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1. COMPONENT/PART NAME PER GENERIC CODE: Ignition Parts & Explisives, Rocket Ignition-Solid, Explosive Charge, Propellant

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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
- [X] (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
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OD 30803
20 MARCH 1968

Code Ident
10001

MANUFACTURING TECHNIQUES

FOR

N-35 PROPELLANT

Approved:

By direction

RECORD OF REVISIONS		
Revision Letter	Date	Changes

This document consists of pages i to iii
and 1 to 19 inclusive.

BY DIRECTION OF THE
COMMANDER OF THE NAVAL ORDNANCE SYSTEMS COMMAND

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1. INTRODUCTION.

1.1 This document describes the manufacturing procedures for the N-35 propellant. The procedures described herein are applicable to the processing of propellant for the Mk 61 Mod 0 BOMROC Unit C igniter and RAP igniter pellets, and are intended only for use by the Naval Ordnance Station (NOS/IH), Indian Head, Maryland.

2. MATERIALS.

2.1 Receive the process materials only from storerooms and record the following information for each material in the weighing facility log book.

(a) Name

(b) Manufacturer

(c) Lot Number

(d) Weight.

2.2 Accept the process materials for use on the following basis:

(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.

2.3 The smallest graduation of the scales and balances should be no larger than one percent of the desired net weight and the tare weights must be recorded from the same scale as the gross weight in order to assure consistency in measurement.

2.4 Weigh the process materials in accordance with the mix sheet and record the actual weights to the smallest scale division and wet the magnesium down with hexane in order to degenerate its reactiveness with air.

2.5 Inspect all containers and insure that they are clean, dry, and labeled with the following information on the container (not the cover):

(a) Name of ingredient

(b) Lot number

(c) Net weight

(d) Intended mix number.

3. PREMIX.

3.1 Place the copolymer in a 55-gallon capacity, stainless steel dissolving drum.

3.2 Add 27 ± 0.5 gallons of technical grade acetone to the dissolving drum for a 200-pound mix.

3.3 Label the dissolving drum with the mix number and enter in the premix log book the following information:

(a) Mix number

(b) Manufacturer's lot number

(c) Weight of copolymer.

3.4 Close and seal the dissolving drum with a cover equipped with bungholes.

3.5 Check the seal around the cover and if the seal is not airtight clean the mating areas and reclose.

3.6 If leaks exist anywhere on the drum, draw a new drum from stores and transfer the solution to the new drum.

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

4. MIXING.

4.1 Equipment. Hemispherical bottom, stainless steel mixing bowl.

Diameter	34 inches
Depth	40 inches
Dissolver	Model No. -520-VHVX Horse Power--20 hp
Blade	18 inch Cowles impeller blade, set 4 inches off center.

4.2 Clean the mixer components, dissolver blade and pot with acetone and a cleaning cloth.

4.3 Pour the copolymer solution from the premix drum through a screen into the mixing bowl. If "jelly" appears on the screen, return the copolymer solution to the dissolving drum and continue the agitation of the solution.

4.4 Clean the premix drum with 2 gallons of acetone and pour the wash into the mixing bowl.

4.5 Place the bowl ring cover onto the bowl and clamp it securely into position. Position the dissolver into the mix bowl and set the Cowles impeller blade 5-1/2 inches from the bottom of the bowl.

4.6 Attach the hexane feed hose and nozzle to the bowl cover and align the nozzle so that the hexane flow is in the same direction as the flow of the mixer action, and the hexane entry is directed at the mixer blade.

4.7 Start the mixer room exhaust system (due to heavier-than-air toxic vapors, a floor-level exhaust system is recommended), and set the dissolver blade speed to 600 rpm. Blend the copolymer solution for 3 minutes to insure homogeneity and to provide mixing action for further addition.

4.8 With the dissolver operating at 600 rpm, manually add to the premix solution the weighed, polytetrafluoroethylene (PTFE), and wetted magnesium and continue mixing until 20 minutes has elapsed from initial addition.

4.9 Raise the dissolver blade 7-1/2 inches from the bottom of the bowl and return to the control room.

4.10 Increase the dissolver speed to 700 rpm and mix the solution for 10 minutes.

4.11 With the mixer blending, pump into the mixing bowl 60 gallons of technical grade hexane at 19.1 gallons per minute and blend the powder-acetone-hexane mixture for 10 minutes.

4.12 Stop the mixer and when all of the solids have fallen to the bottom of the bowl, remove the supernatant liquid (being careful not to disturb the precipitate) to within 1 inch of the top of the solids with a suction hose and a vacuum source.

4.13 Start the addition of 30 gallons of hexane and 10 seconds after initiation, start the dissolver and maintain a mixing speed of 700 rpm. Continue to mix the solution for 10 minutes after the 30 gallons of hexane have been added.

4.14 Stop the dissolver blade and move the powder to one side to facilitate the removal of the supernatant liquid. Decant as much of this supernatant liquid as possible and insure that, in the decantation process, the precipitate is not disturbed.

4.15 Extract additional acetone from the mixture with another hexane wash in accordance with steps 4.13 through 4.14.

4.16 Using a stainless steel or aluminum hand scoop, transfer the precipitate to grounded, shallow stainless steel trays, covered with conductive plastic sheets. Be careful not to fill the trays to more than 1.5 inches in depth to insure nonlumpy, controlled drying of the precipitate.

4.17 Visually inspect the precipitate to assure that it has the appearance of a fine grade of sand. Report all lumpy material on the mix sheet and inform the process supervisor.

4.18 Clean the processing equipment and the operating bay and ensure that the equipment grounding wires are secure.

5. DRYING AND WEIGHING.

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

5.2 Transfer the powder, in drying carts, to the designated weighing buildings.

5.3 Remove the powder from the drying trays and weigh into 5-pound increments.

5.4 Place each 5-pound increment into a conductive plastic bag and secure ends.

5.5 Place six bags of powder (30 pounds) into each container and label with the mix number and weight. Transfer the container to the storage bay.

6. EXTRUSION.

6.1 Equipment.

(a) BOMROC — 3-1/2 inch vertical press

Die	6 ports
Type	conical
Rated capacity	95 tons

Mfg: Logansport Machine Co., Inc.

(b) RAP — 2-inch vertical press

Die	12 ports
Type	conical
Rated capacity	15 tons

6.2 Check to insure that all operating equipment is grounded and that the extrusion basket, the die holder, and the ram are free of any foreign material.

6.3 Inspect the ram head, the O-ring and the interior of the correct die for excess wear or other foreign surface defects that might cause a rough product.

6.4 Set the basket temperature, the die temperature, and the oil temperature to the value indicated in Table I, and maintain these values throughout the extrusion process.

Table I. Extrusion Operating Conditions

Conditions	BOMROC Igniter	RAP Igniter Pellets
Preheat temperature (°F)	220 ± 5	220 ± 5
Press basket temperature (°F)	220	220
Extrusion pressure (psi)	8,000	10,000 max
Extrusion rate (in/min)	12	App. 20
Charge weight (lbs)	4.5	0.5
Oil temperature (°F)	225	225

6.5 Obtain from the preheat oven the powder that has been heating for a minimum of 4 hours at 220 ± 5°F and, after plugging the bottom opening of the shear-ring assembly with a rubber stopper, fill the press basket to within 1 inch of the ram vacuum position.

6.6 Initiate the press from the control room and, when the ram stops for the vacuum cycle, draw a vacuum of 29 inches of mercury (Hg) to insure that there will be no voids in the extruded product and to prevent the adiabatic expansion of entrapped air pockets.

6.7 After the vacuum cycle has been completed and a steady value of 29 inches of Hg vacuum has been established, adjust the extrusion rate to the value listed in Table I. Maintain this rate throughout the process.

6.8 Extrude BOMROC igniter billet to a length suitable for the final cut-to-length operation on the Nichols Mill (see 7.1). Cut the BOMROC igniter billet with the guillotine cutter. When making RAP igniter pellets, extrude into long continuous strands for cutting on the Small Arms Powder Cutting Machine (see 7.2).

6.9 Repeat the steps 6.5 through 6.8 for additional extruded product and when the processing of the propellant has been completed, fill the basket with a charge of oats and repeat steps 6.5 through 6.8 to remove the propellant heel.

6.10 Turn off all equipment and place the extruded propellant in a container that is conductively lined and grounded and transport the container to the holding bay to await inspection and final processing.

6.11 Inspect the processing bay and insure that all processing equipment is clean and grounded and that the propellant waste has been collected for burning.

6.12 For safety requirements see 9.1 through 9.10.

7. CUTTING.

7.1 BORROC Igniter.

7.1.1 Equipment. Nichols Mill

Style	319129SC
Serial No.	GP8748
Blades	Two
Diameter	8 inches
Teeth	48
Thickness	1/8 inch

Modified with an igniter grain holding fixture to hold the igniter strands securely during operation.

7.1.2 Inspect the processing equipment and insure that all equipment is grounded and clean.

7.1.3 Place the saw in the raised position and adjust the saw table to the extended position.

7.1.4 Load the billets onto the saw table and visually check the billets to assure that approximately 1/4 inch will be cut off by the saw.

7.1.5 Clamp the billets securely into position and lower the saws into the cutting slots. Initiate the chip blower to insure that the cutting teeth will remain free of propellant chips.

7.1.6 Close the door to the operating bay securely and return to the control bay.

7.1.7 Set the speed to the cutting saws from 200 to 300 rpm and the feed bed to 1.5 feet per minute. Start the saws and continue processing until all of the grains have been cut and the table has stopped moving (fully extended).

7.1.8 After stopping the saw, enter the saw bay and manually remove the cut grains from the holding fixture.

7.1.9 Position the cut grains in a tray lined with conductive rubber sheets and deliver the grains to the inspection area.

7.1.10 Clean all of the bay area and the processing equipment and insure that all the grounded connections are secure.

7.1.11 Repeat steps 7.1.4 through 7.1.8 to cut additional grains.

7.2 RAP Igniter Pellets.

7.2.1 Equipment. Small Arms Powder Cutting Machine.
Mfg: McKiernan and Terry

Blades: Twenty 3-inch cutting blades orientated along the surface of a 16-inch-diameter steel rotor wheel and facing from the periphery of the wheel towards the arbor.

7.2.2 Inspect the processing equipment and insure that all the equipment is grounded and clean.

7.2.3 Free the roller assembly and remove any superficial powder dust from the bridge plate with a fiber bristle brush.

7.2.4 Inspect the roller assembly and feed-block assembly to insure that they are aligned and adjust the gear ratio between the motor and the feed rollers to give a 3/16-inch pellet cut.

7.2.5 Extract all of the short strands of uncut powder from the roller block and remove the powder dust from the cutting bed, and cutting equipment with a fiber bristle brush (respirators must be worn).

7.2.6 Check the level of alcohol in the glass cup and in the alcohol misticator and replenish the alcohol supply if necessary.

7.2.7 Start the alcohol drip and the alcohol misticator to provide coolant to the cutter blades and manually feed a minimum of five strands of powder into the cutter feed block.

NOTE. A minimum feed of five powder strands will maintain a level roller orientation with the feed block and prevent the clogging of the block with propellant strands.

7.2.8 Set the speed of the blade wheel to 900 rpm and initiate the cutter motor. Continue feeding the strands of powder until all the strands are being cut and collect the igniter pellets in a grounded receiving can that is lined with a conductive plastic bag.

7.2.9 Feed the strands of powder to the cutters over the guide bar, in as straight a line as possible. If the strands become entangled, break the strands and refeed them to the cutters.

7.2.10 If the cutting block becomes clogged during the cutting operation, stop the process and remove the clogged material. Dispose of the propellant refuse in a grounded, conductively lined waste can and continue the cutting operation.

NOTE. The processing of grain will be discontinued whenever less than five strands of uncut powder are available on the powder truck.

7.2.11 Turn off the alcohol drip, the alcohol misticator, and the cutter motor and clean up the processing area. Transport the processed igniter pellets to a storage bay to await quality inspection.

7.2.12 For safety requirements see 9.11 through 9.16.

8. PACKING.

8.1 Ground metal shipping containers (ammunition component box Mk 3 Mod 1 with dimensions approximately 8 by 14 by 18 inches) to the building ground.

8.2 BOMROC Igniter. Using masking tape, wrap igniters into bundles of approximately 20 and additionally wrap each bundle with corrugated paper.

8.3 RAP Igniter Pellets. Load igniter pellets into conductive plastic bags and seal.

8.4 Load wrapped pellets or igniters into metal container.

8.5 Place inside each shipping container a completed explosive data card.

NOTE. Explosive data card contains: Type of igniter;
Formulation_____ Explosive Weight_____
Lot Number_____ No. of Units_____
Shipping Date_____

8.6 Close container and attach safety wire.

8.7 Stencil the shipping container with the following information:

Contents: Formulation N-35
Class B explosive
Total Explosive Weight_____
Lot No._____

8.8 Clean building at the end of operation.

9. SAFETY PRECAUTIONS.

9.1 No person shall enter or pass the press room when the red warning light is flashing unless the operator or the engineer is present and certifies that the presses are empty and are being operated for test purposes, or contain a dummy charge.

9.2 No person shall be present in the press rooms when the press is charged with live propellant and the ram is being operated.

9.3 If it is necessary to repair or adjust the press, the engineer shall insure that the press has been cleaned thoroughly and that all propellant has been removed from all bays before admitting any personnel to press room.

9.4 When the press is being cleaned, the electrical circuit shall be locked in the "OFF" position to prevent initiation of operation of the press.

9.5 The operator shall make periodic checks to insure that the red warning light is lighted when the press is in operation. If the red warning light fails to operate when the press is in operation, the engineer shall be notified immediately. Post personnel on the walkway to warn transient personnel and complete the operations required to empty the press. Discontinue operations until repairs have been made.

9.6 All "skin" and floor sweepings shall be placed in the blue "Scrap Propellant" cans for disposition by burning.

9.7 Inspect shear rings carefully for cracks before use.

9.8 If there is a sudden pressure or temperature rise, oil leak, pipe break or sound change in the extrusion pump, stop all operations by pressing the emergency stop button. Notify engineer in charge of operation.

9.9 If the "jaw closed" light should go out during extrusion, turn the emergency up switch "on" and contact engineer.

9.10 Fill out extrusion sheet completely for each cycle.

9.11 The cutting blades and the bridge plate on the propellant cutting machines shall be inspected for cleanliness at the start of each shift. Twice per shift the cutting machines shall be opened by an approved toolmaker; the cutting wheel removed from the machine, and all propellant

dust blown from the machine and the wheel with compressed air. Upon completion of the cleaning operation, the toolmaker shall reassemble the cutting machine and adjust it for proper operation.

9.12 Before the cutting machine has been started, a small flow and a mist of alcohol shall be started over the cutting blade to prevent over-heating of the machine.

9.13 The electrical circuit for the cutting machine shall be locked in the OFF position prior to removing the bridge plate or removing the cover plate from the cutting blade.

9.14 The fire guard screens shall be in place around the discharge chute of the cutting machines at all times when the machines are being used to cut propellant. The screens shall be grounded and shall be kept clean. If damage occurs to the screen, operations at the cutting machine concerned shall cease until the damaged screen is repaired or replaced.

9.15 After cutting 1/2 of the powder charge, the cut powder will be transferred to the other cutter bay or to the powder storage house. The feed and cutter block will be checked for any heat build-up before cutting the remaining powder. If heat build-up is occurring, notify leadingman.

9.16 Posted personnel and propellant limits shall be observed at all times.

9.17 All drainage ditches shall be swept free of accumulations and then flushed with water at least once per week on the day shift The "washday" shall be the day selected for ram head maintenance.

9.18 All operating areas shall be kept free of spilled propellant at all times and these sweepings shall be placed in the appropriate blue "Scrap Propellant" can for subsequent burning.

9.19 All cans of solvents used within the area shall be grounded.

9.20 All portable ground wires and clamps shall be inspected each time prior to use to insure that the wires are continuous and that the clamps are operable and are attached firmly to the ground wire.

9.21 Whenever a thunderstorm is in progress and strokes of lightning appear over the plant area, all operations shall be shut down and personnel evacuated to Control House.

9.22 Repairs to equipment shall be made only by a qualified NOS/IH mechanic, or by private contractor, who shall first be approved by the Safety Department.

9.23 Upon malfunction of any processing equipment, that particular piece shall be stopped until correction is made. Notify the leadingman.

9.24 Compressed air used for cleaning equipment shall not exceed 10 pounds per square inch (psi) flow pressure. Personnel shall wear safety goggles and whatever other safety equipment is required for the particular job being done.

9.25 Use of this document shall not relieve the manufacturer of responsiblity for the safety of his operation. See OP-5 for safety requirements and precautions. Such other warnings and precautions, pertinent to the operational effectiveness or safety during the mixing, extrusions and handling of the grain, are included in the detailed technical requirements of this document.

9.26 All operations should be conducted in a neat and orderly manner.

9.27 Safe equipment and methods should be utilized for transporting, handling, and machining of explosives.

9.28 Exposure of powder to inclement weather should be minimized. Powder carts should be covered with a tarpaulin during rain and snow storms. Powder should never be held or stored outside.

9.29 All explosives should be stored in suitable storage magazines located in accordance with the American Table of Distances (ATD) or other applicable safety standards. While in process, these items should be located in accordance with intraplant distances.

9.30 Proper care must be exercised at all times to protect personnel, equipment, and working areas from accidents, fires, or explosions.

9.31 Keep only minimum quantities of explosives and completely or partially loaded parts present at each stage of operation.

9.32 Keep explosives and explosive parts in approved covered receptacles and ensure covers are in place after material is taken out of or put into receptacles. Receptacles should be conductive to ground electrostatic charges.

9.33 Protect operations from electrostatic charges by effectively grounding all machinery, equipment, and fixtures. Employ suitable grounded conductive covering for floors, work benches, and tables. Workers' clothing should be of a type to minimize the accumulation of static charges. Fabrics such as silk and nylon, which promote static generation, should be avoided.

9.34 Enforce the wearing of suitable safety footwear, gloves, goggles, respirators, and impregnated garments to protect personnel against burns, poisoning, and associated industrial hazards.

9.35 Allow no fires or exposed electrical or other sparking equipment and allow little or no flammable material to be present in machining, handling, and storage spaces. Enforce proper "Match" and "No Smoking" rules.

9.36 Enforce good housekeeping and maintain effective policing inspection, and supervisory methods throughout the work area and surroundings.

9.37 In case of fire, clear the area. Do not attempt to fight the fire. Warn arriving firemen of the presence of toxic fumes emitting from the fire.

9.38 Store all scrap propellant in conductive plastic bags in grounded metal containers. Transport waste containers to the burning point for disposal of propellant.

9.39 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) and 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.

9.40 Chemicals used in the production of N-35, their toxicities; and the required breathing equipment are listed in Table II.

Table II. Chemicals and Required Breathing Equipment.

Chemical	Toxicity	Breathing equipment for use while		
		Screening	Mixing	Drying
Acetone[a]	Low	NA[b]	None	Vapor mask
Copolymer elastomer	Nontoxic Below 400°F	——	——	——
n-Hexane[a]	Low	NA[b]	None	Vapor mask
Polytetra-fluoroethy-lene	Nontoxic Below 400°F	——	——	——

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

[b]NA - Not applicable.

10. REFERENCES.

10.1 The following documents of the issue in effect on date of this document shall apply.

10.2 Ordnance documents

OP-5	Ammunition Ashore American Table of Distances

10.3 General and Standard Operating Procedures (NOS/IH)

SOP No. PP-293	Cutting Propellant
GOP No. PP-361	Extrusion of Propellant 2-inch press
GOP No. PP-431	Extrusion of Propellant 3-1/2-inch press
SJP (NOS/IH)	Premixing of Fluorocarbon Propellant (Portable drum rotator—Building 530) Date 9/9/67
SJP Code 213 (NOS/IH)	Storing and Weighing Ingredients (Building 1113) Date 7/7/65
SJP Code 213 (NOS/IH)	Magnesium Powder Storage, weight and wet (Building 531) Date 7/9/65
SJP Code 213 (NOS/IH)	Mixing (Building 527 and 530) Date 6/29/65
SJP Code 213 (NOS/IH)	Drying (Building 871) Date 7/6/65
SJP Code 213 (NOS/IH)	Preweigh and Preheat Propellant Powder (Building 531 oven 871) Date 7/8/65
SJP Code 213 (NOS/IH)	Extrude (Building 562 and 561) Date 7/9/65

10.4 Drawings

SK 676335	Igniter Grain BOMROC Unit C
SK 673645	RAP Igniter Pellets

10.5 Weapons Specifications

WS 7689	Naval Ordnance Systems Command Department of the Navy Purchase Description, Propellant, Igniter N-35 (U)

Custodian:
NAVORD ORD9343

Preparing Activity:
NWC/China Lake, California