Motor	2579-6	03-C1		
7 PVP REF	8 QUALITY REQUIREMENT DESCRIPTION (FEATURE)	9 FEATURE TOLERANCE	10 ATT VAR	11 MEASURED RESULTS	12 VERIFICATION STAMP
2579/ 2-2	After curing propellant, visually inspect for cracks or voids.		VAR	None	Anne Evans 8-10-76
2579/ 2-3	Bore Diameter		VAR	FWD CENTER AFT 24.382" 24.662" 24.142" 24.350" 24.661" 24.142" Tensile 16.5th	Anne Evans 8-10-76
2579/ 2-7	Propellant physical properties True elongation % Tensile Strength psi		VAR	Min. values 20% 50 psi Elongation 14.99 15.01 15.02 15.03	Anne Evans 8-10-76
2579/ 2-8	Propellant bond system SE0719 Cartridge/liner/propellant		VAR	Min. value 20 psi	Anne Evans 8-10-76
2579/ 2-9	Propellant bond system test SE0719 Insulation/liner/propellant		VAR	Min. value 20 psi	Anne Evans 8-10-76
2579/ 2-10	Propellant ballistic batch Check test per SE0616, Rev. B		VAR	SE0719 & ECO 19857	Anne Evans 8-10-76

13 OR ACCEPTANCE

15 CUSTOMER ACCEPTANCE

A. B. Evans

Anne Evans 8-10-76

Chief Engineer 8-10-76

P/N C11479-03-01

DATA SUMMARY

<u>Propellant Batch</u>	<u>4# Motor Pressure</u>		<u>Burning Rate</u> <u>(In/Sec)</u>	<u>Physical Properties</u>	
	<u>PSI</u>			<u>True Elongation %</u>	<u>Tensile Strength (.SI)</u>
1499	1000		.413	28	181
	1400		.488		
	1700		.537		
1500	1000		.416	28	177
	1400		.491		
	1700		.540		
1501	1000		.413	28	174
	1400		.482		
	1700		.528		
1502	1000		.417	25	172
	1400		.499		
	1700		.553		
1503	1000		.418	31	180
	1400		.497		
	1700		.550		

PRODUCT ACCEPTANCE RECORD

1 PART NUMBER	2 PART NAME	3 SERIAL NUMBER LOT NUMBER	4 COLE CURATION	5 PART REVISION NUMBER	6 OPERATOR SIGNATURE DATE	
C11479-01-01	ELSH Motor	2579-09	-01-01	C11479 AK & 19833, 19837, 19858, 19894	35878	
7 P/P REF	8	9 QUALITY REQUIREMENT DESCRIPTION (FEATURE)	10 FEATURE TOLERANCE	11 ATT VAR	12 MEASURED RESULTS	13 VERIFICATION STAMP
2579/ 2-2		After curing propellant, visually inspect for cracks and voids	No cracks allowed. No voids > 10"	VAR	None	Anne Evans 8-20-76
2579/ 2-3		Bore diameter	Engineering information	VAR	Fwd 24.337 90° Center 24.500 24.326 Aft 24.417 24.465 24.501	Anne Evans 8-20-76
2579/ 2-7		Propellant physical properties True elongation % Tensile strength psi	Min values 20% 50 psi	VAR	Summary attached	Anne Evans 8-20-76
2579/ 2-8		Propellant bond system SED719 Cartridge/liner/propellant	Min. value 20 psi	VAR	139, 77, 104	Anne Evans 8-20-76
2579/ 2-9		Propellant bond system SED719 Insulation/liner/propellant	Min value 20 psi	VAR	95, 118, 141	Anne Evans 8-20-76
2579/ 2-10		Propellant ballistic data check test per SED616, Rev. B	SED719 & ECO19857	VAR	Summary attached	Anne Evans 8-20-78
14 CUSTOMER ACCEPTANCE			15 CUSTOMER ACCEPTANCE			
Anne Evans 8-20-76			Anne Evans 8-20-76			

P/N C11479-01-01

DATA SUMMARY 2579-9

<u>Propellant Batch</u>	<u>4# Motor Pressure</u> PSI	<u>Burning Rate</u> (in./sec.)	<u>True Elongation</u> %	<u>Tensile Strength</u> (PSI)
1505	1000	.4036	36	98
	1400	.4771		
	1700	.5253		
1506	1000	.4167	31	129
	1400	.4963		
	1700	.5490		
1507	1000	.4127	31	126
	1400	.4903		
	1700	.5415		
1508	1000	.4173	27	121
	1400	.4941		
	1700	.5446		
1509	1000	.4128	35	127
	1400	.4935		
	1700	.5470		

PRODUCT ACCEPTANCE RECORD

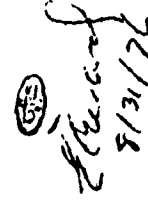
1 PART NUMBER C11479-03-01		2 PART NAME ELSH Motor		3 SERIAL NUMBER 2579-10		4 CONFIRMATION -03-01		5 PART REVISION NUMBER C11479N/C & 19832, 19837, 19858, 19894 DATE		6 OPERATIONS PLANNING REFERENCE 35879	
7 PVP REF	8	9 QUALITY CONTROL DESCRIPTION		10 DATE	11	12 MEASURED RESULTS	13	14 VERIFICATION STAMP			
2579/ 2-2		After curing propellant, visually inspect for cracks and voids.		No cracks allowed, No voids -1.0"	VAR	None			<i>E. Conrad 5/13/12</i>		
2579/ 2-3		Bore Diameter		Engineering information	VAR	Fwd 24.342 Center 24.832 Aft 54.492	0° 90° 24.400 24.628 54.092		<i>E. Conrad 5/13/12</i>		
2579/ 2-7		Propellant physical properties True elongation % Tensile Strength psi		Min. values 20% 50 psi	VAR	Summary Attached			<i>E. Conrad 5/13/12</i>		
2579/ 2-8		Propellant bond system SE0719 Cartridge/liner/propellant		Min. value 20 psi	VAR	114			<i>E. Conrad 5/13/12</i>		
2579/ 2-9		Propellant bond system SE0719 Insulation/liner/propellant		Min. value 20 psi	VAR	121			<i>E. Conrad 5/13/12</i>		
2579/ 2-10		Propellant ballistic batch check test per SE0616, Rev. B		SE0719 & ECO 19857	VAR	Summary attached			<i>E. Conrad 5/13/12</i>		
15 CUSTOMER ACCEPTANCE				16		17					

C111479-03-01

DATA SUMMARY 2579-10

Propellant Batch	4# Motor Pressure psi	Burning Rate in/sec	Physical Properties	
			True Elongation %	Tensile Strength (psi)
1509	1000	.4128	35	127
	1400	.4935		
	1700	.5470		
1510	1000	.4127	35	124
	1400	.4920		
	1700	.5445		
1511	1000	.4121	32	120
	1400	.4902		
	1700	.5419		
1512	1000	.4103	34	132
	1400	.5009		
	1700	.5621		
1513	1000	.4213	35	126
	1400	.5017		
	1700	.5549		

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 8/31/76

PRODUCT ACCEPTANCE RECORD

1 PART NUMBER C11479-03-01		2 PART NAME ELSH Motor		3 SERIAL NUMBER LOT NUMBER 2579-11		4 CONFIGURATION -03-01		5 PART REVISION NUMBER C11479N/C&19832,19837, 19858,19894, & 20107 DATE		6 ORDER NUMBER 36512	
7 PVP REF	8	QUALITY REQUIREMENT DESCRIPTION (FEATURE)		9 FEATURE TOLERANCE	10 ATT VAR	11 MEASURED RESULTS		12 VERIFICATION STAMP			
2579/ 2-2		After curing propellant, visually inspect for cracks and voids.		No cracks allowed. No voids > 1.0	VAR	None		[CSD 4]			
2579/ 2-3		Bore Diameter		Engineering Information	VAR	0° 24.900 24.530 54.300 90° 24.376 24.511 54.360		[CSD 2]			
2579/ 2-7		Propellant physical properties True Elongation % Tensile Strength psi		Min. Values 20% 50 psi	VAR	Summary Attached		[CSD 1]			
2579/ 2-8		Propellant bond system SE0719 Cartridge/liner/propellant		Min. Value 20 psi	VAR	113		[CSD 2]			
2579/ 2-9		Propellant bond system SE0719 Insulation/liner/propellant		Min. value 20 psi	VAR	96		[CSD 2]			
2579/ 2-10		Propellant ballistic batch check test per SE0616, Rev. B		SE0719 & ECO 19857	VAR	Summary Attached		[CSD 2]			
13 ORIGINATOR - E. C. ... 7/7/63				14 QA ACCEPTANCE Anne ... 7-8-74		15 CUSTOMER ACCEPTANCE Prof. E. J. ... 7-8-74					

/9-03-01

DATA SUMM: 2579-11

September 3, 6

Propellant Batch	4# Motor Test		4# Motor Projections		Physical Properties	
	Pressure (psi)	Burning Rate (in/sec)	Pressure (psi)	Burning Rate (in/sec)	True Elongation %	Tensile Strength (psi)
400-1520	769	.3649	1000	.4061	43	115
	996	.4010	1400	.4711		
	1360	.4598	1700	.5133		
	1551	.4995				
400-1521	820	.3683	1000	.4034	36	110
	1016	.4000	1400	.4766		
	1366	.4786	1700	.5248		
	1555	.4983				
400-1522	755	.3558	1000	.4022	39	113
	984	.3997	1400	.4688		
	1293	.4436	1700	.5122		
	1680	.5159				
400-1523	802	.3657	1000	.4020	34	114
	1005	.3964	1400	.4720		
	1467	.4848	1700	.5178		
	1642	.5100				
400-1524	767	.3599	1000	.4014	37	113
	985	.3881	1400	.4728		
	1316	.4550	1700	.5197		
	1638	.5178				

H-191

020

PRODUCT ACCEPTANCE RECORD

1 PART NUMBER	2 PART NAME	3 SERIAL NUMBER / LOT NUMBER	4 CONFIGURATION	5	6 OPERATOR REFERENCE
C11479-02-01	ELSH Motor	2579-12	-02-01	C11479 W/c & 19832, 19837, 19858, 19894	36385
7. PVP REF	8 QUALITY REQUIREMENT DESCRIPTION (FEATURE)	9 FEATURE TOLERANCE	10 ATT/ VAR	11 MEASURED RESULTS	12 VERIFICATION STAMP
2579/ 2-2	After curing propellant, visually inspect for cracks and voids	No cracks allowed; no voids > 1.0"	VAR	None	
2579/ 2-3	Bore diameter	Engineering Information	VAR	End 24.308 Center 24.465 AFT 24.417	90° 24.375 24.480 24.490
2579/ 2-7	Propellant physical properties True elongation % Tensile strength psi	Min. values 20% 50 psi	VAR	Summary attached	
2579/ 2-8	Propellant bond system Cartridge/liner/propellant	Min values 20 psi	VAR	101 psi	
2579/ 2-9	Propellant bond system Insulation/liner/propellant	Min value 20 psi	VAR	93 psi	
2579/ 2-10	Propellant ballistic batch check test per SE0616, Rev. B	SE0719 & ECO 19857	VAR	Summary attached	
13 ORIGINATOR	14 QA ACCEPTANCE	15 CUSTOMER ACCEPTANCE			
Anne Evans	Anne Evans	9-15-76			

C114. J2-01

DATA SUMMARY SH 2579-12

9/14/76

Propellant Batch	4# Motor Test		4# Motor Projections		Physical Properties	
	Pressure (psi)	Burning Rate (in/sec)	Pressure (psi)	Burning Rate (in/sec)	True Elongation %	Tensile Strength (psi)
1516	792	.3652	1000	.4014	34	112
	1001	.3964	1400	.4665		
	1409	.4624	1700	.5088		
	1521	.4914				
1517	802	.3675	1000	.4046	31	116
	1030	.4060	1400	.4728		
	1357	.4666	1700	.5173		
	1490	.4882				
1518	834	.3663	1000	.4001	40	120
	978	.3914	1400	.4762		
	1297	.4625	1700	.5266		
	1425	.4780				
1519	820	.3651	1000	.4006	36	114
	1019	.4026	1400	.4710		
	1410	.4719	1700	.5171		
	1510	.4898				
1520	769	.3649	1000	.4061	42	115
	996	.4010	1400	.4711		
	1360	.4598	1700	.5133		
	1551	.4995				

PRODUCT ACCEPTANCE RECORD									
1 PART NUMBER	2 PART NAME	3 SERIAL NUMBER / LOT NUMBER	4 CONFIGURATION	5 C11479 M/C & 18978, 19704	6 ORDER NUMBER				
7 PVP REF	8 QUALITY REQUIREMENT DESCRIPTION (FEATURE)	9 FEATURE TOLERANCE	10 ATT / VAR	11 MEASURED RESULTS	12 VERIFICATION STAMP				
C11479-01-01	ELSH Motor	2579-13	-01-C1		36760				
2579/ 2-2	After curing propellant, visually inspect for cracks and voids		None						
2579/ 2-2	Core diameter		UAR						
2579/ 2-7	Propellant physical properties (UTP 18803A)								
2-7	Tensile elongation (%)	Engineering information	UAR	End 24.528" 90° 21.340" 24.769" 24.751" 24.361" 24.537"					
2579/ 2-8	Propellant bond system SED719		UAR	Summary attached					
2-8	Cartridge/liner/propellant	Min value 20psi	UAR	78 psi					
2579/ 2-9	Propellant bond system SED719		UAR	88 psi					
2-9	Insulation/liner/propellant	Min value 20 psi	UAR	Summary attached					
2579/ 2-0	Propellant ballistic batch check test for SED616, Rev B.	SED719 & ECR857	UAR						
13 OPERATOR Anne Evans 10-14-76		14 QA ACCEPTANCE Anne Evans 10-14-76		15 CUSTOMER ACCEPTANCE Corp. Mine. Div 10-20-76					

11479-01-01

Data Summary. ELSH 2579-13

10-5-76

Propellant Batch	4# Motor Test		4# Motor Projections		Physical Properties	
	Pressure (psi)	Burning Rate (in./sec.)	Pressure (psi)	Burning Rate (in./sec.)	True elongation (%)	Tensile strength (psi)
1527	901	.3976	1000	.4130	37	103
	1128	.4268	1400	.4911		
	1229	.4616	1700	.5427		
	1653	.5392				
1528	761	.3680	1000	.4180	34	102
	865	.3936	1400	.4878		
	1265	.4612	1700	.5332		
	1619	.5242				
1529	747	.3660	1000	.4219	35	104
	954	.4058	1400	.5005		
	1447	.5124	1700	.5523		
	1663	.5378				
1530	767	.3709	1000	.4222	38	103
	886	.3936	1400	.5016		
	1322	.4875	1700	.5441		
	1581	.5344				
1532	705	.3590	1000	.4168	39	105
	880	.3881	1400	.4858		
	1477	.4983	1700	.5306		
	1673	.5280				

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02
10-13-76

PRODUCT ACCEPTANCE RECORD

1 PART NUMBER C11479-01-01	2 PART NAME F.L.C.H motor	3 SERIAL NUMBER/ LOT NUMBER 2579-14	4 CONFIGURATION -01-01	5 C11479 N/A E: 18978, 19704	6 G REVISION 36761
7 PVP REF	8 QUALITY REQUIREMENT DESCRIPTION (FEATURE)	9 FEATURE TOLERANCE	10 ATT/ VAR	11 MEASURED RESULTS	12 VERIFICATION STATUS
2579/ 2-2	After curing propellant, visually inspect for cracks and voids	AS cracks allowed. NO voids > 1.0"	VAR	See IOR 042890 (attached)	(Checked) 10-13-76
2579/ 2-3	Bore diameter	Engineering information	VAR	End 0° 24.349" 80° 24.312" Center 24.621" 24.627" Aff 24.491" 24.553°	(Checked) 10-13-76
2579/ 2-7	Propellant physical properties (UTP18803A)	Min values 20%	VAR	Summary attached	(Checked) 10-13-76
2579/ 2-8	True elongation (%) Tensile strength (psi) Propellant bond system SE 0719 Cartridge/liner/propellant	50 psi Min value 20 psi	VAR	80 p.s.i.	(Checked) 10-13-76
2579/ 2-9	Propellant bond system SE 0719 Insulation/liner/propellant	Min value 20 psi	VAR	70 p.s.i.	(Checked) 10-13-76
2579/ 2-10	Propellant ballistic batch check test per SE 0616, Rev B	SE 0719 & E 019857	VAR	Summary attached	(Checked) 10-13-76

13 ORIGINATOR Anne Evans 10-13-76

14 QA ACCEPTANCE Anne Evans 10-13-76

15 CUSTOMER ACCEPTANCE

C11479-01-01

DATA SUMMARY - H 2579-14

10/13/76

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10-13-76

Propellant Batch	4# Motor Test		4# Motor Projection		Physical Properties	
	Pressure (psi)	Burning Rate (in/sec)	Pressure (psi)	Burning Rate (in/sec)	True Elongation (%)	Tensile Strength (psi)
1532	705	.3590	1000	.4168	39	105
	880	.3881	1400	.4858		
	1477	.4983	1700	.4306		
	1673	.5280				
1533	698	.3610	1000	.4192	36	104
	866	.3908	1400	.4847		
	1313	.4722	1700	.5271		
	1538	.5053				
1534	792	.3816	1000	.4241	34	106
	992	.4195	1400	.4951		
	1452	.5097	1700	.5414		
	1749	.5445				
1535	777	.3707	1000	.4236	38	101
	855	.3989	1400	.4956		
	1279	.4804	1700	.5427		
	1723	.5415				
1536	1000	.4212	1000	.4213	33	100
	1355	.4820	1400	.4955		
	1793	.5582	1700	.5442		

REGULATORY REPORT

No. 000

Page 1 of 1

1. Assembly No. 2579-01-01

2. Part No. 2579-01-01

3. Lot No. 2579-01-01

4. Function 3A

5. Rel. Code 04

6. Ship No. 04

7. Unit Meas. Lot Size 1

8. No. Accepted 1

9. No. Rejected 1

10. Unit Meas. Lot Size 1

11. Time 1

12. Date 1/23/76

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PRODUCT ACCEPTANCE RECORD						
1 PART NUMBER	2 PART NAME	3 SERIAL NUMBER/ LOT NUMBER	4 CONFIGURATION	5 C/H79 N/C & 18978, 19704	6 OPERATIONS PLANNING REFERENCE	12. VERIFICATION STAMP
C11479-02-01	ELSH Motor	2579-15	-02-01		38037	
7 PVP REF	8	QUALITY REQUIREMENT DESCRIPTION (FEATURE)	9 FEATURE TOLERANCE	10. ATT/ VAR	11. MEASURED RESULTS	
2579/ 2-2	After curing propellant, visually inspect for cracks and voids		No cracks allowed. No voids > 10"	VAR	None	CSD 2 Anne Evans NOV 15 1976
2579/ 2-3	Bore diameter		Engineering VAR information	VAR	End 24.332" 24.335" Center 24.738" 24.735" BT 24.600" 24.600"	CSD 2 Anne Evans NOV 15 1976
2579/ 2-7	Propellant physical properties (C11479039)		Min values 200% 50 psi	VAR	Summary attached	Anne Evans NOV 15 1976
2579/ 2-8	Propellant bond system SE0719 Cartridge/liner/propellant		Min value 20 psi	VAR	110 psi	Anne Evans NOV 15 1976
2579/ 2-9	Propellant bond system SE0719 Insulation/liner/propellant		Min value 20 psi	VAR	84 psi	Anne Evans NOV 15 1976
2579/ 2-10	Propellant ballistic batch check test per SE0616, Rev B		SE0719 & ECO 19857	VAR	Summary attached	Anne Evans NOV 15 1976
13 ORIGINATOR	14. QA ACCEPTANCE	15 CUSTOMER ACCEPTANCE				
Anne Evans NOV 15 1976	Anne Evans NOV 15 1976	Prof E. J. Marmette 11/16/76				

C11, -02-01

DATA SUMMARY: SH 2579-15

12 November . 3

Batch No.	4# Motor Test		4# Motor Projection		Physical Properties	
	Pressure (psia)	Burning Rate (in/sec)	Pressure (psia)	Burning Rate (in/sec)	True Elongation (%)	Tensile Strength (psi)
1546	916	.3984	1000	.4088	37	134
	1235	.4336	1400	.4622		
	1447	.4733	1700	.4961		
1547	942	.4049	1000	.4145	32	134
	1271	.4578	1400	.4841		
	1502	.5037	1700	.5294		
1548	739	.3527	1000	.4065	35	136
	896	.3868	1400	.4770		
	1177	.4329	1700	.5232		
1549	1434	.4864				
	737	.3567	1000	.4056	33	131
	911	.3849	1400	.4717		
1550	1200	.4387	1700	.5146		
	1459	.4833				
	740	.3545	1000	.4069	35	124
	924	.3913	1400	.4773		
	1181	.4353	1700	.5233		
	1467	.4921				

H-200



Anne Evans

NOV 15 1976

PRODUCT ACCEPTANCE RECORD					
1. PART NUMBER	2. PART NAME	3. SERIAL NUMBER/ LOT NUMBER	4. CONFIGURATION	5. C11479 X/C & ECO's 18979, 19704	6. OPERATIONS PLANNING REFERENCE 38038
7. PVP REF	8. QUALITY REQUIREMENT DESCRIPTION (FEATURE)	9. FEATURE TOLERANCE	10. ATT/ VAR	11. MEASURED RESULTS	12. VERIFICATION STAMP
2579/ 2-2	After curing propellant, visually inspect for cracks and voids	No cracks allowed. 16 voids > 1.0"	VAR	None	
2579/ 2-3	Bore diameter	Engineering information	VAR	OS 0° 03900 Fwd 34.106" 384.314" Cdr 24.649" 24.65-4" Aft 24.344" 24.319"	
2579/ 2-7	Propellant physical properties (UTP 18803 A) True elongation (%) Tensile strength (psi)	Min values 20% 50 psi	VAR	Summary attached	
2579/ 2-8	Propellant bond system SE0719 Cartridge/liner/propellant	Min value 20 psi	VAR	101 psi	
2579/ 2-9	Propellant bond system SE0719 Insulation/liner/propellant	Min value 20 psi	VAR	100 psi	
2579/ 2-10	Propellant ballistic batch check test per SE0616, Rev B	SE0719 and ECO 19857	VAR	Summary attached	
13. ORIGINATOR <i>Anne Evans</i>	14. QA ACCEPTANCE <i>Anne Evans</i>	15. CUSTOMER ACCEPTANCE <i>[Signature]</i>	NOV 12 1976		

C11479-03-07

DATA SUMMARY: LSH 2579-16

12 November 1976

Batch No.	4# Motor Test		4# Motor Projection		Physical Properties	
	Pressure (psia)	Burning Rate (in/sec)	Pressure (psia)	Burning Rate (in/sec)	True Elongation (%)	Tensile Strength (psi)
1550	740	.3545	1000	.4069	35	724
	924	.3913	1400	.4773		
	1181	.4353	1700	.5233		
	1467	.4921				
1551	746	.3560	1000	.4096	24	107
	899	.3953	1400	.4790		
	1192	.4362	1700	.5240		
	1494	.4979				
1552	749	.3545	1000	.4054	24	104
	921	.3927	1400	.4746		
	1222	.4368	1700	.5197		
	1492	.4947				
1553	766	.3602	1000	.4037	22	102
	900	.3806	1400	.4745		
	1156	.4256	1700	.5209		
	1590	.5120				
1554	767	.3620	1000	.4080	18	105
	907	.3836	1400	.4800	(Ref. IDR #41201)	
	1220	.4524	1700	.5271		
	1622	.5148				

H-202

CSO
C. C.
Anne E. Evans

NOV 12 1976

PRODUCT ACCEPTANCE RECORD									
1 PART NUMBER	2 PART NAME	3 SERIAL NUMBER/ LOT NUMBER	4 CONFIGURATION	5 PAR REVISION NUMBER	6 OPERATIONS PLAN/ V3 REFERENCE				
C11479-01-01	ELSH Motor	2579-17	-01-01	Rev. A & ECO 20159 DATE 7/22/77	43971				
7 PVP REF	8 QUALITY REQUIREMENT DESCRIPTION (FEATURE)	9 FEATURE TOLERANCE	10 ATT/ VAR	11 MEASURED RESULTS	12 VERIFICATION STAMP				
2579/ 2-2	After curing propellant, visually inspect for cracks and voids	No cracks allowed. No voids > 1.0"	VAR	Separation exist IDR 042153	(36) 7-22-77				
2579/ 2-3	Bore Diameter	Engineering VAR Information.	VAR	0° 90° Fwd 24.300 24.350 Ctr 24.510 24.487 Aft 24.462 24.400	(36) 7-22-77				
2579/ 2-7	Propellant physical properties True Elongation (%) Tensile Strength (psi)	Min. values VAR 20% 50 psi	VAR	Summary attached	(36) 7-22-77				
2579/ 2-8	Propellant bond system (SD0719) Cartridge/liner/propellant	Min. Value VAR 20 psi	VAR	95 psi	(36) 7-22-77				
2579/ 2-9	Propellant Bond System (SD0719) Insulation/liner/propellant	Min. Value VAR 20 psi	VAR	109 psi	(36) 7-22-77				
2579/ 2-10	Propellant ballistic batch check test	SD0719 & ECO 19857	VAR	Summary Attached	(36) 7-22-77				
N/A	Propellant Weight	Engineering VAR Information	VAR	22,798#	(36) 7-22-77				
13 ORIGINATOR Anne Evans A. B. Evans		14 QA ACCEPTANCE Anne Evans		15 CUSTOMER ACCEPTANCE					
7-22-77		7-22-77							

PRODUCT ACCEPTANCE RECORD DATA

ELSH MOTOR 2579-17

Swann
7-22-77

<u>Propellant Batch</u>	<u>4# Motor Data Pressure (psi)</u>	<u>Burn Rate (in/sec)</u>	<u>Physical Properties True Elongation (%)</u>	<u>Tensile Strength (psi)</u>
1574	1000	.3933		
	1400	.4606	34	117
	1700	.5045		
1575	1000	.3925		
	1400	.4702	39	120
	1700	.5218		
1576	1000	.3946		
	1400	.4706	42	116
	1700	.5210		
1577	1000	.3982		
	1400	.4710	34	113
	1700	.5189		
1578	1000	.3971		
	1400	.4705	36	113
	1700	.5189		

TECHNOLOGIES
CHEMICAL SYSTEMS DIVISION

UNCLASSIFIED DATA FILE UNIT

Page 1 of 1

1. End Item No.		Serial No.		Name	
7. Assembly No.		Serial No.		Name	
8. Part No.		Serial No.		Name	
2. Proj. No.		3. Div. No.		4. Function	
5. PO No.		Item No.		Ship No.	
10. Unit Meas.		Lot Size		No. Accepted	
11. a time		No. Rejected		12. Cycles	
13. Type AC		14. a time		15. b time	
16. Description of Nonconformance					
17. Separations Exceeds at the Fillet Radius					
18. on the end of the Fillet Radius					
19. 3 1/2" x 1/2" x 1/2" 300° Interference					
20. Depth is undetectable					
21. Disposition Instructions					
22. Item 1 R					
23. Item 1 R					
24. Item 1 R					
25. Item 1 R					
26. Item 1 R					
27. Item 1 R					
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96. Item 1 R					
97. Item 1 R					
98. Item 1 R					
99. Item 1 R					
100. Item 1 R					

PRODUCT ACCEPTANCE RECORD

1 PART NUMBER C11479-03-02		2 PART NAME ELSH Motor		3 SERIAL NUMBER/ LOT NUMBER 2579-18		4 CONFIGURATION -03-02		5. PAR REVISION NUMBER 20377 Rev. A & ECO'S 20159 & DATE 7/22/77		6 OPERATIONS PLANNING REFERENCE 44113	
7 PVP REF	8	QUALITY REQUIREMENT DESCRIPTION (FEATURE)		9 FEATURE TOLERANCE	10 ATT/ VAR	11 MEASURED RESULTS		12 VERIFICATION STAMP			
2579/ 2-2		After curing propellant, visually inspect for cracks and voids		No cracks allowed. No voids > 1.0"	VAR	None		(36) 7-22-77			
2579/ 2-3		Bore diameter		Engineering Information	VAR	Fwd 0° 90° Ctr 24.331 24.338 Aft 24.577 24.543 54.812 55.062		7-22-77			
2579/ 2-7		Propellant physical properties True Elongation (%) Tensile Strength		Min. values 20% 50 psi	VAR	Summary attached		(36) 7-22-77			
2579/ 2-8		Propellant bond system Cartridge/liner/propellant		Min. value 80 psi	VAR	79 psi 7-26-77 IDR 04222 42405		7-22-77			
2579/ 2-9		Propellant bond system Insulation/liner/propellant		Min. value 80 psi	VAR	113 psi		(36) 7-22-77			
2579/ 2-10		Propellant ballistic batch check test		SE0719 & ECO 19857	VAR	Summary attached		7-22-77			
N/A		Propellant weight		Engineering Information	VAR	20,140#		(36) 7-22-77			

13 ORIGINATOR

A. B. Evans 7-22-77

14 QA ACCEPTANCE

Anne Evans

7-22-77

15 CUSTOMER ACCEPTANCE

PRODUCT ACCEPTANCE RECORD DATA

ELSH MOTOR 2579-18

OK
7-22-77

<u>Propellant Batch</u>	<u>4# Motor Data Pressure(psi)</u>	<u>Burn Rate (in/sec)</u>	<u>Physical Properties True Elongation(%)</u>	<u>Tensile Strength (psi)</u>
1578	1000	.3971		
	1400	.4705	36	113
	1700	.5189		
1579	1000	.3991		
	1400	.4813	35	119
	1700	.5362		
1580	1000	.3964		
	1400	.4740	41	125
	1700	.5255		
1581	1000	.3944		
	1400	.4730	39	120
	1700	.5252		
1582	1000	.3996		
	1400	.4720	38	111
	1700	.5197		

H-208

PRODUCT ACCEPTANCE RECORD									
1. PART NAME		3. SERIAL NUMBER/ LOT NUMBER	4. CONFIGURATION	5. C11479 A & ECO 20159	6. OPERATIONS PLANNING REFERENCE 44963				
7. PVP REF	8	QUALITY REQUIREMENT DESCRIPTION (FEATURE)	9. FEATURE TOLERANCE	10. ATT/ VAR	11. MEASURED RESULTS	12. VERIFICATION STAMP			
2579/ 2-2	01-01	Loaded cartridge - ELSH							
2579/ 2-3		After curing propellant, visually inspect for cracks and voids	No cracks allowed. No voids > 1.0'	VAR	See IDR 040102 (attached)	36 CS9 10-3-77			
2579/ 2-7		Bore diameter	Engineering information	VAR	Fwd 24.323 24.329 Center 24.683 24.705 Att 24.618 24.510	36 CS9 10-3-77			
2579/ 2-8		Propellant physical properties (UTP 18803A) True elongation (%) Tensile strength (psi)	Min values 20% 50 psi	VAR	Summary attached	36 CS9 10-3-77			
2579/ 2-9		Propellant bond system SE0719 & ECO 20339 cartridge/liner/propellant	Min value 80 psi	VAR	91 psi	36 CS9 10-3-77			
2579/ 2-10		Propellant bond system SE0719 & ECO 20339 insulation/liner/propellant	Min value 80 psi	VAR	94 psi	36 CS9 10-3-77			
N/A		Propellant ballistic batch check test per SE0616, Rev B	SE0719 & ECO 19857	VAR	Summary attached	36 CS9 10-3-77			
		Propellant weight	Engineering information	VAR	22761.0 #	36 CS9 10-3-77			
13. ORIGINATOR Anne Evans		14. QA ACCEPTANCE Anne Evans		15. CUSTOMER ACCEPTANCE 10-3-77		10/3/77			

CL1479-01-01

DATA SUMMARY Form 2579-19

10/3/77

Propellant Batch	4# Motor Test		4# Motor Projection		Physical Properties	
	Pressure (psi)	Burning Rate (in/sec)	Pressure (psi)	Burning Rate (in/sec)	True Elongation (%)	Tensile Strength (psi)
1588	957	.385	1000	.3948	31	97
	1629	.525	1400	.4815		
	1976	.5914	1700	.5400		
1589	969	.3976	1000	.4046	30	102
	1718	.5398	1400	.4825		
	1832	.5527	1700	.5340		
1590	798	.3700	1000	.4035	34	101
	1030	.4107	1400	.4882		
	1650	.5435	1700	.5434		
1591	1871	.5654				
	990	.4048	1000	.4078	36	99
	1859	.5821	1400	.4903		
1592	2017	.5904	1700	.5453		
	794	.3686	1000	.4046	31	97
	994	.4027	1400	.4877		
	1737	.5535	1700	.5432		
	1992	.590				



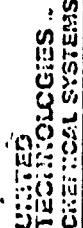
CHEMICAL SYSTEMS DIVISION

INTEGRATED DATA REPORT

No. 042100

Page 1 of 2 pages

1. End Item No.		Serial No.		Name		2. Proj. No.		3. Bldg. No.		4. Function		5. Reference		6. Plan		Specification No.	
7. Assembly No.		Serial No.		Name		8. PO No.		Item No.		Ship. No.		Supplier Name				No.	
C 11179-01-01		2579-19		LOADED CONTAINER ELEM								C 50				042100-44963	
9. Part No.		Serial No.		Name		10. Unit Meas.		Lot Size		No. Accepted		No. Rejected		11. Time		12. Cycles	
						PC		1		0		1		114		114	
13. Item No.		14. Qty. Units		15. Orig. Resp		16. Drwg. Zone Spec Para		17. Dimension/ Specification Nominal		18. Tolerance Limits		19. Name		20. DESCRIPTION OF NONCONFORMANCE		21. Type FC	
1		1		31F		Note #8		11070		11070		11070		SEPARATIONS EXIST IN HFT PROPELLANT SURFACE AT THE FILLET AREA. INTERMITTENTLY 200" W, DEPTH IS UNDEFINABLE.		H-D	
H-211																	
22. Item No.		23. Qty. Units		24. Disp. Code		25. Recur		26.		27. Originator		28. Date		29. Operations		30. Date	
1		1		H		0				H. Hamilton		9-17-77		9-17-77		9-17-77	
29. Remarks:		30. Supporting Documents:		31. Engineering		32. Operations		33. Quality Assurance		34. Customer		35. Date		36. Date		37. Date	
Reference JLC-059-77 attached		John Baldwin		CSB		8/29/77		8/29/77		S. C. Hamilton		9-1-77		9-1-77		9-1-77	

INTEGRATED DATA REPORT
CONTINUATION SHEET

NO. 012102

ITEM NO.	QTY. UNITS	DISP. CODE	RE- CUR.	ORGN. RESP.	FEAT. TYPE	DPWG. SPEC.	ZONE PARA.	DIM./SPEC. NOMINAL	TOLERANCE LIMITS	DESCRIPTION OF NONCONFORMANCE
H-212										
CONT'D. Page 1 DISPOSITION INSTRUCTIONS OPERATIONS QUALITY										
1	1	A								a) accumulation trimmed out - 1" depth minimum - 2" depth maximum b) weight of laminate removed 4413.0 grams c) unit will void unless repaired d) portion of laminate removed 1563.18 gms total 2610.0 grams <i>OK CS White 8/29/77</i>
ENGINEERING DATE QUALITY ASSURANCE DATE CUSTOMER DATE										

PRODUCT ACCEPTANCE RECORD						
1. PART NUMBER	2. PART NAME	3. SERIAL NUMBER/ LOT NUMBER	4. CONFIGURATION	5. C 11479 A & ECO 20159	6. OPERATIONS PLANNING REFERENCE 44962	
7. PVP REF	8. QUALITY REQUIREMENT DESCRIPTION (FEATURE)	9. FEATURE TOLERANCE	10. ATT/ VAR	11. MEASURED RESULTS	12. VERIFICATION STAMP	
2579/ 2-2	After curing propellant; visually check for cracks and voids	16 cracks allowed, 16 voids > 1.0"	VAR	See IDR 042137 Attached)	(36) 10-3-77	
2579/ 2-3	Bore diameter	Engineering information	VAR	Ful 0° 24.347 24.328 Center 24.351 24.727 Aft 24.540 24.517	(36) 10-3-77	
2579/ 2-7	Propellant physical properties (UTP 18803A) True elongation (0%) Tensile strength (psi)	Min values 20% SD psi	VAR	Summary attached	(36) 10-3-77	
2579/ 2-8	Propellant bond system SEO 719 & ECO 20339 cartridge/liner/propellant	Min values 80 psi	VAR	92 psi	(36) 10-3-77	
2579/ 2-9	Propellant bond system SEO 719 & ECO 20339 insulation/liner/propellant	Min value 80 psi	VAR	111 psi	(36) 10-3-77	
2579/ 2-10	Propellant ballistic batch check test per SED616, Rev B	SEO 719 & ECO 19857	VAR	Summary attached	(36) 10-3-77	
N/A	Propellant Weight	Engineering information	VAR	22727. #	(36) 10-3-77	
13. ORIGINATOR Anne Evans 10-3-77		14. QA ACCEPTANCE Anne Evans		15. CUSTOMER ACCEPTANCE 10/3/97		

J114, -02-01

DATA SUMMARY JSH 2579-20

10/3/77

Propellant Batch	4# Motor Test		4# Motor Projection		Physical Properties	
	Pressure (psi)	Burning Rate (in/sec)	Pressure (psi)	Burning Rate (in/sec)	True Elongation (%)	Tensile Strength (psi)
1592	794	.3686	1000	.4046	31	97
	994	.4027	1400	.4877		
	1737	.5535	1700	.5432		
	1992	.590				
1593	793	.3649	1000	.3993	34	92
	1064	.4126	1400	.4894		
	1692	.5567	1700	.5503		
	2133	.6252				
1594	776	.361	1000	.4036	36	101
	1068	.4181	1400	.4834		
	1873	.5649	1700	.5364		
1595	830	.3775	1000	.4084	37	97
	1057	.4207	1400	.4892		
	1718	.5459	1700	.5428		
1596	837	.3848	1000	.4073	32	98
	1087	.4258	1400	.4895		
	1751	.5599	1700	.5443		
	1857	.5641				

H-214



INTEGRATED DATA REPORT

No. 042137

Page 1 of 2 pages

UNITED TECHNOLOGIES

CHROMALOX

1. End Item No.

2. Assembly No.

3. Part No.

4. Function

5. Reference

6. Plan

7. Specification No.

8. PO No.

9. Supplier Name

10. Unit Meas.

11. Lot Size

12. No. Accepted

13. No. Rejected

14. Time

15. Cycles

16. Type AC

17. Description of Nonconformance

18. Item No.

19. Qty.

20. Open

21. Recur

22. Disposition Instructions

23. Originator

24. Date

25. Operations

26. Quality

27. Supporting Documents

28. Customer

29. Date

30. Quantity

31. Engineering

32. Operations

33. Quality Assurance

34. Date

35. Quantity

36. Date

37. Quantity

38. Date

39. Quantity

40. Date

41. Quantity

42. Date

43. Quantity

44. Date

45. Quantity

46. Date

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219. Quantity

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320. Date

321. Quantity

322. Date

INTEGRATED DATA REPORT

CONTINUATION SHEET

NO. 042137

UNIVERSITY OF CALIFORNIA
NUCLEAR SYSTEMS DIVISION

ITEM NO.	QTY. UNITS	ORGN. RESP.	FEAT. TYPE	DRWG. ZONE SPEC. PARA.	DIM./SPEC. NOMINAL	TOLERANCE LIMITS	DESCRIPTION OF NONCONFORMANCE	ORIGINATOR	ORGN. NO.	DATE	OPER. ACTIONS	QUALITY
1	1	R										
5 Cont'd. Page 1 2) separation trimmed out - 1" depth minimum 2" depth maximum 3) weight of propellant removed 4296.10 Gms 4) trimmed void below per above 5) netfilm, compound batch no. 1563.18 - 2-2 weight 2610.0 gms. OK CS Ashlin 8/29/77												
ENGINEERING DATE QUALITY ASSURANCE DATE CUSTOMER DATE 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100 101 102 103												

R-216

PRODUCT ACCEPTANCE RECORD

1 PART NUMBER	2 PART NAME	3 SERIAL NUMBER/ LOT NUMBER	4 CONFIGURATION	5 C11479 Rev A & ECO 20159	6 OPERATIONS PLANNING REFERENCE
C11479-01-01	Loaded Cartridge ELSH	2579-21	-01-01		46156
7 PVP REF	8 QUALITY REQUIREMENT DESCRIPTION (FEATURE)	9 FEATURE TOLERANCE	10 ATT/ VAR	11 MEASURED RESULTS	12 VERIFICATION STAMP
2579/ 2-2	After curing propellant, visually check for cracks and voids	No cracks allowed 16" voids > 1.0"	VAR	See IDR 041702 (attached)	(36) ESD 10 19 77
2579/ 2-3	Bore diameter	Engineering information	VAR	Full 24.374 24.324 Center 24.864 24.880 Aft 24.322 24.560	(36) ESD 10 19 77
2579/ 2-7	Propellant physical properties (UTP18803A) True elongation (%) Tensile strength (psi)	Min values 20% 50 psi	VAR	Summary attached	(36) ESD 10 19 77
2579/ 2-8	Propellant bond system SEO 719 & ECO 20339 Cartridge/liner/propellant	Min value 80 psi	VAR	76 psi See IDR # 042434 (attached)	(36) ESD 10 19 77
2579/ 2-9	Propellant bond system SEO 719 & ECO 20339 Insulation/liner/propellant	Min value 80 psi	VAR	108 psi	(36) ESD 10 19 77
2579/ 2-10	Propellant ballistic batch check test per SEO 616, Rev B	SEO 719 & ECO 19857	VAR	Summary attached	(36) ESD 10 19 77
N/A	Propellant weight	Engineering information	VAR	22650#	(36) ESD 10 19 77
13 ORIGINATOR Anne Evans 10 19 77		14 QA ACCEPTANCE Anne Evans 10 19 77		15 CUSTOMER ACCEPTANCE (LWS) 10/19/77	

Batch	4# Motor Test		4# Motor Projection		Propellant Physical Properties	
	Pressure	Burning Rate	Pressure	Burning Rate	Tensile Strength(psi)	True Elongation(%)
1606	849	.3786	1000	.403	42	114
	1088	.4220	1400	.481		
	1217	.4459	1700	.533		
	1551	.5085				
1607	812	.3693	1000	.399	38	118
	1012	.3993	1400	.459		
	1176	.4306	1700	.497		
	1404	.4573				
1608	887	.382	1000	.395	37	112
	986	.3938	1400	.472		
	1176	.4262	1700	.523		
	1444	.4817				
1609	840	.3679	1000	.394	36	100
	949	.3826	1400	.467		
	1207	.4375	1700	.515		
	1415	.4670				
1610	910	.3706	1000	.420	38	105
	878	.3887	1400	.480		
	1263	.4606	1700	.519		
	1452	.487				

Page 1 of 1 pages

H-219

C 1138 (76/02)

Page 1 of 1 pages

CSO 1138 (76/C2)

PRODUCT ACCEPTANCE RECORD

1. PART NUMBER	2. PART NAME	3. SERIAL NUMBER/ LOT NUMBER	4. CONFIGURATION	5. C11479 A & ECO 20159	6. OPERATIONS PLANNING REFERENCE 46157
7. PVP REF	8. QUALITY REQUIREMENT DESCRIPTION (FEATURE)	9. FEATURE TOLERANCE	10. ATT/ VAR	11. MEASURED RESULTS	12. VERIFICATION STAMP
2579/ 2-2	After curing propellant, visually check for cracks and voids	No cracks allowed. No voids > 1.0"	VAR	See IDR 041703 (attached)	(36) 10-18-77
2579/ 2-3	Bore diameter	Engineering information	VAR	Fwd 0° 900 Center 24.341 24.316 Aft 24.858 24.822 24.463 24.474	(36) 10-18-77
2579/ 2-7	Propellant physical properties (UTP 18803A) True elongation (%) Tensile strength (psi)	Min values 20% 50 psi	VAR	Summary attached	(35) 10-18-77
2579/ 2-8	Propellant bond system Cartridge/liner/propellant	Min value 80 psi	VAR	45 psi See IDR 042434 (attached)	(33) 10-18-77
2579/ 2-9	Propellant bond system Insulation/liner/propellant	Min value 80 psi	VAR	64 psi See IDR 042434 (attached)	(36) 10-18-77
2579/ 2-10	Propellant ballistic batch check test per SEO 616, Rev 3	SEO 719 & ECO 19857	VAR	Summary attached	(36) 10-18-77
N/A	Propellant weight	Engineering information	VAR	22.620 #	(36) 10-18-77

H-221

13. ORIGINATOR Anne Evans 10-18-77	14. QA ACCEPTANCE Anne Evans	15. CUSTOMER ACCEPTANCE (36) 10/19/97
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DATA SUMMARY ELSH 2579-22

Batch	4# Motor Test		4# Motor Projection		Propellant Physical Properties	
	Pressure	Burning Rate	Pressure	Burning Rate	Tensile Strength(psi)	True Elongation(%)
1611	789	.3637	1000	.404	37	102
	944	.3955	1400	.475		
	1151	.4266	1700	.522		
	1435	.4839				
1612	921	.3952	1000	.401	38	102
	931	.3858	1400	.480		
	1380	.4767	1700	.532		
	1608	.5156				
1613	859	.3739	1000	.421	12, 38	59, 112
	843	.3963	1400	.476	(See IDR 042442 Attached)	
	1323	.4586	1700	.511		
	1472	.4905				
1614	821	.3782	1000	.406	34	114
	920	.3881	1400	.489		
	1238	.4567	1700	.545		
	1450	.4995				
1615	804	.3722	1000	.402	39	113
	1053	.4113	1400	.469		
	1227	.4414	1700	.513		
	1395	.4680				

TECHNICAL SYSTEMS DIVISION

Page 1 of 1 pages

1. End Item No.		Serial No.		Name		2. Proj. No.		3. Bldg. No.		4. Function		5. Reference		6. Plan		Specification No.			
7. Assembly No.		Serial No.		Name		8. PO No.		Item No.		Ship. No.		Supplier Name		No.		0577-41117			
9. Part No.		Serial No.		Name		10. Unit Meas		Lot Size		No. Accepted		No. Rejected		11. Time		12. Cycles			
14. Item No.		15. Qty. Units		16. Orig. Code		17. Draw. Zone Spec Para		18. Dimension/Specification Nominal		19. Tolerance Limits		20.		21. Originator		Date			
1		1		316		Note 8		100.10		Bond		SEPARATIONS EXISTS ON ART PROPELLANT SURFACE AT THE FILLET RADIIUS AREA INTERMITTENTLY 340° VIEW, DEPTH IS UNDETERMINED.		H-223		9-22-77			
22. Item No.		23. Qty. Units		24. Dis. Code		25. Recur		26.		27. Operations		28. Cycle		29. Remarks		30. Supporting Documents			
1		1		R						Total propellant to remove separation entire production of grain to approx 1" in depth as shown or until separation is removed, but no more than 2" deep. If 4" separation has not disappeared after 2" of propellant are removed contact the equipment manager and get a) Separation trimmed out - 1" min to 2" max 1.0" b) 4" of propellant removed 35500 ERAMS c) Trimmed void per above 1.0" d) Putting in ground batch no. 1563-18-94 with 1987 options Article		31. Engineering		32. Operations		33. Quality Assurance		34. Customer	
John Paulson		9-22-77		9-22-77		9-22-77		9-22-77		9-22-77		9-22-77		9-22-77		9-22-77			
12. JLC-058-77		Drop. Change will be made for next contact														B E Hamilton 22 Sept 77			

UTP TECHNOLOGIES CHEMICAL SYSTEMS DIVISION

Page 1 of 1 pages

End Item No.		Serial No.		Name	
Assembly No.		Serial No.		Name	
C11479-01-01		2579-22		Loaded Cartridge	
Part No.		Serial No.		Name	
UTP 18803A		400-1613		Propellant	
15. Qty. Units	16. Orig. Resp	17. Drug Zone Spec Para	18. Dimension/Specification	19. Nominal Limits	20.
1	2220	3.4.2	N/A	20% min	
DESCRIPTION OF NONCONFORMANCE					
Strain at Maximum stress (E_m) values were 13, 11, 10, and 13%.					
NOTE: The stress values for the above samples were 59, 59, 58, and 60					
with an average of 59 psi.					
A second carton from this batch gave the following ~~PHYSICAL~~ physicals:					
Stress, psi - 117, 113, 108, 110, with an average of 112.					
Strain, % - 40.41, 33, 37, with an average of 38.					
H-225					
DISPOSITION INSTRUCTIONS					
23. Qty. Units	24. Dispo. Code	25. Recur	26.	27. Discretions	28. Date
1	A	06			10/17/77
USE AS IS - Results of the second carton demonstrate adequate mechanical properties -					
First carton is suspect sample preparation. <i>First</i>					
<i>IN FOR MRB</i>					
<i>copy</i>					
<i>DR 042433</i>					
<i>codes</i>					
<i>SOP</i>					
Remarks					
30. Supporting Documents					
No. 12442					
31. 32 33 34 35 36 37 38 39 40			34. Customer		
91 92 93 94 95 96 97 98 99			Date		
33. Quality Assurance			Date		
32. Operations			Date		
Engineering			Date		
<i>John S. Ballman 17 Oct 77</i>			<i>N/A</i>		
<i>Edmund</i>			<i>10/17/77</i>		
<i>Bob Taylor</i>			<i>10/19/77</i>		

PRODUCT ACCEPTANCE RECORD

1 PART NUMBER C11479-01-01	2 PART NAME Loaded Cartridge ELSH	3 SERIAL NUMBER/ LOT NUMBER 2579-23	4 CONFIGURATION -01-01	5 C11479 A & ECO 20159	6 OPERATIONS PLANNING REFERENCE 46715
7 PVP REF	8 QUALITY REQUIREMENT DESCRIPTION (FEATURE)	9 FEATURE TOLERANCE	10 ATT/ VAR	11 MEASURED RESULTS	12 VERIFICATION STAMP
2579/ 2-2	After curing propellant, visually check for cracks and voids	No cracks allowed. No voids > 1.0"	VAR	See IDR 042073 (Attached)	(36) 11-11-77
2579/ 2-3	Bore diameter	Engineering information	VAR	Ed 24.331 20° Center 24.554 24.327 Aft 24.598 24.536 24.262	(36) 11-11-77
2579/ 2-7	Propellant physical properties (UTP 18803A) True elongation (%) Tensile strength (psi)	Min values 20% 50 psi	VAR	Summary attached	(36) 11-11-77
2579/ 2-8	Propellant bond system SE0719 & ECO 20339 Cartridge/liner/propellant	Min value 80 psi	VAR	See IDR 042444 (Attached)	(36) 11-11-77
2579/ 2-9	Propellant bond system SE0719 & ECO 20339 Insulation/liner/propellant	Min value 80 psi	VAR	See IDR 042444 (Attached)	(36) 11-11-77
2579/ 2-10	Propellant ballistic batch check test per SE0616, rev B	SE0719 & ECO 19857	VAR	Summary attached	(36) 11-11-77
N/A	Propellant weight	Engineering information	VAR	22622. #	(36) 11-11-77

13 ORIGINATOR

Anne Evans 11-11-77

14 QA ACCEPTANCE

Anne Evans 11-11-77

15 CUSTOMER ACCEPTANCE

(36) 11/11/77

-1479-01-01

DATA SUMMARY ELSH 2579-23

11/8/77

Propellant Batch	4# Motor Test		4# Motor Projection		Propellant Physical Properties	
	Pressure (psi)	Burning Rate (in/sec)	Pressure (psi)	Burning Rate (in/sec)	True Elongation (%)	Tensile Strength (psi)
1620	1031	.4133	1000	.407	38	127
	1244	.4523	1400	.480		
	1450	.4880	1700	.527		
1621	753	.3507	1000	.397	34	127
	913	.3792	1400	.477		
	1212	.4357	1700	.521		
	1414	.4837				
1622	765	.3592	1000	.403	34	126
	925	.3878	1400	.472		
	1283	.4552	1700	.517		
	1486	.4835				
1623	755	.3462	1000	.392	32	110
	955	.3805	1400	.469		
	1212	.4393	1700	.520		
	1530	.4887				
1624	746	.3503	1000	.396	36	113
	958	.3888	1400	.463		
	1194	.4273	1700	.507		
	1393	.4635				



UP
TECHNOLOGIES
CHEMICAL SYSTEMS DIVISION

INTEGRATE DATA REPORT

No. 04773
Page 1 of 2 pages

1. End Item No.

Serial No. Name

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CHEMICAL SYSTEMS DIVISION

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CONTINUATION SHEET

NO. 373

[illegible]

CSD 1138A (76/06)

AL 227-70 WEIGHOUT

ATCH NO. 1563-18-10.3

PREMIX OCTAG NO. 44891

MOTOR NO. 2579-23

DER 332 or
EPOXY LOT NO. 18

AFT END POTTED

DATE 10-24-77

SPLIT BATCH: YES ☐ NO ☒

PREMIX

GROSS 6,290.0gms

OPERATOR

TARE 1,390.0gms

NET 4,900.0gms

DER 332 or
EPOXY

GROSS 2,530.0gms

TARE 430.0gms

NET 2,100.0gms

MIXED WEIGHT

GROSS 4,540.0gms

TARE BACK 2,479.0gms

NET IN MOTOR 2,061.0gms



No. 0.2444

SUPERSEEDING

No. 0.2444

Page 1 of 1 pages

GENERAL INFORMATION										SPECIFICATION									
1. End Item No.	2. Serial No.	3. Name	4. Description	5. Part No.	6. Lot No.	7. Date	8. Quantity	9. Price	10. Specification No.	11. Drawing No.	12. Item No.	13. Ship. No.	14. Supplier Name	15. No.					
7. Assembly No. C11479-01-01	2579-23	Loaded 84" Cartridge												N/A					
9. Part No. UTP 18803A	400-1620	Propellant												N/A					
14. Item No.	15. Qty.	16. Dimen./Spec Para	17. Draw. Zone	18. Dimen./Spec Para	19. Dimen./Spec Para	20. Dimen./Spec Para	21. Dimen./Spec Para	22. Dimen./Spec Para	23. Dimen./Spec Para	24. Dimen./Spec Para	25. Dimen./Spec Para	26. Dimen./Spec Para	27. Dimen./Spec Para	28. Dimen./Spec Para					
1	1	2220	4.1.2.2.2																
2	1	2220	Table IV	N/A															
H-231																			
DISPOSITION INSTRUCTIONS																			
USE AS IS. Sufficient propellant/liner/cartridge BUS have been tested on previous loaded cartridges with this propellant/liner system to demonstrate the adequacy of the component bonding.																			
USE AS IS. The average values of 43 psi is satisfactory for use in H-231.																			
29. Remarks																			
30. Information ONLY																			
31. Engineering																			
32. Operations																			
33. Quality Assurance																			
34. Customer																			
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PRODUCT ACCEPTANCE RECORD									
1. PART NUMBER	2. PART NAME	3. SERIAL NUMBER/ LOT NUMBER	4. CONFIGURATION	5.	6. OPERATIONS PLANNING REFERENCE				
C11479-02-01	Loaded cartridge ELSH	2579-24	-02-01	C11479A & ECO 20159	46716				
7. PVP REF	8.	QUALITY REQUIREMENT DESCRIPTION (FEATURE)		9. FEATURE TOLERANCE	10. ATT/ VAR	11. MEASURED RESULTS	12. VERIFICATION STAMP		
2579/ 2-2	After curing propellant, visually check for cracks and voids			No cracks allowed. No voids > 1.0"	VAR See IDR 042071 (attached)		11-11-77		
2579/ 2-3	Bore diameter			Engineering information	VAR	36 9.9 24.385 90° Center 24.685 24.342 APT 24.540 24.657 24.558	11-11-77		
2579/ 2-7	Propellant physical properties (UTP 18803A) True elongation (%) Tensile strength (psi)			Min values 20% 50 psi	VAR Summary attached		11-11-77		
2579/ 2-8	Propellant bond system SE0719 & ECO 20339 Cartridge/liner/propellant			Min value 80 psi	VAR	83 psi	11-11-77		
2579/ 2-9	Propellant bond system SE0719 & ECO 20339 Insulation/liner/propellant			Min value 80 psi	VAR	see IDR 042440 attached	11-11-77		
2579/ 2-10	Propellant ballistic batch check test per SE0616, Rev B			SE0719 & ECO 19857	VAR	Summary attached	11-11-77		
N/A	Propellant weight			Engineering information	VAR	2.2672 #	11-11-77		
13. ORIGINATOR		14. QA ACCEPTANCE		15. CUSTOMER ACCEPTANCE					
Anne Evans 11-11-77		R. S. 11-11-77		11/11/77					

CLL-479-02-01

JUNMAR. LSH 2579-24

11/8/77

Propellant Batch	4# Motor Test		4# Motor Projection		Propellant Physical Properties	
	Pressure (psi)	Burning Rate (in/sec)	Pressure (psi)	Burning Rate (in/sec)	True Elongation (%)	Tensile Strength (psi)
1625	777	.3591	1000	.398	36 28 11-11-77	106
	961	.3900	1400	.481		
	1253	.4491	1700	.537		
	1424	.4880				
1626	783	.3656	1000	.396	36 24 11-11-77	124
	937	.3844	1400	.466		
	1200	.4261	1700	.512		
	1266	.4444				
1627	773	.3566	1000	.397	36 24 11-11-77 See IDA 041890	36 24 11-11-77
	959	.3900	1400	.474		
	1222	.4352	1700	.525		
	1431	.4836				
1628	787	.3681	1000	.404	36 24 11-11-77	128
	962	.3953	1400	.478		
	1225	.4502	1700	.527		
	1429	.4809				
1629	951	.395	1000	.407	36 24 11-11-77	133
	1027	.413	1400	.486		
	1029	.416	1700	.538		
	1499	.503				

H-233



No. 042,71

Page 1 of 17 pages

CHEMICAL SYSTEMS DIVISION						Page 1 of 2 Pages	
Serial No.		Name		Serial No.		Name	
C11479-02-01		2579-24		LOADED CARTRIDGE ELKH			
7. Assembly No.		Serial No.		Name		Serial No.	
C11479-02-01		2579-24		LOADED CARTRIDGE ELKH			
9. Part No.		Serial No.		Name		Serial No.	
1. End Item No.		Serial No.		Name		Serial No.	
2. Proj. No.		3. Bldg. No.		4. Function		5. Reference	
2579		0453		36		0408	
8 PO No.		Item No.		Ship. No.		Supplier Name	
						C.S.D.	
10. Unit Meas.		Lot Size		No. Accepted		No. Rejected	
PC		1		0		1	
11. Time		12. Cycles		13. Type AC		14. Type BC	
N/A		N/A		N/A		N/A	
DESCRIPTION OF NONCONFORMANCE							
SEPARATIONS EXISTS ON AIR PROPELLANT SURFACE AT THE FILLET AREA, INTERMITTENTLY. 360° VIEW, DEPTH IS UNDETERMINED.							
INFORMATION ONLY							
DISPOSITION INSTRUCTIONS							
Trim propellant to remove separation. Trim entire perimeter of grain to approximate 1" min. depth as shown (entire perimeter) or until separation is removed, but no more than 2" deep. If the separation has not disappeared after 2" of propellant was removed contact the supplier. Program Experiment and QP. Pot the resultant void with AL-227 formulation versamid-epoxy. (Cont'd, Page 2)							
Dwg. Note will be added for next Contract							
29. Remarks:							
23. Item No.							
24. Qty.							
25. Unit							
26. Recd.							
27. Date							
28. Operations							
29. Quality							
30. Supporting Documents:							
31. Engineering							
32. Operations							
33. Quality Assurance							
34. Customer							
Date							
NO 42771							



INIEGKAIEU DAIA KEPUKI

CRITICAL SYSTEMS DIVISION

CONTINUED FROM SHEET 1

NO

0420

DESCRIPTION OF NONCONFORMANCE									
1. Item No.	2. Qty Units	3. Cor Resp.	4. Draw Zone Spec. Para	5. Dimension/ Specification Nominal	6. Tolerance Limits	7.	8. Originator	9. Orgn. No.	10. Date
DISPOSITION INSTRUCTIONS									
1	1	0/6	a) Separation threaded cut - 1" depth maximum						
			b) Height of precast concrete removed	3.152.0	6.817.5				
			c) Threaded wire attached to concrete						
			d) Topping concrete batch no. 15763 - 18-10-2						
2020-0 C. Davis P. H. H.									
NOTIFICATION ONLY									
15. Engineering									
16. Operations <i>Terry V. O'Hara</i> 17. Quality Assurance <i>C. S. O'Hara</i> 18. Customer <i>11/11/77</i>									

CSD 1136A (76/06)



JH D
TECHNOLOGIES
CHEMICAL SYSTEMS DIVISION

INTEGRATEL DATA REPORT

No. 0 440

Page 1 of 1 pages

1 End Item No.

1. End Item No.	2. Proj. No.	3. Bldg. No.	4. Function	5. Reference	6. Plan	Specification No.
	2579	0700	36	004835		SE0719A

7. Assembly No.	8. PO No.	9. Part No.	10. Unit Meas.	11. Time	12. Cycles	13. Type AC
02-01	N/A	N/A	1	N/A	N/A	1RB

14. Item No.	15. Qty	16. Orig Resd	17. Drwg. Zone	18. Dimension/ Specification	19. Tolerance	20. Name
1	1	222	4.1.2.2.2			Propellant

21. Description of Nonconformance	22. No. Accepted	23. No. Rejected	24. Supplier Name	25. No.
No propellant/liner/insulation bit specimens were made for this 84"	0	1	N/A	N/A

26. Cartridge.	27. Operations	28. Quality

29. Remarks	30. Supporting Documents

INTEGRATION ONLY

H-236

29. Remarks	30. Supporting Documents

29. Remarks	30. Supporting Documents

29. Remarks	30. Supporting Documents

29. Remarks	30. Supporting Documents

29. Remarks	30. Supporting Documents

29. Remarks	30. Supporting Documents

29. Remarks	30. Supporting Documents

29. Remarks	30. Supporting Documents

29. Remarks	30. Supporting Documents

29. Remarks	30. Supporting Documents

29. Remarks	30. Supporting Documents

29. Remarks	30. Supporting Documents

29. Remarks	30. Supporting Documents

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Coordinated by Telecon with T Kinzel AFRPL on 3 Nov 77

3 Nov 77

AFCE

31. Engineering

32. Operations

33. Quality Assurance

34. Customer

No. 42440

81 82 83 84 85 86 87 94 102 103

34. Customer

11/1/77

11/1/77

11/1/77

11/1/77



**UNIVERSITY OF CALIFORNIA
TECHNOLOGICAL
CHEMICAL SYSTEMS DIVISION**

No. 0.890

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APPENDIX I
PRODUCT ACCEPTANCE RECORDS - CHAR

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CHAR- 84" CHAR MOTOR

PRODUCT ACCEPTANCE RECORD						
1. PART NUMBER	2. PART NAME	3. SERIAL NUMBER/ LOT NUMBER	4. CONFIGURATION	5. C12185 + ECO's 19832, 19837, 19858	6. OPERATIONS PLANNING REFERENCE	12. VERIFICATION STAMP
C12185	84" CHAR MOTOR	2579-1	-01-01		08QR 33645	
7. PVP REF	8. QUALITY REQUIREMENT DESCRIPTION (FEATURE)	9. FEATURE TOLERANCE	10. ATT/ VAR	11. MEASURED RESULTS		
2579/ 3-2	After curing propellant, visually inspect for cracks or voids.	No cracks allowed. No voids > 1.0"	VAR	None	E. Good 5/12/76	
2579/ 3-3	Bore Dia.	Engineering Information	VAR	Fwd 21.512 Center 21.443 Aft 21.361	E. Good 5/12/76	
2579/ 3-7	Propellant Physical Properties (UTP-18803A) True Elongation % Tensile Strength psi	Min. Values 20% 80 psi	VAR	Summary Attached	E. Good 5/12/76	
2579/ 3-8	Propellant bond system SE0719 Cartridge/liner/propellant	Min. Value 80 psi	VAR	97 psi, 107 psi, 113 psi	E. Good 5/12/76	
2579/ 3-9	Propellant bond system SE0719 Insulation/liner/propellant	Min. Value 80 psi	VAR	126 psi, 127 psi, 132 psi	E. Good 5/12/76	
2579/ 3-10	Propellant ballistic batch check Test per SE0616, Rev. B	SE0719 + ECO 19858	VAR	Summary Attached	E. Good 5/12/76	

I-239

13. ORIGINATOR <i>E. Good</i>	14. QA ACCEPTANCE <i>E. Good 5/12/76</i>	15. CUSTOMER ACCEPTANCE <i>W. J. Taylor 5/12/76</i>
----------------------------------	---	--

P/N C12185-01-01		PRODUCT ACCEPT/RECORD		S/N 2579-1	
DATA SUMMARY					
<u>Propellant Batch</u>	<u>4# Motor Pressure (psi)</u>	<u>Burning Rate (in/sec)</u>	<u>Physical Properties</u>		
			<u>True Elongation (%)</u>	<u>Tensile Strength (psi)</u>	
1400-1463	966	.4049	32	107	
	1653	.5200			
1400-1464	1015	.4031	38	110	
	1651	.5200			
1400-1465	1033	.4172	33	136	
	1804	.5547			

5/12/96

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PRODUCT ACCEPTANCE RECORD									
1 PART NUMBER	2 PART NAME	3 SERIAL NUMBER (LOT NUMBER)	4 CORRELATION	5	6 OPERATIONS PLANNING REFERENCE				
C12185-02-01	Loaded Cartridge 84" Char Motor	2579-06	-02-01	ECO19832	36164				
7 PVP REF	8	9 FEATURE TOLERANCE		10 ATT VAR	11 MEASURED RESULTS	12 VERIFICATION STAMP			
2579/ 3-2	After curing propellant, visually inspect for cracks and voids	No cracks allowed; no voids > 1.0"		VAR	None	Anne Evans 8-20-76			
2579/ 3-3	Bore diameter	Engineering information		VAR	0° 90° 45.618" 45.637"	Anne Evans 8-20-76			
2579/ 3-7	Propellant physical properties Tensile elongation 70 Tensile strength psi	Min Values 2070 50 psi		VAR	Summary attached	Anne Evans 8-20-76			
2579/ 3-8	Propellant bond system SE0719 Cartridge/liner/propellant	Min Value 20 psi		VAR	90, 72, 87, 90, 67, 85	Anne Evans 8-20-76			
2579/ 3-9	Propellant bond system SE0719 Insulation/liner/propellant	Min value 20 psi		VAR	86, 84, 95, 122, 72, 84	Anne Evans 8-20-76			
2579/ 3-10	Propellant ballistic batch check test per SE0616, Rev. B	SE0719 & ECO19858		VAR	Summary attached	Anne Evans 8-20-76			
13 ORIGINATOR		14 QA ACCEPTANCE		15 CUSTOMER ACCEPTANCE					
Anne Evans 8-20-76		Anne Evans 8-20-76		E. J. [Signature] 8-30-76					

P/1 - 2 -02-C1

DATA SUBJECT: 579-⁶8 CHAP

<u>Propellant Batch</u>	<u>4# Motor Pressure</u> PSI	<u>Burn. Rate</u> (in./sec.)	<u>True Elongation</u> %	<u>Tensile Strength</u> PSI
1513	1000 1400 1700	.4213 .5017 .5349	35	126
1514	1000 1400 1700	.4194 .5019 .5566	36	128
1515	1000 1400 1700	.4192 .5030 .5589	30	131

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PRODUCT ACCEPTANCE RECORD						
1 PART NUMBER	2 PART NAME	3 SERIAL NUMBER / LOT NUMBER	4 CONFIGURATION	5	6 OPERATIONS PLANNING REFERENCE	12 VERIFICATION STAMP
C1285-03-01	Loaded Cartridge 84" Char Motor	2579-07	-03-01	ECO 19832	35782	
7. PVP REF	8. QUALITY REQUIREMENT DESCRIPTION (FEATURE)	9. FEATURE TOLERANCE	10 ATT/ VAR	11. MEASURED RESULTS		
2579 / 3-2	After curing propellant, visually inspect for cracks and voids	No cracks allowed; no voids > 1.0"	VAR	none	Anne Evans 8-10-76	
2579 / 3-3	Bore diameter	Engineering information	VAR	00 59.502 900 59.392	Anne Evans 8-10-76	
2579 / 3-7	Propellant Physical Properties (UTP188039) True Elongation % Tensile Strength psi	Min. values 20% 0 psi	VAR	Summary attached	Anne Evans 8-10-76	
2579 / 3-8	Propellant Bond System SE0719 Cartridge / Liner / Propellant	Min value 20 psi	VAR	90 psi 72 psi 87 psi	Anne Evans 8-10-76	
2579 / 3-9	Propellant Bond system SE0719 Insulation / Liner / Propellant	Min value 20 psi	VAR	96 psi 84 psi 95 psi	Anne Evans 8-10-76	
2579 / 3-10	Propellant Ballistic batch check Test Per SE066, Rev. B	SE0719 ECO 19858	VAR	Ballistics test per SE066 waived per TUL-910-938-9245	Anne Evans 8-10-76	
SIGNATOR		14 QA ACCEPTANCE		15 CUSTOMER ACCEPTANCE		
Anne Evans 8-10-76		Anne Evans 8-10-76		Car/ E. W. Evans		8-11-76

P/N C12185-03-01

Data Summary

Propellant Batch

4# Motor Ballistics

Propellant Physical Properties
Elongation Tensile Strength
(%) (p.s.i.)

400-1515

waived
TWX-910-339-9245

30

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PRODUCT ACCEPTANCE RECORD						
1 PART NUMBER	2 PART NAME	3 SERIAL NUMBER/ LOT NUMBER	4 CONFIGURATION	5	6 OPERATIONS PLAN, NO REFERENCE	12 VERIFICATION STAMP
C12185-02-01	Char Motor	2579-8	-02-01	19832, 19837 19858, 19894	36386	
7 PVP REF	8	QUALITY REQUIREMENT DESCRIPTION (FEATURE)		9 FEATURE TOLERANCE	10 ATT/ VAR	11 MEASURED RESULTS
2579/ 3-2		After curing propellant, visually inspect for cracks and voids		No cracks allowed. No voids > 1.0"	VAR	None
2579/ 3-3		Bore diameter		Engineering information	VAR	0° 45.57" 90° 45.63"
2579/ 3-7		Propellant Physical Properties (UTP18803A)		Min values	VAR	Summary attached
2579/ 3-8		True elongation (70%) Tensile strength (psi)		20% 50 psi	VAR	
2579/ 3-9		Propellant bond system SEO 719 cartridge liner/propellant		Min value 20 psi	VAR	96 psi
2579/ 3-10		Propellant bond system SEO 719 Insulation/liner/propellant		Min value 20 psi	VAR	77 psi
2579/ 3-10		Propellant ballistic batch check test per SEO 616, Rev B		SEO 719 \$ ECO 19857	VAR	Summary attached
13 ORIGINATOR	14 QA ACCEPTANCE			15 CUSTOMER ACCEPTANCE		
Anne Evans 9-14-76	Anne Evans 9-15-76			Chief E. J. Kennedy 9/14/76		

012185 -01

DATA SUMMARY CHAR 2579-8

9/14/76

Propellant Batch	4# Motor Test		4# Motor Projections		Physical Properties	
	Pressure (psi)	Burning Rate (in/sec)	Pressure (psi)	Burning Rate (in/sec)	True Elongation %	Tensile Strength (psi)
1524	767	.3599				
	985	.3881	1000	.4014	36	113
	1316	.4550	1400	.4728		
	1638	.5178	1700	.5197		
1525	786	.3558	1000	.3989		
	1031	.4039	1400	.4693	40	115
	1460	.4772	1700	.5154		
	1650	.5100				

PRODUCT ACCEPTANCE RECORD						
1 PART NUMBER	2 PART NAME	3 SERIAL NUMBER / LOT NUMBER	4 CONFIGURATION	5 19832, 19837, 19858, 19894	6 OPERATIONS PLANNING REFERENCE	
7 PVP REF	8 QUALITY REQUIREMENT DESCRIPTION (FEATURE)	9 FEATURE TOLERANCE	10. ATT/ VAR	11 MEASURED RESULTS	12 VERIFICATION STAMP	
C12185-03-01	Char Motor	2579-9	-03-01		36387	
2579/ 3-2	After curing propellant, visually inspect for cracks and voids		No cracks allowed. No voids > 1.0"	VAR None		
2579/ 3-3	Bore diameter		Engineering information	VAR 0° 59.430" 90° 59.475"		
2579/ 3-7	Propellant physical properties (UTP 18803A) True elongation (%) Tensile strength (p.s.i)		Min values 20% SDpsi	VAR Summary attached		
2579/ 3-8	Propellant bond system SE0719 Cartridge/liner/propellant		Min value 20psi	VAR 110 psi		
2579/ 3-9	Propellant bond system SE0719 Insulation/liner/propellant		Min values 20 psi	VAR 100 psi		
2579/ 3-10	Propellant ballistic batch check test per SE0616, Rev B		SE0719 & ECD 19857	VAR Summary attached		
13. ORIGINATOR		14. QA ACCEPTANCE		15. CUSTOMER ACCEPTANCE		
Anne Evans 9-15-76		Anne Evans 9-15-76		E. J. McManis 9/16/76		

C12 -03-01

DATA SUMMARY CHAR 2579-9

9/14/76

Propellant Batch	4# Motor Test		4# Motor Projections		Physical Properties	
	Pressure (psf)	Burning Rate (in/sec)	Pressure (psf)	Burning Rate (in/sec)	True Elongation %	Tensile Strength (psi)
1526	787	.3699	1000	.4123		
	1016	.4110	1400	.4880	40	114
	1449	.4890	1700	.5377		
	1778	.5580				

PRODUCT ACCEPTANCE RECORD						
1 PART NUMBER	2 PART NAME	3 SERIAL NUMBER/LOT NUMBER	4 CONFIGURATION	5	6 OPERATIONS PLANTING REFERENCE	12 VERIFICATION STAMP
C12185-01-01	Char motor	2579-10	-01-01		C12185 N/C & 19832, 19837, 19858, 19894	37351
7 PVP RES	8 QUALITY REQUIREMENT DESCRIPTION (FEATURE)	9 FEATURE TOLERANCE	10 ATT/ VAR	11 MEASURED RESULTS		
2579/3-2	After curing propellant, visually inspect for cracks and voids	No cracks allowed. No voids > 1.0"	VAR	None	CSE Re. 9 2 10-13-76	
2579/3-3	Bore diameter	Engineering information	VAR	0° - 21.331 90° - 21.325	CSE Re. 9 2 10-13-76	
2579/3-7	Propellant physical properties (UTP18803A) True elongation (%) Tensile strength (psi)	Min values 20% 50 psi	VAR	Summary attached	CSE Re. 9 2 10-13-76	
2579/3-8	Propellant bond system SE0719 Cartridge/liner/propellant	Min value 20 psi	VAR	121 psi	CSE Re. 9 2 10-13-76	
2579/3-9	Propellant bond system SE0719 Insulation/liner/propellant	Min value 20 psi	VAR	109 p.s.i	CSE Re. 9 2 10-13-76	
2579/3-10	Propellant ballistic batch check test per SBO 616, Rev. B	SE0719 & ECO19857	VAR	Summary attached	CSE Re. 9 2 10-13-76	
13 ORIGINATOR		14 QA ACCEPTANCE		15 CUSTOMER ACCEPTANCE		
Anne Evans 10-13-76		Anne Evans 10-13-76		CSE Re. 9 2 10-13-76		

C12185-01-01

DATA SUMMAR. CHAR 2579-10

10/13/76

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D-13-76

Propellant Batch	4# Motor Test		4# Motor Projection		Physical Properties	
	Pressure (psi)	Burning Rate (in/sec)	Pressure (psi)	Burning Rate (in/sec)	True Elongation (%)	Tensile Strength (psi)
1541	761	.3728	1000	.4170	35	105
	1018	.4180	1400	.4816		
	1232	.4505	1700	.5234		
	1370	.4832				
1542	761	.3551	1000	.4054	43	118
	941	.3954	1400	.4756		
	1342	.4654	1700	.5216		
	1451	.4838				
1543	780	.3643	1000	.4072	35	104
	982	.3960	1400	.4824		
	1306	.4606	1700	.5319		
	1456	.5000				

PRODUCT ACCEPTANCE RECORD						
1 PART NUMBER	2 PART NAME	3 SERIAL NUMBER/ LOT NUMBER	4 CONFIGURATION	5 C12185 N/C 2A332, 19837, 19858, 19894	6 OPERATIONS PLANNING REFERENCE	
7 PVP REF	8	QUALITY REQUIREMENT DESCRIPTION (FEATURE)	9 FEATURE TOLERANCE	10. ATT/ VAR	11. MEASURED RESULTS	12 VERIFICATION STAMP
2579/ 3-2	Char motor	2579-11	-03-01			
	After curing propellant, visually inspect for cracks and voids					
2579/ 3-3	Bore diameter			VAR	None	
2579/ 3-7	Propellant physical properties (UTP 18803A) Tie elongation % Tensile strength (psi)			VAR	0° 59.633 90° 59.645	
2579/ 3-8	Propellant bond system SEO719 Cartridge/liner/propellant			VAR	Summary attached	
2579/ 3-9	Propellant bond system SEO719 Insulation/liner/propellant			VAR	52 psi	
2579/ 3-10	Propellant ballistic batch check test per SEO616, Rev B			VAR	50 psi	
				VAR	Summary attached	

CL2185-03-01

Data Summary Char 2579-11

10-5-76

013-76
D



Propellant Batch	4# Motor Test		4# Motor Projection		Physical Properties	
	Pressure (psi)	Burning Rate (in./sec.)	Pressure (psi)	Burning Rate (in./sec.)	True elongation (%)	Tensile strength (psi)
1536	1000	.4212	1000	.4213	33	100
	1355	.488	1400	.4955		
	1793	.5582	1700	.5442		
1537	816	.3791	1000	.4224	34	99
	908	.4078	1400	.5003		
	1487	.5042	1700	.5517		
	1808	.5778				

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PRODUCT ACCEPTANCE RECORD											
1 PART NUMBER	2 PART NAME	3 SERIAL NUMBER	4 CONFIGURATION	5 C12185-02-01	6 OPERATIONAL REFERENCE	7 P/P REF	8 QUALITY REQUIREMENT DESCRIPTION (FEATURE)	9 FEATURE TOLERANCE	10 ATT/ VAR	11 MEASURED RESULTS	12 VERIFICATION STAMP
C12185-02-01	Char motor	2579-12	-02-01		37350						
2579/3-2	After curing propellant, visually inspect for cracks and voids			VAR	None						Ann 9 10-13
2579/3-3	Bore diameter			VAR	0° 45.629"						Ann 9 10-13
2579/3-7	Propellant physical properties (UTP 18303A) True elongation (%) Tensile strength (psi)			VAR	Summary attached						Ann 9 10-13
2579/3-8	Propellant bond system SEO719 Cartridge/liner/propellant			VAR	95 psi						Ann 9 10-13
2579/3-9	Propellant bond system SEO719 Insulation/liner/propellant			VAR	90 psi						Ann 9 10-13
2579/3-10	Propellant ballistic batch check test per SEO 616, Rev B			VAR	Summary attached						Ann 9 10-13

13 ORIGINAL
Anne Evans 10-13-76

14 QA ACCEPTANCE
Anne Evans 10-13-76

15 CUSTOMER ACCEPTANCE
Anne Evans 10-13-76

CSO 1489 (75 0.1)

DATA SUMMARY - JHAR 2579-12

C12185-02-01

Q2 10-13-76

10/13/76

Propellant Batch	4 $\frac{1}{2}$ Motor Test		4 $\frac{1}{2}$ Motor Projection		Physical Properties	
	Pressure (psi)	Burning Rate (in/sec.)	Pressure (psi)	Burning Rate (in/sec.)	True Elongation (%)	Tensile Strength (psi)
1539	898	.3769	1000	.3937	44	91
	1126	.4092	1400	.4608		
	1241	.4366	1700	.5047		
	1343	.4554				
1540	912	.4005	1000	.4114	29	97
	1085	.4195	1400	.4632		
	1306	.4500	1700	.4935		
	1366	.4629				

Q2 10-13-76

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PRODUCT ACCEPTANCE RECORD									
1 PART NUMBER	2 PART NAME	3 SERIAL NUMBER/ LOT NUMBER	4 CONFIGURATION	5 C12185 A/C & ECO's 19832, 19837, 19858, 19894	6 OPERATIONS PLANNING REFERENCE				
7 PVP REF	8	9 QUALITY REQUIREMENT DESCRIPTION (FEATURE)	9 FEATURE TOLERANCE	10 ATT/ VAR	11 MEASURED RESULTS	12 VERIFICATION STAMP			
2579/ 3-2	Char motor	2579-13	-01-01		38036				
After curing propellant, visually inspect for cracks and voids									
2579/ 3-8	Bore diameter			VAR	None				
2579/ 3-7	Propellant Physical Properties (UTP18803A)			VAR	0° 21.287				
	True elongation (%)				80° 21.265				
2579/ 3-8	Tensile strength (psi)			VAR	Summary attached				
	Propellant bond system SE0719								
	Cartridge/liner								
2579/ 3-9	Propellant bond system SE0719			VAR	85 psi				
	Insulation/liner/propellant								
2579/ 3-10	Propellant ballistic batch check test per SE0616, Rev. B			VAR	97.0% 97 psi				
				SE0719 ECO 19857	Summary attached				

13 ORIGINATOR

Anne Evans 11-10-76

CSD 1489 (75 05)

14 QA ACCEPTANCE

Anne Evans 11-10-76

15 CUSTOMER ACCEPTANCE

Prof. E. Munn 11-15-76

I-255

C12185-01-01

DATA SUMMARY. CHAR 2579-13

10 November 1970

Batch No.	4# Motor Test		4# Motor Projection		Physical Properties	
	Pressure (psia)	Burning Rate (in/sec)	Pressure (psia)	Burning Rate (in/sec)	True Elongation %	Tensile Strength (psi)
400-1554	767	.3620	1000	.4080	18	105
	907	.3836	1400	.4800	(IDR 041201)	
	1220	.4524	1700	.5271		
	1622	.5148				
400-1555	787	.3644	1000	.4112	28	122
	938	.4100	1400	.4802		
	1217	.4397	1700	.5252		
	1675	.5255				
400-1556	753	.3525	1000	.3999	34	121
	959	.3870	1400	.4726		
	1252	.4388	1700	.5204		
	1619	.5163				
400-1557	731	.3464	1000	.3984	39	102
	747	.3645	1400	.4665		
	1124	.4137	1700	.5110		
	1542	.4930				

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PRODUCT ACCEPTANCE RECORD						
1 PART NUMBER	2 PART NAME	3 SERIAL NUMBER/ LOT NUMBER	4 CONFIGURATION	5 C12185 N/C & ECO'S 19832, 19837, 19858, 19894, 20017, 20124, 20121, 20161	6 OPERATIONS PLANNING REFERENCE	7 PVP REF
8	QUALITY REQUIREMENT DESCRIPTION (FEATURE)	9 FEATURE TOLERANCE	10 ATT/ VAR	11 MEASURED RESULTS	12 VERIFICATION STAMP	
2579/ 3-2	After curing propellant, visually inspect for cracks and voids	No cracks allowed. No voids > 1.0"	VAR	See IDR 041777 (attached)	(36) 10-3-77	43972
2579/ 3-3	Bore diameter	Engineering information	VAR	0° 21.338 90° 21.232	(36) 10-3-77	
2579/ 3-7	Propellant physical properties (UTP 18803A) True elongation (%) Tensile strength (psi)	Min values 20% 50 psi	VAR	Summary attached	(36) 10-3-77	
2579/ 3-8	Propellant bond system SE0719 & ECO 20239 cartridge/liner/propellant	Min value 80 psi	VAR	47 psi IDR 042417 (attached)	(36) 10-3-77	
2579/ 3-9	Propellant bond system SE0719 & ECO 20239 insulation/liner/propellant	Min value 80 psi	VAR	56 psi IDR 042417 (attached)	(36) 10-3-77	
2579/ 3-10	Propellant ballistic batch check test per SE0616, Rev B	SE0719 & ECO 19857	VAR	Summary attached	(36) 10-3-77	
N/A	Propellant weight	Engineering information	VAR	14760.0 #	(36) 10-3-77	
13 ORIGINATOR		14 QA ACCEPTANCE		15 CUSTOMER ACCEPTANCE		
Anne Evans 10-3-77		Anne Evans 10-3-77		(36) 10-3-77		

C12-85-01-01

DATA SUMMARY: CHAR 2579-14

10/3/77

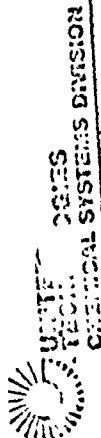
Propellant Batch	4# Motor Test		4# Motor Projection		Physical Properties	
	Pressure (psi)	Burning Rate (in/sec)	Pressure (psi)	Burning Rate (in/sec)	True Elongation (%)	Tensile Strength (psi)
1596	837	.3848	1000	.4073	32	98
	1087	.4258	1400	.4895		
	1751	.5599	1700	.5443		
	1857	.5641				
1597	835	.3885	1000	.4123	29	90
	1084	.430	1400	.4924		
	1741	.5557	1700	.5455		
	1826	.5634				
1598	810	.3746	1000	.4215	34	113
	1074	.4298	1400	.4960		
	1659	.5392	1700	.5517		
	1877	.1877				
1599	820	.380	1000	.4132	32	116
	1012	.4159	1400	.4967		
	1622	.5382	1700	.5523		
	1893	.5859				

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No. 041777

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INTEGRATED VIA REPORT



UNITED STATES
CHEMICAL SYSTEMS DIVISION

1. End Item No.
2. Assembly No.
3. Part No.

4. Item No.
5. Reference
6. Plan
7. Date

8. PO No.
9. Proj. No.
10. Unit No.

11. Lot Size
12. Cycles
13. Type AC

14. Ship. No.
15. Supplier Name
16. Date

17. Item No.
18. Item No.
19. Item No.

20. Item No.
21. Item No.
22. Item No.

23. Item No.
24. Item No.
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56. Item No.
57. Item No.
58. Item No.

59. Item No.
60. Item No.
61. Item No.

DESCRIPTION OF NONCONFORMANCE

20. Description of Nonconformance

21. Description of Nonconformance

22. Description of Nonconformance

23. Description of Nonconformance

24. Description of Nonconformance

25. Description of Nonconformance

26. Description of Nonconformance

27. Description of Nonconformance

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36. Description of Nonconformance

37. Description of Nonconformance

38. Description of Nonconformance

DISPOSITION INSTRUCTIONS

20. Disposition Instructions

21. Disposition Instructions

22. Disposition Instructions

23. Disposition Instructions

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76. Disposition Instructions

77. Disposition Instructions

78. Disposition Instructions

APPENDIX J
SPECIFICATION - LINER, UTL-0040A

CODE IDENT NO.
14134

Specification No. SE0618
28 Feb 1975

SPECIFICATION

LINER, JFL-0040

BEST AVAILABLE COPY

Approved by	SPECIFICATIONS	Date 2-28-75	Approved by <i>W. J. [Signature]</i>	PROGRAM MANAGEMENT	Date 3-24-75
Approved by	SPECIFICATIONS	Date 2-28-75	Approved by <i>W. J. [Signature]</i>	QUALITY ASSURANCE	Date 3-24-75
Approved by	DESIGN ENGINEERING	Date 2-4-75	Approved by	CONFIGURATION MANAGEMENT	Date
Approved by	DESIGN ENG. SECTION CHIEF	Date 4 MAR 75	Approved by <i>J. [Signature]</i>	SAFETY	Date 3-25-75
Approved by <i>[Signature]</i>	ENGINEERING MANAGEMENT	Date 3-24-75	Approved by		Date
Approved by	SYSTEMS DESIGN	Date	Approved by		Date
Approved by	MATERIALS & PROCESSES	Date	Approved by		Date

P. . .	LCO No.	Prepared By	Approved by	Date
		REFERENCE PRINT — RELEASED THIS DOCUMENT WILL NOT BE KEPT UP TO DATE. NOT VALID FOR PROCUREMENT OR FABRICATION. HOLDER SHOULD CHECK WITH RELEASE GROUP FOR STATUS BEFORE USING. HOLDER RESPONSIBLE FOR DESTRUCTION WHEN NOT IN USE.		

SPECIFICATION

LINER, UTL-0040

1. SCOPE

1.1 Scope. This specification covers one type of liner, designated as UTL-0040, for use in solid rocket motors.

2. APPLICABLE DOCUMENTS

2.1 The following documents form a part of this specification to the extent specified herein. Unless otherwise indicated, the issue in effect on date of invitation for bids shall apply.

UNITED TECHNOLOGY CENTER (UTC)

Publication

Quality Control Methods and Procedures

(Application for copies should be addressed to United Technology Center, Post Office Box 358, Sunnyvale, California 94088. Attention: Purchasing Department.)

OTHER MANUFACTURERS

<u>Manufacturer</u>	<u>Designation</u>	
ARCO	BDR-45M	} See UTC Quality Control Laboratory Methods and Procedures number QC-J-703 for description of and acceptance criteria for raw materials.
General Mills	DDI-1410	
3M	HX-868	
Thermatic Carbon	Thormax	

3. REQUIREMENTS

3.1 Formulation. The nominal formulation of UTL-0040 liner shall be as shown in table I.

Table I. UTL-0040 Liner Formulation

Ingredient	Typical Percent by Weight	Weight Percent Tolerance Limits, %
BDR-45M	41.85	± 1.5
Dimeryl diisocyanate	12.15	± 0.5
HX-868	6.00	± 0.5
Thermax	40.00	± 2.0

3.2 Physical properties. A minimum of four bond-in-tension samples shall be prepared with insulation-liner-propellant and cartridge-liner-propellant bond systems to be used in the technology motor. When tested, bond-in-tension samples shall fail in the propellant at a tensile strength of 80 psi or greater.

3.3 Peel strength. The average peel strength of test specimens from a liner peel tray shall be 6.0 pounds minimum per inch of width. The peel strength of each test specimen shall exceed 4.0 pounds minimum per inch of width. The liner peel strength test shall be conducted under the following conditions:

- (a) 180 degrees peel at 12 inches per minute cross head speed
- (b) A temperature of 77 ± 5 degrees Fahrenheit, $^{\circ}\text{F}$
- (c) 0.070 ± 0.015 inch-thick cured liner
- (d) When bonded to a propellant which is specified for the applicable technology motor program.

3.4 Workmanship. The liner shall be a homogeneous blend of material containing no foreign matter which would render the liner unsuitable for its intended use.

4. QUALITY ASSURANCE PROVISIONS

4.1 Classification of tests. The inspection and testing of the liner shall be classified as acceptance tests (see 4.2).

4.2 Acceptance tests. Acceptance tests shall consist of:

- (a) Individual tests (see 4.2.1)
- (b) Sampling plan and tests (see 4.2.2).

4.2.1 Individual tests. Individual tests shall consist of the tests specified in table II.

Table II. Individual Tests

<u>Test</u>	<u>Requirement Paragraph</u>	<u>Test Paragraph</u>
Examination of formulation	Table I	4.3.1.1
Examination of workmanship	3.4	4.3.1.2

4.2.2 Sampling plan and tests.

4.2.2.1 Sampling plan. Homogeneous samples shall be selected from each batch of liner and propellant in quantities of sufficient size to enable performance of the required tests of this specification.

4.2.2.2 Batch. For the purpose of this specification, a batch shall consist of the material offered for acceptance which has been produced by one set of equipment using the same production process.

4.2.2.3 Sampling tests. Sample test specimens shall be subjected to the tests specified in 4.3.2.

4.3 Test methods.

4.3.1 Examinations.

4.3.1.1 Examination of formulation. Weight or manufacturing records shall be examined to determine conformance to the formulation requirements of 3.1. The formulation shall be verified by chemical analysis performed in accordance with Quality Control Laboratory Methods and Procedures.

4.3.1.2 Examination of workmanship. The liner shall be examined to determine conformance to the requirements of 3.4.

4.3.2 Tests.

4.3.2.1 Bond-in-tension test. Bond-in-tension tests shall be conducted in accordance with procedure N-616 of the UTC Quality Control Laboratory Methods and Procedures.

4.3.2.2 Peel strength test. The liner peel strength shall be determined in accordance with procedure QC-N-605 of the UTC Quality Control Laboratory Methods and Procedures.

4.4 Rejection criteria. A batch or part of a batch may be rejected if the liner does not meet the requirements of this specification.

4.5 Acceptance criteria. Liner acceptance shall be demonstrated by conformance to the requirements of 3.1, 3.2, 3.3, and 3.4.

5. PREPARATION FOR DELIVERY

This section is not applicable to this specification.

6. NOTES

Not applicable.

APPENDIX K

X-RAY TEST PROCEDURE
EXTENDED LENGTH SUPER HIPPO

UNCLASSIFIED

WPNSTA/CO WQEC PM-214

NONDESTRUCTIVE TEST PROCEDURE
FOR
UNITED TECHNOLOGIES CORPORATION
CHEMICAL SYSTEMS DIVISION (UTCSD)
EXTENDED LENGTH SUPER HIPPO (ELSH)
PROPELLANT LOADED CARTRIDGE

OCTOBER 1976

**Weapons
Quality
Engineering**

WPNSTA Concord
California

UNCLASSIFIED

Copy
1

Center

NAVAL WEAPONS STATION
WEAPONS QUALITY ENGINEERING CENTER
CONCORD, CALIFORNIA

NONDESTRUCTIVE TEST PROCEDURE
FOR
UNITED TECHNOLOGIES CORPORATION
CHEMICAL SYSTEMS DIVISION (UTCSD)
EXTENDED LENGTH SUPER HIPPO (ELSH)
PROPELLANT LOADED CARTRIDGE

WPNSTA/CO WQEC PM-214

OCTOBER 1976

NAVAL WEAPONS STATION
CONCORD, CALIFORNIA 94520

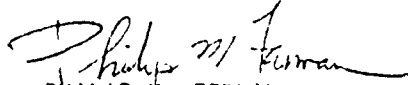
October 1976

WPNSTA/CO WQEC PM-214

Nondestructive Test Procedure for UTC ELSH Propellant Loaded Cartridge

Ref: (a) United Technologies Corporation - Chemical Systems Division
Purchase Order No. 231618 of 29 Apr 76

1. This manual provides the procedures for the radiographic inspection of the UTC ELSH propellant loaded cartridge. It is designed for use by the Weapons Quality Engineering Center and other activities to provide the inspections described in reference (a).
2. The objective of this procedure is to detect and identify critical defects or other anomalies of ELSH cartridges. Comments, suggestions or recommendations regarding the test equipment, conditions or procedures which will benefit the inspection are encouraged.


PHILIP M. FERMAN
Director, Weapons Quality
Engineering Center

LIST OF EFFECTIVE PAGES

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Additional copies of this publication may be obtained from Commanding Officer, Naval Weapons Station (Code 311), Concord, CA 94520

CERTIFICATION PAGE

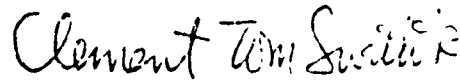
WPNSTA/CO Procedure Manual No. 214 provides the necessary radiographic tests of UTC ELSH Propellant Loaded Cartridge Rocket Motors.

PREPARED BY:



J. RICHARDS, JR.
Quality Inspection
Specialist (Process)

APPROVED BY:



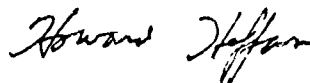
CLEMENT T. SWITLIK, JR.
Safety Director

REVIEWED BY:



B. J. BRUNTY
Head, Radiological
Applications Branch

APPROVED BY:



HOWARD HEFFAN
Head, Scientific and
Engineering Division

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SAFETY SUMMARY

The following WARNINGS and CAUTIONS are repeated from the text to emphasize safety precautions for personnel using Nondestructive Test Procedure.

WARNING

X-RAY RADIATION IS HAZARDOUS, PERSONNEL MUST BE FAMILIAR WITH SAFETY AND OPERATING PROCEDURES FOR RADIATION TESTING FUNCTIONS. (Page 4-1)

* * * * *

PERSONNEL WORKING AROUND EXPOSED PROPELLANT SHALL WEAR COTTON UNDERWEAR, COTTON SOCKS, FLAME-PROOF COVERALLS, SAFETY SHOES AND PERSONAL GROUNDING STRAPS (LEGSTATS). (Page 4-1)

* * * * *

KEEP THE ROCKET MOTOR GROUNDED TO THE FACILITY GROUND DURING HANDLING AND EXAMINATION. TAKE CABLES WITH ADAPTER CLIP AND ATTACH ONE END TO THE GROUNDING BAR AND THE OTHER END TO THE TURNTABLE. (Page 4-1)

* * * * *

ELSH CARTRIDGES CONTAIN 33,000 POUNDS OF ROCKET PROPELLANT AND ARE QUANTITY DISTANCE CLASS 1 DIVISION 3 MATERIAL. HANDLE IN ACCORDANCE WITH NAVSEA OP-5, VOLUME 1, FOURTH REVISION. (Pg 4-1)

CAUTION

OPERATORS MUST HAVE IN THEIR POSSESSION A VALID FORKLIFT AND CRANE OPERATORS PERMIT WHILE USING A FORKLIFT OR OPERATING AN OVERHEAD CRANE. (Page 4-1)

WARNING

THE RADIOGRAPHIC AREA IS DESIGNATED AS A FOOT HAZARDOUS AREA. FOOT PROTECTIVE EQUIPMENT MUST BE WORN. (Page 4-2)

* * * * *

PERSONNEL ENGAGED IN WORKING WITH ORDNANCE ITEMS SHALL BE LIMITED TO THE MINIMUM NUMBER REQUIRED TO PERFORM THE OPERATION PROPERLY. (Page 4-2)

332:8JB:vn
3960
October 1976

WEAPONS QUALITY ENGINEERING CENTER
HAZARD CONTROL BRIEFING

1. The Extended Length Super Hippo (ELSH) solid propellant rocket motor is made of a fiberglass case containing 33,000 pounds of solid propellant. It is open on both ends with exposed propellant on the ends and in the internal bore. It is 83-1/2 inches in diameter and 87-1/2 inches long.
2. Care must be taken not to drop, shock or rough handle the motors. The hazard of this motor is that of fire. Confined propellant can burn and sometimes will explode. This solid propellant is characterized by the fact that it contains its own oxidizer and does not need external oxygen to burn. Because of this fact it is not possible to extinguish a burning of the propellant by eliminating the oxygen supply. It is necessary to cool the burning propellant with the use of water or other cooling devices.
3. If a fire or explosion occurs during working hours, call the fire department; Pittsburgh X-ray Laboratory call Pittsburgh Fire Department 432-3515, then the WPNSTA Fire Department 453-2100 and ask for extension 333.
4. This Hazard Control Briefing is used with PM-214.

SECTION I
INTRODUCTION

1-1 The purpose of this document is to provide procedures for the radiographic inspections of United Technologies Corporation Chemical Systems Division (UTCSD) Extended Length Super Hippo (ELSH) propellant loaded cartridges. It provides for the 100% radiographic inspection of the bore and tangents.

1-2 This document includes descriptions of the set-up arrangement and radiographic technique, the equipment and materials required to perform the work and the guidelines for film interpretation and safety precautions.

SECTION 2
TECHNICAL REFERENCES

- 2-1 25 MEV Betatron Instruction Manual
- 2-2 MIL-STD-453 Inspection, Radiographic
- 2-3 WPNSTA/CO Dwg. 2966, 6 Jun 1976
- 2-4 WPNSTA/CO Instruction 5100.5 WQEC Safety Manual
- 2-5 UTCSD Dwg. #C12187 (Film Holder and Positioner) Letter Reference
- 2-6 WPNSTA/CO ltr 33:HH:fr 3960 of 16 Aug 1976
- 2-7 WPNSTA/CO ltr 332:JR:de 3960 of 30 Jun 1976
- 2-8 WPNSTA/CO ltr 332:BJB:da 3960 of 25 Mar 1976
- 2-9 UTCSD ltr DIN-040-76-P of 23 Apr 1976
- 2-10 UTCSD ltr DN-317 of 9 Sep 1975
- 2-11 WPNSTA/CO ltr 023:SLF:ep 3360 of 27 May 1976
- 2-12 UTCSD ltr DN-334 of 6 Jan 1976

SECTION 3
EQUIPMENT AND MATERIAL

- 3-1 25 million volt Betatron
- 3-2 UTCSD film holder and positioner fixture; Dwg #C12187
- 3-3 Lead letters and numbers
- 3-4 Kodak type "AA" or "T" industrial type X-ray film, 14" X 17"
- 3-5 Lead intensifying screens, .030" thick
- 3-6 Film cassettes 14" X 17"
- 3-7 Penetrameters - bore and tangent
- 3-8 Automatic film processor, Kodak Model "B" or equivalent
- 3-9 Pen, marking
- 3-10 Film badges and holders
- 3-11 Cartridge stand and turntable
- 3-12 Densitometer - Macbeth Model TD-504 or equivalent

SECTION 4
RADIOGRAPHIC PROCEDURE

WARNING
X-RAY RADIATION IS HAZARDOUS, PERSONNEL MUST BE FAMILIAR WITH SAFETY AND OPERATING PROCEDURES FOR RADIATION TESTING FUNCTIONS.

4-1 UTCSD ELSH Cartridge will be received at the Pittsburgh X-ray facility in the Vertical Position as specified in WPNSTA/CO ltr 322:BJB:da 3960 of 25 Mar 1976.

WARNING
PERSONNEL WORKING AROUND EXPOSED PROPELLANT SHALL WEAR COTTON UNDERWEAR, COTTON SOCKS, FLAME-PROOF COVERALLS, SAFETY SHOES AND PERSONNAL GROUNDING STRAPS (LEGSTATS).

4-2 Place the cartridge on the vertical turntable for X-ray using UTCSD supplied lifting device and the 25 ton weight handling crane. The Betatron will be placed in the horizontal plane.

WARNING
KEEP THE ROCKET MOTOR GROUNDED TO THE FACILITY GROUND DURING HANDLING AND EXAMINATION. TAKE CABLES WITH ADAPTER CLIP AND ATTACH ONE END TO THE GROUNDING BAR AND THE OTHER END TO THE TURNTABLE.

CAUTION
OPERATORS MUST HAVE IN THEIR POSSESSION A VALID FORKLIFT AND CRANE OPERATORS PERMIT WHILE USING A FORKLIFT OR OPERATING AN OVERHEAD CRANE.

WARNING
ELSH CARTRIDGES CONTAIN 33,000 POUNDS OF ROCKET PROPELLANT AND ARE QUANTITY DISTANCE CLASS 1 DIVISION 3 MATERIAL. HANDLE IN ACCORDANCE WITH NAVSEA OP-5, VOLUME 1, FOURTH REVISION.

4-3 The film holder and positioner furnished by UTCSD (Dwg. #C12187) will be placed in position inside the bore for the radiographic inspection of the propellant grain.

WARNING

THE RADIOGRAPHIC AREA IS DESIGNATED AS A FOOT HAZARDOUS AREA. FOOT PROTECTIVE EQUIPMENT MUST BE WORN.

4-4 Place two 14" X 17" cardboard cassettes loaded with the proper film (see Table 1) inside holder, place identification lead letters and numbers on lucite lid of holder and prepare to take bore radiographs rotating the cartridge every 15° (see Figures 1 and 3).

WARNING

PERSONNEL ENGAGED IN WORKING WITH ORDNANCE ITEMS SHALL BE LIMITED TO THE MINIMUM NUMBER REQUIRED TO PERFORM THE OPERATION PROPERLY.

4-5 Upon completion of the bore radiographs, remove the film holder from the bore area and place holder on the outside of the tangents (see Table 2). Place proper film, penetrameter (see Figure 5), and identification on cartridge. Proceed to radiograph tangents as shown in Figures 2 and 3, rotating the cartridge every 30°.

4-6 All radiographs will be processed in the Kodak X-omat Model "B" Industrial Processor.

Table 1. ELSH Cartridge
Dwg. No. C11479-01-01 Radiographic Technique - Bore Section
Bore Exposures - Every 15°

VIEWS	A	B-C	D-E	F-G	H			
SOURCE	Betatron -	-	-	-	-			
SOURCE CURIES CRKV	25 MEV	-	-	-	-			
MA	N/A	-	-	-	-			
DISTANCE SOURCE TO FILM	12'	-	-	-	-			
TIME	450R	-	-	-	400R			
MATERIAL THICKNESS RADIOGRAPHED	29.5"	-	-	-	29"			
PENETRATOR 2% Lucite	27 In.	-	-	-	-			
PEN BLOCK	None	-	-	-	-			
FILM SIZE	(1) 14X17	(2) 14X17	-	-	(1) 14X17			
FILM TYPE Kodak	AA	-	-	-	-			
SCREEN Pb BACK	.030	-	-	-	-			
SCREEN Pb FRONT	.060	-	-	-	-			
SENSITIVITY	2%	-	-	-	-			

Table 2. ELSH Cartridge
 Dwg. No. C11479-01-01 Radiographic Technique Tangent Section
 Tangent Exposures 0° thru 330° - Every 30°

VIEWS	A	B-C	D-E	F-G	H			
SOURCE	Betatron	-	-	-	-			
SOURCE CURIES ORKV	25 MEV	-	-	-	-			
MA	N/A	-	-	-	-			
DISTANCE SOURCE TO FILM	12'	-	-	-	-			
TIME	35QR	-	-	-	-			
MATERIAL THICKNESS RADIOGRAPHED	23"/45"	-	-	-	-			
PENETRANT	Slit Lucite	See Note	-	-	-			
PEN BLOCK	None	-	-	-	-			
FILM SIZE	(1) 14X17	(2) 14X17	-	-	(1) 14x17			
FILM TYPE	Kodak AA/T	-	-	-	-			
SCREEN Pb BACK	.030	-	-	-	-			
SCREEN Pb FRONT	.060	-	-	-	-			
SENSITIVITY	2%	-	-	-	-			

*Note: Lucite Slit 0.030 Inch Wide X 1 Inch Long X 0.75 Inch Thick

Figure 1
United Technologies Corporation Chemical Systems Division
ELSH Propellant Loaded Cartridge C11479-01-01
Bore Exposures A thru H 0° thru 345° Every 15°

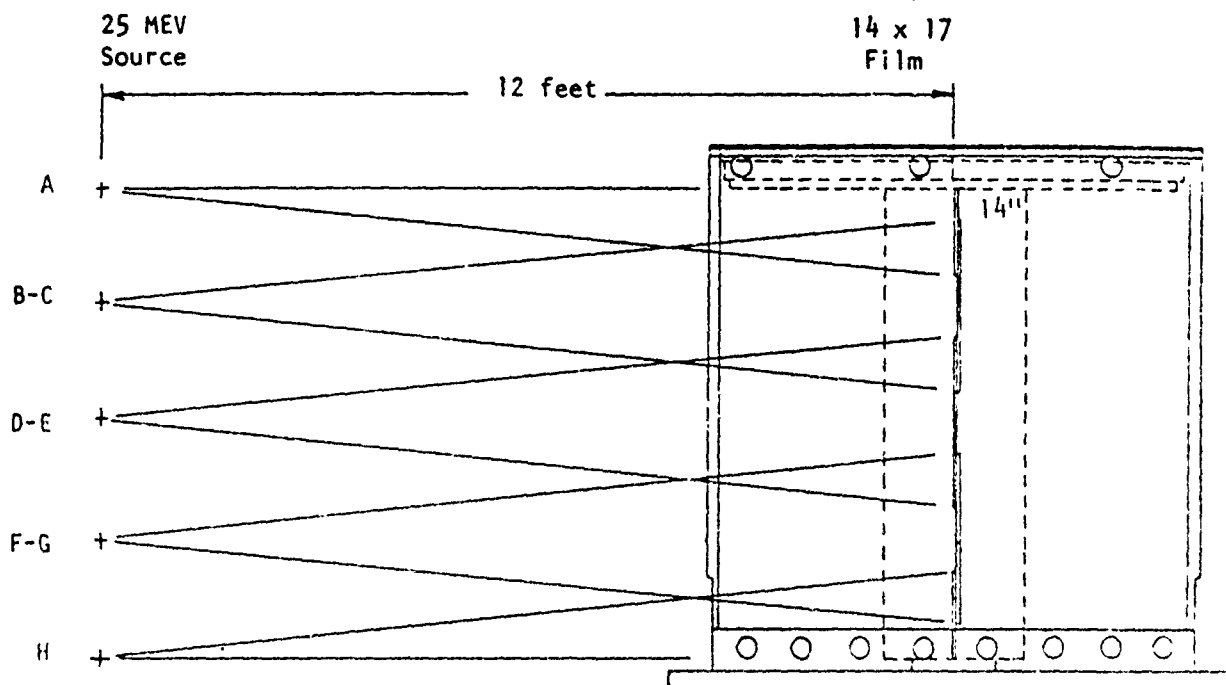
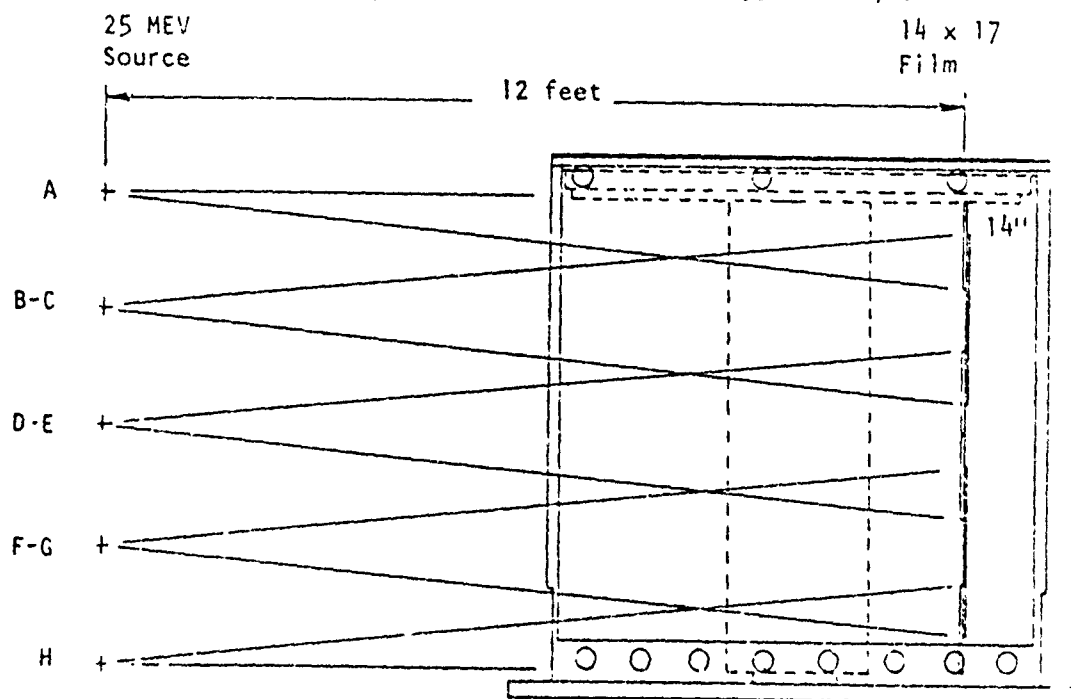
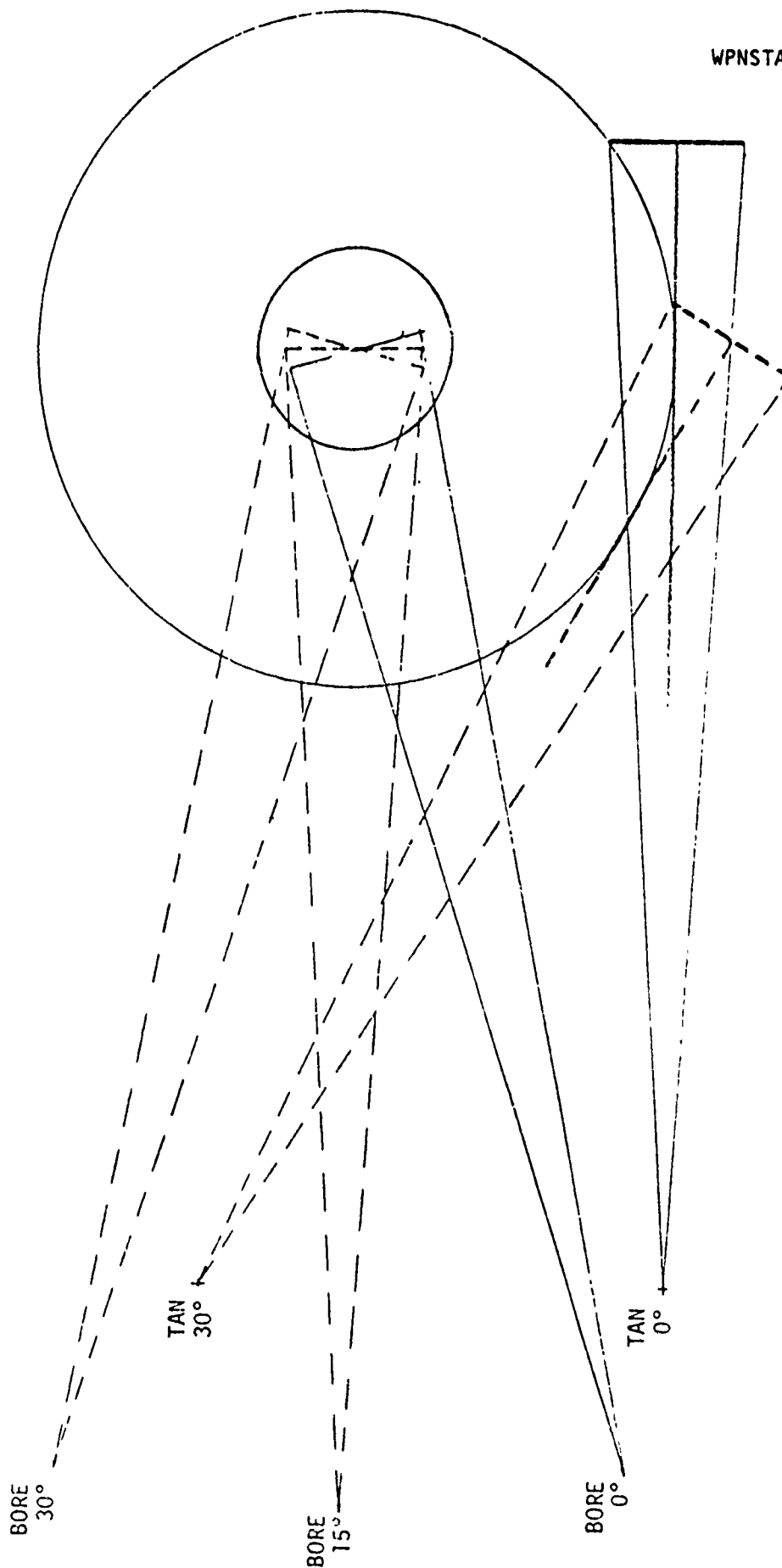


Figure 2
United Technologies Corporation Chemical Systems Division
ELSH Propellant Loaded Cartridge C11479-01-01
Tangent Line Exposures A thru H 0° thru 330° Every 30°





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Figure 3
 United Technologies Corporation Chemical Systems Division
 ELSH Propellant Loaded Cartridge C11479-01-01
 Bore Exposures A thru H 0° thru 345° Every 15°
 Tangent Exposures A thru H 0° thru 330° Every 30°

CSD ELSH ROCKET MOTOR
INTERNAL DEFECT TEST DATA SHEET

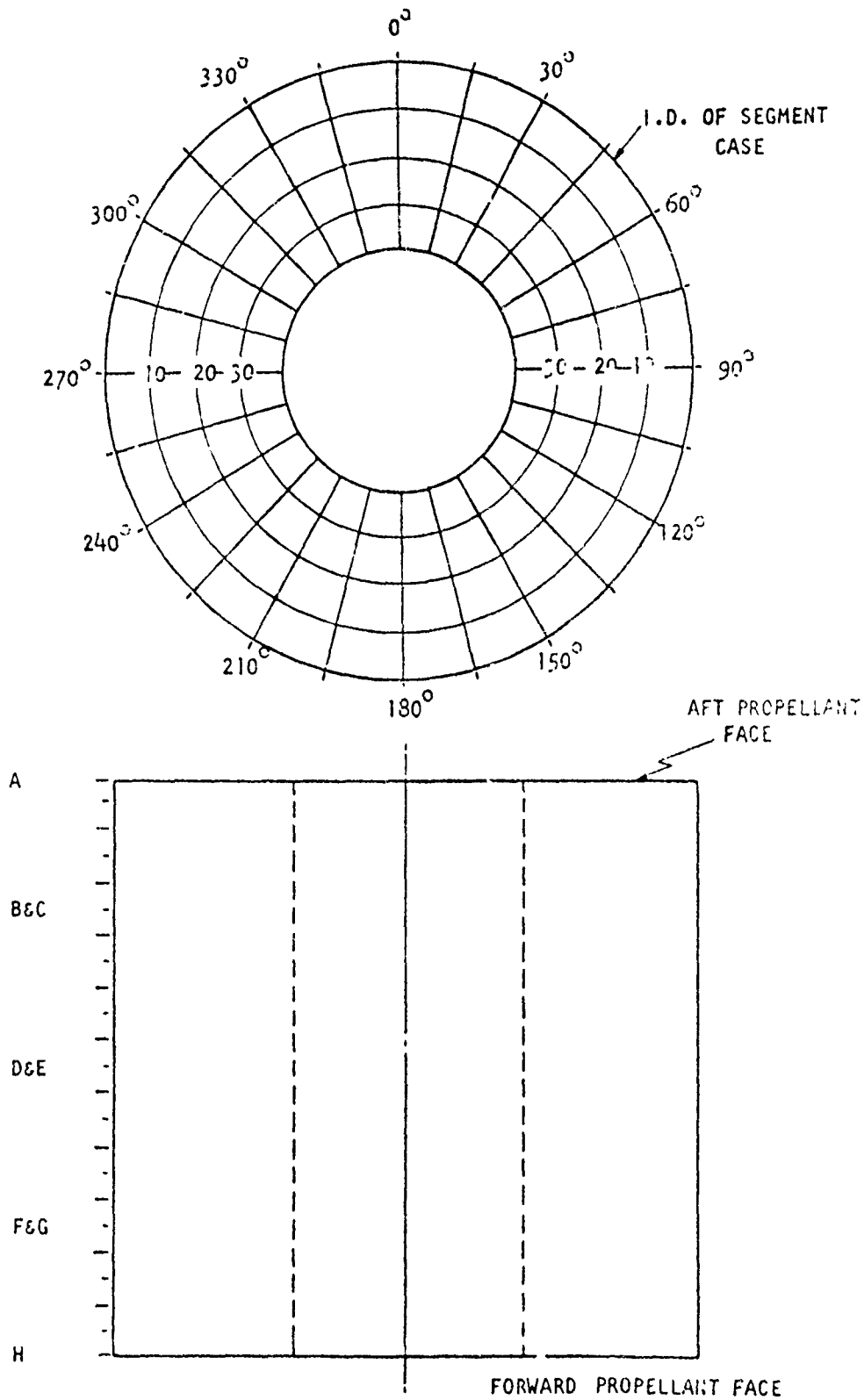
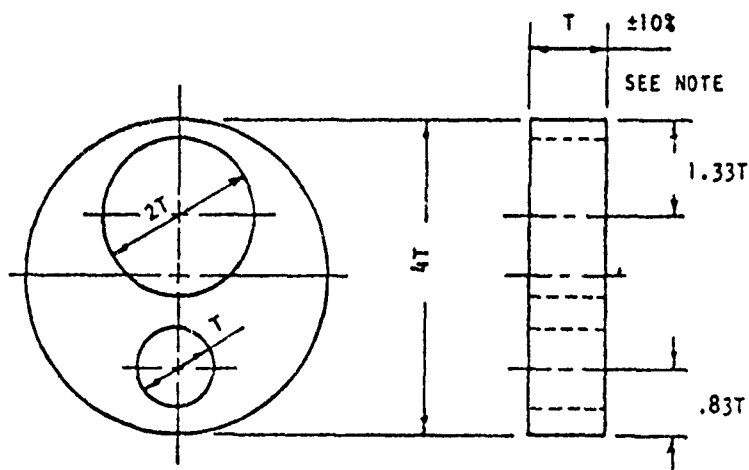


Figure 4

K-284

DESIGN FOR PENETRATOR THICKNESS OF .180" AND OVER

NOTE: MADE IN .020" INCREMENTS



NOTE: TOLERANCES ON PENETRATOR THICKNESS AND HOLE DIAMETER SHALL BE PLUS OR MINUS 10 PER CENT OR $1/2$ OF THE THICKNESS INCREMENT BETWEEN PENETRATOR SIZES, WHICHEVER IS SMALLER

PENETRATOR MATERIAL NOTE: LUCITE

FIGURE 5
LUCITE PENETRATOR

SECTION 5
FILM INTERPRETATION

5-1 Radiographs will be checked for proper density (1.5 H&D minimum to 3.5 H&D maximum) using a Macbeth Model TD-504 densitometer or equivalent.

5-2 The acceptance criteria for the ELSH cartridge will be furnished by UTCSD.

5-3 Conditions found in the radiographs will be interpreted and reported as the basis of the X-ray requirements using Figures 4, 6 and 7. Results will be entered on the Film Interpreter Report Sheets for bore and tangents. The film will be packaged and sent to the designated agency as required.

Figure 7

CSA ELSH ROCKET MOTOR SN _____

FILM INTERPRETER REPORT SHEET NAME _____ DATE _____

REPORT ALL: CRACKS, VOIDS, CAVITIES, PROPELLANT LINER SEPARATIONS AND
FOREIGN MATERIAL.

TANGENT SECTION

REMARKS	I.D.	CRACKS	VOIDS	CAVITIES	PROP. LINER SEPARATION	FOREIGN MATERIAL
	0°					
	30°					
	60°					
	90°					
	120°					
	150°					
	180°					
	210°					
	240°					
	270°					
	300°					
	330°					

Figure 6

CSA ELSH ROCKET MOTOR SN _____

FILM INTERPRETER REPORT SHEET

NAME _____

DATE _____

REPORT ALL: CRACKS, VOIDS, CAVITIES, PROPELLANT LINER SEPARATIONS AND
FOREIGN MATERIAL.

BORE SECTION

REMARKS	I.D.	A	B	C	D	E	F	G	H
	0°								
	15°								
	30°								
	45°								
	60°								
	75°								
	90°								
	105°								
	120°								
	135°								
	150°								
	165°								
	180°								
	195°								
	210°								
	225°								
	240°								
	255°								
	270°								
	285°								
	300°								
	315°								
	330°								
	345°								

SECTION 6
DISPOSITION

6-1 Upon completion of X-ray, the ELSH cartridge will be returned to UTCSD. Reports will be prepared as required by the order under which the work was performed.

DISTRIBUTION

Copy No.

1

United Technologies Corporation Chemical Systems Division,
P.O. Box 358, Sunnyvale, CA 94088 (ATTN: Mrs. Hewgard)