AD NUMBER: AD0851591

LIMITATION CHANGES

TO:

Approved for public release; distribution is unlimited.

FROM:

Distribution authorized to U.S. Government agencies only; Administrative/Operational Use; 20 Mar 1968. Other requests shall be referred to Naval Fleet Missile Systems Analysis and Evaluation Group, Corona, CA 91720.

AUTHORITY

USNWC ltr dtd 30 Aug 1974

THE ATTACHED INFORMATION IS SUBMITTED AT U.S. GOVERNMENT REQUEST, FOR DISTRIBUTION AT THE DISCRETION OF THE RECEIVING GOVERNMENT AGENCY. IT MAY BE CALLED "PRELIMINARY" OR "DRAFT," BUT EVEN IF "FINAL," IT MAY BE CHANGED WITHOUT ADVISING ALL PRIOR RECIPIENTS. SUBMITTAL IMPLIES THE ORIGINATOR'S PERMISSION FOR RECIPIENTS TO UTILIZE THIS DOCUMENT FOR PARTS PROCUREMENT OR OTHER ACTIONS, BUT ENTIRELY AT THE RECIPIENT'S OWN RISK.

IDEP FORM 12:11-62 IDEP 04446

SPECIFICATION

1 of 1

D1261

1. COMPONENT/PART NAME PER GENERIC CODE: Propulsion Parts & Materials, Solid Fuel Engines, Propellants	2. PROGRAM OR WEAPON SYSTEM: Multiple	3. DATE OF:	DAY	MO.	YR.
4. ORIGINATOR'S SPECIFICATION TITLE: Manufacturing Techniques for N-34 Propellant	5. ORIGINATOR'S SPEC. NO.: OD30801A	ISSUE	1	2	68
	6. SPECIFICATION IS: ☐ DRAFT ☐ PRELIMINARY ☒ FINAL	REVISION	20	3	68

7. THIS SPECIFICATION COMPLEMENTS REPORT NO:

8. TYPE OF SPECIFICATION

- ☐ (A) GENERAL PRODUCT REQUIREMENTS FOR A FAMILY OF PARTS - PROCUREMENT DOCUMENT
- ☐ (B) INDIVIDUAL DETAIL PARTS DOCUMENT; STDS BOOK PAGES - FOR PROCUREMENT
- ☐ (C) DETAIL INSPECTION, PROCESS CONTROL, AND/OR TEST PROCEDURES FOR SPECIFIC PARTS
- ☒ (D) PROCESS (PAINTING, WELDING, FINISHING, HEAT TREATING ETC.) APPLICABLE TO MANY PARTS
- ☐ (E) SPEC. FOR PERFORMANCE, RELIABILITY, AND/OR ENVIRONMENT FOR ASSEMBLIES, EQUIPMENTS, SUBSYSTEMS AND SYSTEMS
- ☐ (F) PERFORMANCE AND APPLICATION DATA FOR DESIGN ENG. USE ON PARTS - NOT FOR PROCUREMENT
- ☐ (G) OTHER (DETAIL IN 10.)

NOTE: WHEN MULTIPLE FUNCTIONS ARE COMBINED IN ONE DOCUMENT, CHECK ALL APPLICABLE SQUARES.

9. APPLICABLE REFERENCED SPECIFICATIONS EXCEPT MIL-SPECS, STDS, OR OTHER UNIVERSALLY AVAILABLE DOCUMENTS.	ENCL.	AVAIL. ON REQ.	NOT AVAIL.	PREVIOUSLY SUBMITTED AND FILED AS IDEP REPORT OR SPEC. NUMBER

D1261

10. ADDITIONAL DESCRIPTION OF IMPORTANT DOCUMENT CONTENTS, SIGNIFICANT FEATURES, OR SPECIAL PURPOSE, NOT COVERED BY "TITLE":

AD851591

Each transmittal of this document outside the agencies of the U. S. Government must have prior approval of:

Officer-in-Charge (Code E-6)
U. S. Naval Fleet Missile Systems
Analysis & Evaluation Group
Corona, California 91720
Attn: IDEP Office

The Above limitation does not apply to IDEP participants.

13. SPEC. NO. 565,70,00,00-X7-20 S

11. SIGNED	12. CONTRACTOR	SUBCONTRACTOR
R. S. Harper	NWC/CL	

NOTICES PAGE

FOREIGN NATION RELEASE

This information is furnished upon the condition that it will not be released to another Nation without specific authority of the cognizant agency (military or NASA) of the United States Government, and that the information be provided substantially the same degree of protection afforded it by the Department of Defense of the United States.

DISCLAIMER OF LIABILITY FROM ACT OF TRANSMITTAL

When Government drawings, specifications, or other data are used for any purpose other than in connection with a definitely related Government procurement operation, the United States Government thereby incurs no responsibility nor any obligation whatsoever; and the fact that the Government may have formulated, furnished, or in any way supplied the said drawings, specification, or other data, is not to be regarded by implication or otherwise as in any manner licensing the holder or any other person or corporation, or conveying any rights or permission to manufacture, use, or sell any patented invention that may in any way be related thereto.

Any information disseminated by the Data Distribution Centers of the Interagency Data Exchange Program is intended to promote test data utilization in the National interest among groups engaged in Ballistic Missile, Space Vehicle and related programs.

Dissemination of said information does not imply verification or endorsement of the information. The originator, in submitting the material is acting in accordance with the requirements of his contract, and neither the originator nor the disseminator assumes any liability to parties adopting any product, process or practice based upon the usage of the information. Its presenting the success of failure of one (or several) part number(s), model(s), lot(s) under specific environment and output requirements, does not imply that other products not herein reported on are either inferior or superior.

OMISSION OF CHARGES FOR FOLLOW-ON ACTIONS

Any compliance by the report originator with requests from recipients for more detailed information in IDEP reports originated under Government contracts will be considered within the scope of present contractual obligations. Compliance with such requests will be at the discretion of the report originator and will be performed without cost or obligation to the requester unless otherwise negotiated in advance.

REPRODUCTION OF THIS REPORT

Reproduction or duplication of any portion of this report is expressly forbidden, except by those contractors receiving it directly from the Data Centers or originator, for their internal use or the use of their subcontractors. Reproduction or display of all or any portion of this material for any sales, advertising or publicity purposes is prohibited.

OD 30801A

Code Ident
10001

20 MARCH 1968

SUPERSEDING
OD 30801
1 February 1968
OD 30770A
1 February 1968

MANUFACTURING TECHNIQUES

FOR

N-34 PROPELLANT

Approved:

G. W. Leonard

By direction

RECORD OF REVISIONS		
Revision Letter	Date	Changes

This document consists of pages i to ii
and 1 to 20 inclusive.

PUBLISHED BY DIRECTION OF
THE COMMANDER OF THE NAVAL ORDNANCE SYSTEMS COMMAND

11ND-NOTS-4120/11(8-65)

FOREWORD

The purpose of this document is to describe satisfactory procedures for the preparation of N-34 fluorocarbon powder and the extrusion of N-34 billets. The primary difference in the two procedures described herein is that Chapter I pertains to a large batch of propellant and Chapter II to a small batch.

CHAPTER I

Section 1

1. INTRODUCTION.

1.1 This chapter provides detailed information satisfactory for the following procedures:

(a) Preparation of N-34 fluorocarbon propellant powder.

(b) Extrusion of N-34 propellant billets.

1.2 Activities engaged in the production of propellant powder and billets are requested to advise the cognizant Government installation of significant changes, which, in the opinion of the activity, would substantially improve the operations described herein.

Section 2

2. PROCESSING.

2.1 Mixing.

2.1.1 Receive materials only from stores. Record, in the weighing facility log, the following information on all received materials:

(a) Name of material

(b) Manufacturer

(c) Lot number

(d) Weight

2.1.2 Inspect the materials according to the following qualifications:

(a) The materials must have been accepted by quality control.

(b) The containers must have no leaks.

(c) The materials must have no foreign matter.

(d) Solids must have no moisture.

(e) Liquids must have no significant losses resulting from evaporation.

(f) Reject materials which do not conform to (a) through (e).

2.1.3 Scale graduations of scales and balances should be no larger than 1 percent of the desired net weight.

2.1.4 Tare weights must be recorded from the same scale as the gross weight.

2.1.5 Translate the percentage composition of the N-34 propellant (WS 7686) into the weights of the materials for a mixture of 400 pounds and record on mix sheet. Weigh the materials in accordance with the mix sheet. Record the actual tare, gross and net weights, to the smallest scale division, on the mix sheet.

2.1.6 All containers must be clean, dry, and labeled with the following information on the container (not on the cover):

(a) Name of ingredient

(b) Lot number

(c) Net weight

(d) Intended mix number

2.2 Copolymer is available in various forms, including crumb, sheet, and extruded "rod". Cut the sheet polymer into sections of 5 to 10 inches square and use the extruded "rod" and "crumb" as received.

2.2.1 Put the copolymer into a dissolving drum. A 55-gallon capacity, stainless steel drum is used. A gasket provides leakproof mating surfaces for the cover to drum contact area.

2.2.2 Add 27 ± 0.5 gallons of acetone to the dissolving drum for dissolving the copolymer for a 400-pound mix.

2.2.3 Label the dissolving drum with the mix number. Enter in the copolymer log book the following information:

(a) Mix number

(b) Manufacturer's lot number

(c) Weight of copolymer

2.2.4 Close and seal the dissolving drum with a cover equipped with bungholes. If there are leaks around the cover, clean the mating areas and reclose. If the leak continues, or leaks exist anywhere else on the drum, draw a new drum from stores, and transfer the copolymer-acetone solution to the new drum.

2.2.5 Place the dissolving drum on the drumroller. With the drumroller turning at about 10 revolutions per minute (rpm), agitate the copolymer solution for a minimum of 16 hours.

2.3 Clean the mixer, pot and hopper with acetone and a cleaning cloth.

2.3.1 Pour the copolymer solution from the drum into the dissolver bowl. Screen solution with sieve; give additional agitation—if "jelly" appears on sieve. Clean the drum with 2 gallons of acetone. Pour the acetone wash into the bowl.

2.3.2 Place the bowl ring cover onto the bowl and clamp into position.

2.3.3 The Cowles Dissolver has a horizontal 18-inch Cowles impeller blade and is 4 inches off-center in a 40-inch deep, 34-inch-diameter bowl, 8 inches from the bottom.

2.3.4 Attach the hexane feed hose and nozzle to the bowl ring cover. Align the nozzle so the hexane flow will be in the same direction as the flow of mixer action, and the hexane entry will be at the mixer blade tip.

2.3.5 Start the mix room exhaust system. Due to the presence of heavier-than-air flammable vapors, a floor-level exhaust system is used.

2.3.6 Put the weighed ammonium perchlorate (AP), prescreened through a 20-mesh sieve to remove foreign objects and lumps, in the feed hoppers for later addition to the mix. Position the hoppers over the mix bowl and attach the feed hoses.

2.3.7 Start the dissolver. Set the speed of the dissolver at 600 rpm. Blend the copolymer solution for 3 minutes.

2.3.8 With the dissolver operating, pump into the bowl 26 gallons of hexane (at a rate of 18.3 gallons per minute).

2.3.9 Add to the solution the weighed, polytetrafluoroethylene (PTFE), sodium fluoride, and aluminum (prescreened). Raise the dissolver speed to 900 rpm and blend the mixture for 10 minutes.

2.3.10 From the remote control room, open the hopper valve and start the vibrator to add the AP. Repeat for additional hoppers. Blend the mixture for 5 minutes.

2.4 With the mixture blending, pump into the dissolver 44 gallons of hexane at 18.3 gallons per minute. Blend the powder-acetone-hexane mixture 5 minutes.

NOTE. Uniform suspension of the materials in the mixture at the moment of precipitation is imperative. When the hexane attains a certain proportion of the acetone-hexane mixture, the copolymer will precipitate. The moment of precipitation is apparent; the mixture is no longer a viscous, opaque mass, but is rather a clear liquid over the slurried "powder."

2.4.1 Stop the mixer. Visually inspect the AP hoppers to ensure that they have completely emptied. When all of the solids have fallen to the bottom, remove the liquid with a suction hose and vacuum source without creating sufficient turbulence to disturb the solids. Remove the liquid to within 1 inch of the top of the solids. Do not expose the powder.

2.4.2 After the precipitation cycle of hexane addition and removal, extract additional acetone from the mixture in accordance with 2.4 and 2.4.1, with the following exceptions:

2.4.2.1 Use 46 gallons of hexane for the rinse.

2.4.2.2 Move the powder to one side to form a well into which the solvent will drain and suction off as much of the liquid as possible.

2.4.3 Transfer the powder to grounded, shallow, stainless steel trays. Using a stainless steel or aluminum hand scoop, fill the trays to 1.5 inches maximum depth.

2.4.4 Visually inspect the precipitate to assure that it has the appearance of a coarse grade of sand without large lumps. Report lumpy material on the mix sheet and inform supervisor.

2.4.5 Transfer the trays to the drying cart.

2.5 Drying and weighing.

2.5.1 Dry the powder in circulating air ovens for 7 hours at 170 ± 5 degrees Fahrenheit (°F).

2.5.2 Transfer the powder, in the drying carts, to the designated weighing building. Take the powder from the trays and weigh into 40-pound increments. Place the increments in containers. Label the containers with mix number and weight.

2.6 Block pressing.

2.6.1 Preheat the pressing increments for a minimum of 4 hours at 110 ± 5°F. Clean the press with safety solvent and a clean cloth.

2.6.2 Transfer one increment of propellant powder from the oven to the press. Level the powder in the press by hand.

NOTE. Operators must wear full flame suits while handling hot propellant molding powder.

2.6.3 In the control room, turn on the lockout switch, push "motor start" button, turn selector button to "run", and push "cycle start" button. When cycle is completed, enter press room and remove the pressed block from the press. Return to control room and push the "bottom ram return" button. Repeat for each block.

2.7 Extrusion.

2.7.1 Preheat the propellant blocks for a minimum of 8 hours at 205 ± 5°F. Do not continuously heat for more than 24 hours.

2.7.2 Start the die and jacket heaters and set the thermostat at 190°F. Set the effluent oil at 215°F (basket temperature).

2.7.3 Clean all of the equipment with solvent and a clean cloth, including the following:

(a) Blade, guillotine.

(b) Crown.

(c) Die.

(d) Guides, cutter.

(e) Plug, vacuum.

(f) Press, extrusion, 15-inch horizontal, particularly the ram face.

(g) Ring, die entry.

(h) Stake.

2.7.4 Install the die and die-entry ring in the press. Install the crown and stake if extruding perforated grains. Install the vacuum plug in the die exit. Connect the heating tubes to the die. Install

and align the cutter and the cutter guides. Install and align the grain conveyor. Turn on the press motor and vacuum pump. Set the pumping rate of the high pressure oil pump to exert sufficient hydraulic pressure to extrude the propellant at not more than 7 to 10 inches per minute. This is not necessarily an upper limit, but is the rate used with the present grain configuration and extrusion equipment.

2.7.5 Load the extrusion press with propellant blocks. Brush loose powder from the press loading port. All personnel must leave the press room. Close the press room doors and the personnel gate.

2.7.6 Place the control lever in the forward position. The ram moves toward the die. The ram head moves past the propellant loading port and into a position to seal the vacuum cavity. A ram on the tail rod trips a switch which stops the ram head and moves the control lever to the neutral position. Open vacuum valve. When the desired vacuum of 15 millimeters (mm) of mercury (Hg) has been reached, move the control lever to the forward position. The ram head moves through the vacuum cavity to put pressure on the propellant blocks. When the pressure on the blocks reaches 250 pounds per square inch (psi), the high-pressure oil pump starts automatically, which turns on the 250-pound "pressure lock" lamp on the control panel.

2.7.7 The propellant pushes out the vacuum plug. Scrap the first 45 inches of strand.

2.7.8 When the ram is fully extended, the ram trips a switch, stopping the ram head. Move the control lever to the neutral position. The pressure bleeds off. Move the vacuum lever to the "off" position. When the 250-pound "pressure lock" is broken, move the control lever to reverse and the ram head withdraws. When the ram head reaches the rear of the loading port, enter the press room. Position the cutters to cut the billet to the desired length. Remotely cut the billets. Use a felt tip "dry-rite" marking pen to label the head end of each billet. Transfer the billet to a cart. Transfer the cart from the press room to the holding area.

2.7.9 If additional propellant is to be extruded, reload the press with propellant in accordance with 2.7.4. Extrude the propellant in accordance with 2.7.5 and 2.7.7. When the last increment of propellant blocks is in stage 2.7.7, load the press basket with dry, rolled, oats. Set the pumping rate of the high pressure oil pump to exert sufficient hydraulic pressure to extrude the oats and remaining propellant at approximately 25 inches per minute. Run the ram head forward to the end of the

stroke. Retract the ram head. Repeat the oatmeal procedure until all propellant is out of press. The oatmeal is a filler which enables the extrusion of all the propellant. Do not use the "heel" for propellant grains.

2.7.10 On an extrusion press sheet, enter complete information including the following:

(a) Name of operators.

(b) Extrusion date.

(c) Mix number(s).

(d) Quantity of billets.

(e) Billet serial letters.

(f) Attach charts from all recording instruments, showing temperatures, pressures, vacuum, and cycle times.

CHAPTER II

Section 1

1. INTRODUCTION.

1.1 This document provides detailed information satisfactory for the following procedures:

(a) Preparation of N-34 fluorocarbon propellant powder.

(b) Extrusion of N-34 propellant billets.

1.2 Activities engaged in the production of propellant powder and billets are requested to advise the cognizant Government installation of significant changes, which, in the opinion of the activity, would substantially improve the operations described herein.

Section 2

2. PROCESSING.

2.1 Receive materials only from stores.

2.1.1 Record, in the weighing facility log, the following information on all received materials:

(a) Name.

(b) Manufacturer.

(c) Lot number.

(d) Weight.

2.1.2 Inspect the materials according to the following qualifications:

(a) The materials must have been accepted by quality control.

(b) The containers must have no leaks.

(c) The materials must have no foreign matter.

(d) Solids must have no moisture.

(e) Liquids must have no significant losses resulting from evaporation.

(f) Reject materials which do not conform to (a) through (e).

2.1.3 Scale graduations of scales and balances should be no larger than 1 percent of the desired net weight.

2.1.4 Tare weights must be recorded from the same scale as the gross weight.

2.1.5 Translate the percentage composition of the N-34 propellant (WS 7686) into the weights of the materials for a mixture of a specific weight. Register all calculations on a mix sheet. Weigh the materials in accordance with the mix sheet. Record the actual weights, to the smallest scale division, on the mix sheet.

2.1.6 All containers must be clean, dry, and labeled with the following information on the container (not on the cover):

(a) Name of ingredient.

(b) Lot number.

(c) Gross weight.

(d) Tare weight.

(e) Net weight.

(f) Mix number or intended mix number.

2.2 Copolymer is available in various forms, including crumb, sheet, and rod. Cut the sheet copolymer into sections of 5 to 10 inches square; cut the rod copolymer into lengths of approximately 10 inches.

2.2.1 Put the copolymer into a dissolving drum. A 13-gallon capacity, 12-inch double-base roll shipping drum is satisfactory; a special preformed packing (O-ring) provides leakproof mating surfaces for the cover to drum contact area.

2.2.2 Add 5 ± 0.5 gallons of technical grade acetone to the dissolving drum for dissolving the copolymer for a 100-pound mix.

2.2.3 Label the dissolving drum with the following information:

(a) Name of ingredient.

(b) Manufacturer's lot number (copolymer).

(c) Weight of copolymer: gross, tare, and net.

(d) Quantity of acetone (number of gallons).

(e) Mix number.

2.2.4 Close and seal the dissolving drum with a cover which has a release valve installed in the bunghole. If there are leaks around the cover, clean the mating areas and reclose. If the leak continues, or leaks exist anywhere else on the drum, draw a new drum from stores, and transfer the copolymer-acetone solution to the new drum.

2.2.5 Place the dissolving drum on the drumroller. With the drumroller turning at about 30 revolutions per minute (rpm), agitate the copolymer solution for a minimum of 16 hours. Transfer the drum from the drumroller to the floor. Vent the drum by opening the release valve in the lid to release any pressure buildup from the acetone vapor. Remove the lid from the drum. Insert a long spatula into the drum and search for lumps of undissolved copolymer on the walls, on the bottom, and throughout the mixture. Return all material to the drum.

2.2.6 If lumps are present, repeat 2.2.5, except agitate the copolymer solution until the copolymer is completely dissolved. Record the aggregate running time on the mix sheet.

2.3 Clean the mixer, pot, and hopper with acetone and a cleaning cloth.

2.3.1 The Cowles Dissolver horizontal 12-inch Cowles impeller blade is diametrically-centered in a 25-inch deep, 18-inch diameter pot, 7 inches from the bottom of the pot. A special 6-inch-long blade is located 6 inches below the impeller blade and assists in the mixing by forcing the mixture up from the bottom of the pot.

2.3.2 Attach the hexane loading hose to the hexane pump and to the pipe leading to the bottom fill hole of the pot. In order to assure that a minimal amount of copolymer is removed from the mixing action of the mixture by flowing into and remaining in the hose during the mixing process, affix the hose in a vertical position from the pipe to the top of the pot. A check valve in the fill pipe is a less desirable alternative.

2.3.3 Start the mix room exhaust system. Due to the presence of heavier-than-air flammable vapors, a floor-level exhaust system is desirable.

2.3.4 Put the weighed ammonium perchlorate (AP), prescreened through a 6-mesh (6 divisions to the inch) sieve to remove foreign objects, in the feed hopper for later addition to the mixture (2.3.8). The AP must be free-flowing (free of any lumps). If the AP is lumpy, dry the AP and screen it through a 6-mesh sieve.

2.3.5 Pour the copolymer solution from the drum into the dissolver pot. Clean the drum with several small amounts of acetone. Pour the acetone wash into the dissolver pot. Start the dissolver. Set the speed of the dissolver at 900 rpm. Operate the dissolver at 900 rpm for all operations. Blend the copolymer solution and acetone wash for 3 minutes. Record the time on the mix sheet.

2.3.6 With the dissolver operating, slowly pour the weighed, unscreened polytetrafluoroethylene (PTFE) into the copolymer solution. Blend the mixture for 3 minutes. Inspect the mixture to assure complete wetting of the PTFE. If the PTFE is not thoroughly wet, blend the mixture until the PTFE is wet. Record the aggregate time on the mix sheet.

2.3.7 Stop the dissolver. Pour the aluminum (prescreened through a 6-mesh sieve to remove foreign objects) into the mixture. Pour the sodium fluoride into the mixture. From the remote control room, start the dissolver. Blend the mixture for 3 minutes. Record the time on the mix sheet.

2.3.8 The weighed unground AP was previously placed in the feed hopper (2.3.4). Start the hopper vibrator. Add the AP while the mixture is blending. After all of the AP is in the mixture, blend the mixture for 6 minutes. Stop the dissolver. Visually inspect the AP hopper to insure that it has completely emptied. Record the time on the mix sheet. Inspect the mixture for lumps. If lumps are present, run the dissolver until no lumps are present. Record the aggregate time on the mix sheet.

2.4 With the mixture blending, pump into the dissolver 11 gallons of technical-grade hexane at 8 gallons per minute. Blend the powder-acetone-hexane mixture for 7 minutes.

> NOTE. The bottom fill hole in the pot should be on the bottom, toward the side of the pot, entering horizontally, and pointing in the direction of mixture flow to allow the hexane to flow in the same direction as the mixture flow. Uniform suspension of the materials in the mixture at the moment of precipitation is imperative. When the hexane attains a certain proportion of the acetone-hexane mixture, the copolymer will precipitate. The moment of precipitation is apparent; the mixture is no longer a viscous, opaque mass, but is rather a clear liquid over a suspended particle layer.

2.4.1 Stop the mixer. When all of the solids have fallen to the bottom, remove the liquid with a suction hose and vacuum source without creating sufficient turbulence to disturb the precipitant. Remove the liquid to within 1 inch of the top of the solids. Do not expose the powder.

2.4.2 After the precipitation cycle of hexane addition and removal, extract the acetone from the mixture twice in accordance with 2.4 and 2.4.1, with the following exceptions:

2.4.2.1 Use 7 gallons of hexane for each rinse.

2.4.2.2 Blend the mixture 6 minutes for each rinse.

2.4.2.3 On the last rinse, move the powder to one side to form a well into which the solvent will drain to facilitate complete removal of the solvent, and decant as much of the liquid as possible.

2.4.3 Send the used liquids to the explosives disposal magazine.

2.4.4 Transfer the powder to grounded, shallow, stainless steel trays. Using a stainless steel hand scoop, fill the trays to 1.5 inches maximum depth.

2.4.5 Visually inspect the powder to assure that it has the appearance of a coarse grade of sand without large lumps. Report lumpy material on the mix sheet and inform supervisor.

2.4.6 Label all trays with the mix number. On at least three trays, also enter the name of the powder. Transfer the trays to the drying rack.

2.5 Dry the powder in a well-ventilated, normal room temperature, dustproof room for a minimum of 16 hours.

2.5.1 When the powder has dried for 1 hour, examine the powder for lumps. Although the depth of the powder is relatively shallow, the weight of the powder will sometimes pack the powder on the bottom, causing a hardpan layer which, if allowed to dry while so packed, will break up into lumps which will not easily pulverize. If the hardpan layer is broken up after about one hour of drying, the hardpan will break up easily into powder, and lumps will not reform.

2.5.2 Take the powder from the trays and place into containers; put 30 to 40 pounds (one pressing increment) of powder into each container. Label the containers (not the covers) with the name and mix number. Place the loaded, uncovered containers in a 135 ± 5°F circulating-air oven for a minimum of 8 hours.

2.6 Preheat the pressing increments for a minimum of 16 hours at 135 ± 5°F. Clean the press with acetone and a clean cloth. Turn on the electric power for the following equipment:

(a) 100-ton molding press and control panel.

(b) Molding press oil pump.

(c) Vacuum pump.

(d) Air compressor.

2.6.1 Transfer one increment of propellant powder from the oven to the press. Level the powder in the mold by hand. Avoid introducing any molding powder into the vacuum line orifice.

NOTE. Ordnancemen must wear full flame suits while handling hot propellant molding powder.

2.6.2 In the control panel room, set the controls to the REMOTE OPERATION position. Push the CLOSE button and set the vacuum control lever to the VACUUM position. When the vacuum manometer reads 13 millimeters (mm) of mercury or less, the press is adequately evacuated. Set the vacuum control lever to the OFF position and, at the same time, push the CLOSE button again. Maintain a pressure of 375 ± 5 pounds per square inch (psi) for 5 ± 0.5 minutes, then push the OPEN button and the AIR EJECTOR button. Remove the pressed block from the press. Weigh and measure the block; record the weight and thickness on the press sheet. Repeat for each block.

2.7 Preheat the propellant blocks for a minimum of 10 hours and a maximum of 24 hours at 210 ± 5°F.

2.7.1 Start the die and jacket heaters and set the thermostat at 225°F, which will bring the oil of the control system to the proper temperature for extruding propellant.

2.7.2 Clean all of the equipment with acetone and a clean cloth, including the following:

(a) Blade, guillotine.

(b) Crown.

(c) Die.

(d) Guides, cutter.

(e) Plug, vacuum.

(f) Press, extrusion, 15-inch horizontal cordite.

(g) Ring, die entry.

(h) Stake.

2.7.3 Install the die and die entry ring in the press. Install the crown and stake if extruding perforated grains. Install the vacuum plug, including the preformed packing (O-ring), in the die exit. Connect the heating tubes to the die. Install and align the cutter and install the cutter guides. Install and align the grain conveyor. In the machine room, turn on the high- and low-pressure oil, vacuum, and water pumps. Remove from the press room all of the apparatus and equipment that is not required for extrusion.

2.7.4 Load the extrusion press with propellant blocks. Personnel clad in flame suits are required for the loading operation. Brush loose powder from the press loading port. All personnel must leave the press room, close the press room doors and the personnel gate.

2.7.5 Push the control lever (johnson bar) forward to the ADVANCE position. The ram (plunger) head moves toward the die. When the ram head moves past the propellant loading port and into a position to seal the vacuum cavity, the ram head trips a switch which stops the ram head and starts the vacuum pump. When the cavity is evacuated to 15 mm of mercury, the ram head automatically advances through the vacuum cavity to put pressure on the propellant blocks. When the pressure on the propellant blocks reaches 100 psi, the high-pressure oil pump starts automatically, which turns on the "lever locked" lamp on the control panel. Set the pumping rate of the high-pressure oil pump to exert sufficient hydraulic pressure to extrude the propellant at not more than 7 inches per minute. This is not necessarily an upper limit, but is the rate used with the present grain configuration and extrusion equipment.

2.7.6 The propellant pushes out the vacuum plug. When the propellant is extruded through the cutter, pull the control lever to the CENTER position to stop the extrusion. Push the CUTTER button to cut off the extruded billet. Repeat or set the press to operate automatically.

2.7.7 When approximately 160 pounds of propellant remain in the press, pull the johnson bar to the CENTER position to stop the ram head. After a 5-second delay to bleed off the pressure from the high-pressure pump, the "lever locked" lamp goes out, indicating that the high oil pressure is off. Pull the johnson bar to the RETRACT position to withdraw the ram head to the rear of the loading port. Enter the press room. Use a marking pen to label the head end of each billet grain. Transfer the grains to the boxes on the cart. Transfer the cart from the press room to the dock area.

2.7.8 If additional propellant is to be extruded, reload the press with propellant blocks in accordance with 2.7.4 and extrude the propellant in accordance with 2.7.5 through 2.7.7. When the last increment of propellant blocks is in stage 2.7.7, load one 35-pound sack of oatmeal into the press and run the ram head forward to the end of stroke. Retract the ram head. Repeat the oatmeal procedure twice for a total of three sacks of oatmeal. The oatmeal is a filler which enables the extrusion of all the propellant. Extrude the remaining propellant and oatmeal in accordance with 2.7.5 and 2.7.6.

2.7.9 On an extrusion sheet, enter complete information including the following:

(a) Propellant type and tooling identifications.

(b) Extrusion number.

(c) Mix number(s).

(d) Quantity of billets.

(e) Billet serial letters.

(f) Billet lengths.

(g) Propellant request number.

Section 3

3. SAFETY.

3.1 When working with chemicals, assume that all are toxic unless known to be nontoxic. Avoid breathing and skin contact with wet or dry chemicals (including solvents). Wear a respirator, for volatiles, and rubber gloves unless instructed that this protection is not necessary in a specific instance. Damaging effects of chemicals may be cumulative.

3.1.1 Chemicals used in the production of fluorocarbon propellants, their toxicities, and the required breathing equipment are listed in Table I.

Table I. Chemicals and Required Breathing Equipment

Chemical	Toxicity	Breathing equipment for use while		
		Screening	Mixing	Drying
Acetone[a]	low	NA[b]	none	vapor mask
Aluminum	low	dust mask	none	none
Ammonium perchlorate	medium	dust mask	none	none
Copolymer elastomer	nontoxic below 400°F	—	—	—
n-Hexane[a]	low	NA[b]	none	vapor mask
Polytetra-fluoroethylene	nontoxic below 400°F	—	—	—
Sodium fluoride[c]	medium	dust mask	dust mask	dust mask

[a]While of low toxicity, both acetone and hexane are extremely flammable in both liquid and vapor form.

[b]NA - Not applicable.

[c]A rat poison. Wear rubber gloves. Wash hands and face well before eating food or drinking.

3.2 Grounding of personnel and equipment is mandatory. Static electricity builds up with friction and movement, including movement of air. Built-up static electricity causes a spark when discharged to a point of lower potential. The spark may ignite vapors of solvents and finely ground chemicals suspended in air.

3.2.1 Keep yourself grounded at all times, and especially before touching a container holding explosives or flammable chemicals.

3.2.2 Ground all equipment. Equipment may build up static electricity through the stirring of mixtures and solutions. All static charge must be drained off through a proper grounding wire.

3.2.2.1 The following equipment is included:

(a) Balances.
(b) Containers, metal.
(c) Carts.
(d) Compressors.
(e) Dissolvers.
(f) Drumrollers (if drum is rolled on nonconductive rubber rollers, ground the drum through a grounding wheel or brush and wire).
(g) Drums, disposal, waste explosive and waste solvent.
(h) Drums, fresh solvent.
(i) Hoppers.
(j) Mix pot.
(k) Ovens.
(l) Presses.
(m) Pumps.
(n) Racks.
(o) Sieves.
(p) Scales.
(q) Stairsteps.
(r) Trays.

3.3 Cloth or rags made from silk, wool, synthetic fibers, and non-conductive plastics are forbidden in the presence of explosives, propellants, and pyrotechnics, herein referred to as explosives, and finely ground chemicals; such materials produce static electricity and cause sparks. One hundred percent cotton is recommended for any cloth item.

3.4 The following protective equipment is necessary during processing of the fluorocarbon molding powder.

(a) Coveralls, flame resistant, without top pockets.

(b) Glasses, safety.

(c) Gloves, leather, rubber.

(d) Hat, hard, nonmetallic.

(e) Masks, vapor, dust.

(f) Shield, face.

(g) Shoes, safety.

(h) Suit, flame.

3.4.1 No jewelry, including wedding band, is permitted.

3.5 Remote operation of the block and extrusion presses is mandatory. These operations will be controlled from the control panel room. Explosive powders may explode upon application of friction, pressure, or heat. Before operating:

(a) All personnel leave press room.

(b) Close press room doors.

(c) Close personnel gate.

After operating: Open presses by remote control before reentry for reloading or product removal.

3.6 Store solvent drums away from the direct rays of the sun.

3.7 Waste disposal: Put waste explosives in the waste disposal drum. Send the drum to the waste explosives disposal magazine.

Custodian:
NAVORD ORD9343

Preparing Activity:
NWC/China Lake, California