



DEPARTMENT OF THE NAVY

NAVAL SEA SYSTEMS COMMAND
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ARLINGTON VA 22242-5160

IN REPLY REFER TO

NAVSEAINST 8020.5C
Ser 53/017
05 May 00

NAVSEA INSTRUCTION 8020.5C

From: Commander, Naval Sea Systems Command

Subj: QUALIFICATION AND FINAL (TYPE) QUALIFICATION PROCEDURES
FOR NAVY EXPLOSIVES (HIGH EXPLOSIVES, PROPELLANTS,
PYROTECHNICS AND BLASTING AGENTS)

Ref: (a) OPNAVINST 8020.14
(b) OPNAVINST 8010.13
(c) SECNAVINST 5400.15
(d) NATO STANAG 4170
(e) MIL-STD-1751
(f) NAVSEAINST 8010.5
(g) NAVSEA SW010-AG-ORD-010
(h) NAVSEAINST 8020.11
(i) NAVSUP P-724

Encl: (1) Definitions
(2) Responsibilities and Procedures of the Explosive
Selection Working Group
(3) Qualification Procedures for Explosives
(4) Final (Type) Qualification Procedures for Explosives

1. Purpose. To establish policy and provide procedures for approving explosives for Navy use and to establish the Explosive Selection Working Group (ESWG).

2. Cancellation. NAVSEAINST 8020.5B of 16 May 1988.

3. Information

a. Qualification is the assessment of the explosive material to determine whether it possesses properties which make it safe and suitable for consideration for use in its intended role. Final (Type) Qualification is granted when the Qualified explosive has been assessed as part of the design of a specific munition and predicted to be safe and suitable for military operational or training use.

b. The Naval Sea Systems Command is assigned the Navy-wide responsibility for energetic materials, explosives safety and insensitive munitions policy. References (a), (b) and (c) provide the basis for this assignment. Lead Systems Command responsibilities include the approval authority for Qualification and Final (Type) Qualification of explosives.



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c. The term "explosive" is defined in enclosure (1) and specifically includes high explosives, propellants, pyrotechnics and blasting agents.

d. The policies and procedures provided herein are for (1) the Qualification of explosives for evaluation in programs leading to munition applications and (2) Final (Type) Qualification of explosives for use in specific operational or training munitions.

e. This instruction is the Navy implementing document for reference (d) and related Standard NATO Agreements (STANAGS). Reference (e) provides relevant test procedures.

f. The ESWG is established to provide recommendations to program managers with respect to the explosive best suited for use in a specific weapon system based on insensitive munitions (IM) characteristics and other factors such as operational requirements, producibility, availability of materials, performance, safety, and cost. Enclosure (2) describes the responsibilities and procedures of the ESWG.

4. Applicability. This instruction applies to explosives at Navy installations and aboard Navy ships or aircraft, whether designed and built by the Navy or developed by other services, private industry, or foreign sources and whether intended for operational use, testing, training, or transport. Fleet ballistic missile strategic weapons and nuclear weapons are excluded.

5. Policy

a. In accordance with references (b) and (f), the least sensitive explosive material shall be used in all Navy munitions consistent with the performance/operational requirements of that munition. In selecting an explosive, the program manager shall place emphasis on reducing the weapon susceptibility to violent reaction as a result of cook-off, bullet and fragment impact and to sympathetic detonation during transportation, storage and use.

b. High explosives shall be qualified in accordance with enclosure (3) prior to use in a munitions development or product improvement program. Qualified high explosives approved for weapon development are listed in reference (g), Table 3. Approval to use any finalized or developmental high explosive not listed in reference (g), Table 3 must be requested in writing to the Commander, Naval Sea Systems Command (COMNAVSEASYS COM). Any

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high explosive Qualified between revisions of reference (g) shall be considered included in reference (g).

c. Test data on propellants and pyrotechnics as described in enclosure (3) shall be reviewed by the Director, Insensitive Munitions Office, Naval Ordnance Safety and Security Activity (NAVORDSAFSECACT Code N6) within 45 days of receipt prior to initiating testing of the next higher assembly (e.g., propulsion systems, cartridges, pyrotechnic devices, etc.). Qualification shall be obtained after the formulation has been finalized which occurs after testing of the next higher assembly.

d. For previously Qualified explosives changes in materials or processing, which result in changes to explosive safety, performance, or mechanical properties, or the process by which the energetic ingredients are made, shall be reviewed by NAVORDSAFSECACT Code N6 to determine whether requalification is required. A review will be based on sensitivity and other data requested by NAVORDSAFSECACT Code N6 from the explosive formulator. The Department of Defense (DoD) Component Office of Primary Responsibility for Hazard Classification Support is NAVORDSAFSECACT Code N7143 which will also review the changes with respect to hazard classification. Changes must be duly recorded by the program manager in the appropriate documents (e.g., Specification or Naval Munitions Data Document (NMD), reference (h)).

e. Explosives previously Qualified by the Navy and listed in reference (g), Table 3 need only go through the Final (Type) Qualification procedures of enclosure (4).

f. Only Final (Type) Qualified explosives, as defined in enclosure (1), shall be employed in munitions and explosive devices introduced for operational or training use. The fact that an explosive has been Final (Type) Qualified for a specific munition does not imply that it is acceptable for other uses. Each new application must be reviewed by the Weapon System Explosives Safety Review Board (WSESRB) and approved by COMNAVSEASYSYSCOM. Production prior to receiving Final (Type) Qualification will be allowed only if the items are placed in a suspended ammunition condition code as defined in reference (i). The condition code may be subsequently changed to serviceable when Final (Type) Qualification is approved.

g. A Qualified or Final (Type) Qualified booster explosive may be considered for use as a Qualified main charge explosive if a safety analysis of the proposed weapon or application has been made, reviewed by the WSESRB and approved for Final (Type) Qualification by COMNAVSEASYSYSCOM.

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h. Explosives which are not Qualified are only permitted at Navy Research and Development (R&D) and pilot plant processing facilities for research or development, including synthesis, formulation, processing, characterization studies up to testing of the next higher assembly. Testing aboard Navy aircraft and ships is specifically prohibited. Only Qualified explosives shall be recommended to other government activities, private industry or allied countries for weapon development.

i. For the use of an un-Qualified explosive in existing, non-developmental, munitions and explosive devices introduced for operational or training use, a written request must be submitted to COMNAVSEASYSKOM, documenting the need to use an un-Qualified explosive and describing special precautions that will be taken to offset the higher hazard associated with its use. If justified and after WESRB review, COMNAVSEASYSKOM will grant Final (Type) Qualification for use in the particular application. The explosive will retain its un-Qualified status.

j. In accordance with reference (h), to ensure production safety for contractor-developed munitions, NAVORDSAFSECACT Code N6 will determine if Navy in-house explosive loading validation is required.

6. Action

a. Naval Sea Systems Command (COMNAVSEASYSKOM)

(1) In the capacity as Lead Systems Command for energetic materials and insensitive munitions in accordance with reference (b), SEA 53 is the approval authority for Qualification and Final (Type) Qualification.

b. Naval Ordnance Safety and Security Activity (NAVORDSAFSECACT)

(1) The Insensitive Munitions Office (NAVORDSAFSECACT Code N6), will:

(a) Review Qualification data packages submitted on explosives and either prepare documentation granting Qualification for COMNAVSEASYSKOM signature or provide a written response citing reasons for denial of Qualification or requesting additional information within 45 days of receipt of the data package.

(b) Review Qualification data packages submitted on propellants and pyrotechnics. Written comments to the

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originating program manager will be provided within 45 days of receipt, which will allow the program manager to proceed at their discretion with testing at the next higher assembly. Formal qualification of the propellant or pyrotechnic will either be granted by COMNAVSEASYSCOM within 60 days or may be postponed until the propellant or pyrotechnic composition is finalized and/or additionally requested test data are submitted by the developing activity or program manager.

(c) Review Final (Type) Qualification requests and provide a written response to the requesting activity after receiving WSESRB recommendations. A response shall be provided within 60 days of receipt of WSESRB recommendations.

(d) Issue designations (nomenclature) for Qualified and Final (Type) Qualified explosives as part of COMNAVSEASYSCOM documentation granting Qualification or Final (Type) Qualification.

(e) Serve as Chair for the ESWG.

(f) Respond to requests to use an explosive in a new application which is not included in Table (3) of reference (g).

(2) The Ordnance Safety and Security Office (NAVORDSAFSECACT N7), will:

(a) Provide a Weapon System Explosives Safety Review Board (WSESRB) review of Final (Type) Qualification requests (concurrent with the WSESRB review of the weapon system) and shall provide a written recommendation to approve or disapprove the requests. A response shall be provided to NAVORDSAFSECACT Code N6 within 60 days of receipt of the data package or 30 days of the completion of the WSESRB review, whichever is later.

(b) Provide a WSESRB review of Qualification requests and provide concurrence or nonconcurrence within 15 days of receipt.

(3) The Ordnance Quality Evaluation Office (NAVORDSAFSECACT Code N8), will:

(a) Provide service life history on in-service explosives, as available, to the ESWG for consideration during the selection process.

(b) Develop and maintain a Navy wide Quality Evaluation (aging and surveillance) database to enable the

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exchange of service life and aging technical data and lessons learned.

(4) The ESWG, enclosure (2), will make recommendations to the program managers for selecting the least sensitive explosive available which will meet the operational requirements of the weapon system.

c. Commander Naval Air Systems Command (COMNAVAIRSYSCOM)

(1) Support and assist COMNAVSEASYSYSCOM as requested to implement this instruction.

(2) Assign a NAVAIR code the responsibility for assuring that explosives used in NAVAIR applications meet the requirements of this directive.

(3) Provide a representative to the ESWG.

d. Marine Corps Systems Command (MARCORSYSYSCOM)

(1) Support and assist COMNAVSEASYSYSCOM as required to implement this instruction.

(2) Assign a point of contact the responsibility for assuring that explosives used in Marine Corps applications meet the requirements of this instruction.

(3) Act as the program manager for all Marine Corps Class V (W) explosives which may be transported in Navy ships.

(4) Provide a representative to the ESWG.

e. Naval Surface Warfare Center, Dahlgren Division (NAVSURFWARCENDIV DAHLGREN)

(1) Provide technical support to COMNAVSEASYSYSCOM and other commands or activities, as required, to implement this instruction.

(2) Assist in the preparation of Final (Type) Qualification data packages for explosives to support program offices as required.

f. Naval Air Warfare Center, Weapons Division, China Lake (NAVAIRWPCENWPNDIV CHINA LAKE)

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(1) Provide technical support to COMNAVSEASYSKOM and other commands or activities, as required, to implement this instruction.

(2) Assist in the preparation of Final (Type) Qualification data packages for high explosives and propellants to support program offices as required.

(3) Prepare and submit Qualification data packages for high explosives and propellants in accordance with this instruction.

(4) Provide advisory statements on the processing and safe-handling characteristics of propellants and high explosives for Final (Type) Qualification.

(5) Support Naval Surface Warfare Center, Indian Head Division (NAVSURFWARCENDIV INDIAN HEAD) as required, in the preparation of advisory statements on the processability and safe-handling characteristics of high explosives and propellants.

(6) Provide a representative to the ESWG as specified by NAVORDSAFSECACT Code N6.

(7) Identify to NAVORDSAFSECACT Code N6 a code with signature authority responsible for recommending Qualification of explosives.

(8) Perform high explosive loading process validations for contractor developed munitions as required. Load and assemble explosive charges as required by development centers or program offices for test and evaluation data leading to Final (Type) Qualification for Navy in-house development programs.

g. Naval Surface Warfare Center, Indian Head Division
(NAVSURFWARCENDIV INDIAN HEAD)

(1) Provide technical support to COMNAVSEASYSKOM and other commands or activities to implement this instruction.

(2) Assist in the preparation of Final (Type) Qualification data packages for propellants, high explosives and pyrotechnics and support program offices as required.

(3) Prepare and submit Qualification data packages for high explosives, propellants and pyrotechnics in accordance with this instruction.

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(4) Provide advisory statements on the processing and safe-handling characteristics of high explosives, propellants and pyrotechnics for Final (Type) Qualification.

(5) Support NAVAIRWPNCENWPNDIV CHINA LAKE, as required, in the preparation of advisory statements on the processability and safe-handling characteristics of high explosives and propellants.

(6) Provide a representative to the ESWG as specified by NAVORDSAFSECACT Code N6.

(7) Identify to NAVORDSAFSECACT Code N6 a code with signature authority responsible for recommending Qualification of explosives.

(8) Update and maintain reference (g).

(9) Maintain repository of all explosive Qualification and Final (Type) Qualification data.

(10) Perform high explosive loading process validations for contractor developed munitions as required. Load and assemble explosive charges as required by development centers or program offices for test and evaluation data leading to Final (Type) Qualification for Navy in-house development programs.

h. Naval Surface Warfare Center, Crane Division
(NAVSURFWARCENDIV CRANE)

(1) Provide technical support to COMNAVSEASYSCOM and other commands or activities to implement this instruction.

(2) Assist in the preparation of Final (Type) Qualification data packages for pyrotechnics and blasting agents to support program offices as required.

(3) Prepare and submit Qualification packages for pyrotechnics and blasting agents in accordance with this instruction.

(4) Provide advisory statements on the processing and safe-handling characteristics of pyrotechnics and blasting agents for Final (Type) Qualification.

(5) Identify to the NAVORDSAFSECACT Code N6 a code with signature authority responsible for recommending Qualification of pyrotechnics and blasting agents.

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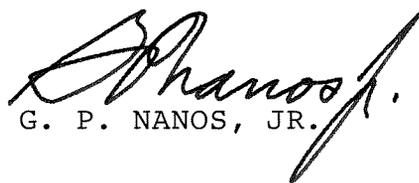
i. Development Activities and Program Managers(1) Submit Qualification Data Packages

(a) Qualification data packages for high explosives and propellants shall be prepared in accordance with enclosure (3) and submitted, to NAVORDSAFSECT Code N6, by NAVSURFWARCENDIV INDIAN HEAD or NAVAIRWPNCENWPNDIV CHINA LAKE as specified in paragraphs 6.f and 6.g. Program managers may also submit, to NAVORDSAFSECT Code N6, Qualification data packages with written concurrence from the Commanding Officer or authorized representative of NAVSURFWARCENDIV INDIAN HEAD or NAVAIRWPNCENWPNDIV CHINA LAKE.

(b) Qualification data packages for pyrotechnics shall be prepared in accordance with enclosure (3) and submitted, to NAVORDSAFSECT Code N6, by NAVSURFWARCENDIV INDIAN HEAD or NAVSURFWARCENDIV CRANE as specified in paragraphs 6.g and 6.h. Program managers may also submit, to NAVORDSAFSECT Code N6, Qualification data packages with written concurrence from the Commander or authorized representative of NAVSURFWARCENDIV CRANE or NAVSURFWARCENDIV INDIAN HEAD.

(c) Qualification data packages for blasting agents shall be prepared and submitted, to NAVORDSAFSECT Code N6, by NAVSURFWARCENDIV CRANE or the program manager with written concurrence from the Commanding Officer or authorized representative of NAVSURFWARCENDIV CRANE.

(2) Submit Final (Type) Qualification Data Packages. Requests for Final (Type) Qualification shall be submitted to NAVORDSAFSECT Code N6 by the program manager in accordance with enclosure (4).


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DEFINITIONS

1. The following definitions are consistent with the common usage within the United States Department of Defense and most other US agencies. The terms marked with asterisk (*) are definitions taken from NATO STANAG 4170 and modified, as appropriate, to identify the responsible authorities and to assure relevance to the U.S. Navy.

a. Assessment.* The analysis of the properties of an explosive, including the results of appropriate tests, to determine its relative sensitivity to various stimuli and the relationship, with particular regard to safety, to other explosives already in service use. Data for similar formulations may be considered relevant.

b. Blasting Agents.* Insensitive explosives which usually consist of mixtures of fuels and oxidizers combined in the proper ratio and combination to provide an explosion upon initiation from a booster. Blasting agents cannot be initiated with a Number 8 commercial blasting cap and are not considered high-explosives.

c. Booster Explosives. Materials of sensitivity intermediate between those of primary explosives and main charge explosives. Booster explosives are used to transmit and augment the detonation reaction (initiated by the primary explosive), with sufficient energy to reliably initiate a stable detonation reaction in the main charge explosive. CH-6, PBXN-5 and PBXN-7 are examples of booster explosives.

d. Cartridge Actuated Devices. Includes any device that provides the means of releasing potential cartridge energy or harnessing this energy to accomplish work.

e. Cartridges. Includes any assembled unit, containing high explosive, propellant, or pyrotechnic material, either singly or in any combination, designed as the energy source for cartridge-actuated devices.

f. Comparison Explosive.* An in-service explosive with proven safety characteristics whose properties are used to assess the relative safety and sensitivity of a new explosive intended for use in a similar role.

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g. Explosives.* Substances capable, by chemical reaction, of producing gas at such a temperature, pressure, and rate as to be capable of causing damage to the surroundings. Included are pyrotechnic substances even though some may not produce reaction gases. The term explosives includes solid, liquid, and hybrid materials variously known as high explosives, propellants, pyrotechnics, and blasting agents. Fuel-air explosives and explosives comprised of liquid fuels and oxidants are included, when used in munitions, even though the individual components may not be explosives.

h. Final (Type) Qualified Explosives.* A material in a specific application or weapon system that has been formally approved by COMNAVSEASYS COM for service use. The approval is based, in part, on an assessment of the explosive as part of the design of the item or configuration in which it will be used, and for which it has been judged by COMNAVSEASYS COM to be safe and suitable for use by the Navy. This approval step is required and the data must be presented to the Weapon System Explosives Safety Review Board before a weapon or other device is approved for service use.

i. Fuel-Air Explosive. Liquid slurry, gel, or solid, which exhibits explosive properties when dispersed in air. The individual substances may not be explosives. The mixtures of combustible fuels and air ordinarily require initiation by a booster explosive.

j. High Explosive.* Substances or mixtures which, in their application as primary, booster, or main charges in warheads or other applications, are required to detonate.

k. Main Charge Explosive. Materials that are less sensitive than booster explosives are generally used as the final charge in any explosive application. Because of their relative insensitivity, this type of explosive ordinarily requires initiation by a booster explosive. PBXN-103, PBXN-110, PBXN-107, and PBXN-9 are examples of materials used as main charge explosives.

l. Munition. A device loaded with high explosives, propellants, pyrotechnics, initiating compositions, or nuclear,

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biological, or chemical material for use in connection with conflict or demolition.

m. New Explosive.* This term encompasses:

(1) explosives not previously Qualified;

(2) any modification to an existing specification changing the composition of the explosive, its material constituents or the process by which the explosive is made which results in changes to the explosive's safety, performance, and mechanical properties; and

(3) the application of an explosive in a role for which it has not been Qualified (e.g., a booster explosive used as a main charge, or propellant used as a high explosive).

n. Primary Explosives. Sensitive materials used to initiate a chemical reaction in booster explosives or used as an initiation or ignition source for squibs and igniters used with propelling and pyrotechnic devices. These primary explosives are sensitive to heat, impact, and shock and, in warheads, are separated from the booster explosive by the fuze, exploder, or safety-and-arming device as specified in MIL-STD-1316. Lead styphnate, dextrinated lead azide, and DXN-1 are examples of primary explosives.

o. Propellants.* Substances or mixtures of substances used for propelling projectiles and missiles, or to generate gases for powering auxiliary devices. When ignited, propellants burn at a controlled rate to produce quantities of gas capable of performing work, but in their application they are required not to undergo deflagration-to-detonation transition.

p. Propellant-Actuated Device (PAD). A rocket-powered device releasing controlled propellant energy to perform a work function.

q. Pyrotechnics.* Substances or mixtures of substances, which when ignited undergo an energetic chemical reaction at a controlled rate intended to produce, on demand and in various combinations, specific time delays or quantities of heat, noise, smoke, light, or infra-red radiation. Pyrotechnics, in most of

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the applications, are required not to undergo a deflagration-to-detonation transition.

r. Qualified Explosive.* An explosive that possesses properties judged to make it safe and suitable, primarily from a safety point of view, for consideration for use in a particular role. The material has been approved for use in munitions development, product improvement, or other programs leading to eventual service application.

s. Reference Standard Explosive.* An explosive whose properties are consistent and sufficiently well-defined to enable its use for the calibration of a test apparatus. The explosive nominated as a reference standard, together with its lot number when appropriate, will be identified on the relevant national test information sheet.

Enclosure (1)

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**RESPONSIBILITIES AND PROCEDURES OF THE
EXPLOSIVE SELECTION WORKING GROUP**

1. Purpose. The Explosive Selection Working Group (ESWG) shall provide technical assistance to program managers in the selection of explosives for use in weapon systems. The ESWG is convened when requested by the program manager or NAVORDSAFSECT Code N6.

2. Scope. The ESWG shall make recommendations prior to completion of the Demonstration and Validation phase of a program on the most suitable explosive(s) for use in the weapon system. Recommendations will take into consideration such issues as weapon performance requirements; availability of materials; cost, schedule and technical constraints; lifecycle environments and IM performance of candidate explosives in generic IM tests.

3. Composition

a. Members:

Chairman: Director, Insensitive Munitions Office,
NAVORDSAFSECT Code N6

Vice Chairman: Assistant for Technology,
NAVORDSAFSECT Code N6

Secretary: Assistant for Weapon Programs,
NAVORDSAFSECT Code N6

Representatives for Navy weapons engineering

Representatives for Navy weapons research and technology

b. Other Members. At the request of NAVORDSAFSECT Code N6

4. Responsibility. The ESWG shall assist weapon systems program managers (including joint programs) in fulfilling the requirements of OPNAVINST 8010.13. The instruction states that the explosive least sensitive to external energy sources shall be used in all Navy munitions while meeting the system operational requirements.

5. Actions

a. Chairman

(1) Notify members of their required attendance at ESWG meetings.

(2) Request activities provide members with particular expertise when need arises.

(3) Preside at ESWG meetings.

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(4) Report actions and recommendations of the ESWG to the program manager, program sponsor, and technical support personnel.

b. Vice Chairman

(1) Assist the chairman in the execution of his duties.

(2) Perform the duties of the chairman when required.

(3) Review all technical documentation packages prior to ESWG meetings.

c. Secretary

(1) Schedule ESWG meetings as required by the Chairman.

(2) Provide administrative support to the ESWG.

(3) Issue reports generated by the ESWG.

(4) Maintain the official files of the ESWG.

d. Members

(1) Attend the meetings as required by the chairman or provide suitable alternate representation.

(2) Prepare technical documentation packages and briefings for ESWG meetings as required. Briefings shall summarize all requirements of this instruction and any additional information requested by NAVORDSAFSECACT Code N6.

e. Program Managers

(1) Request the ESWG Chairman convene an ESWG prior to the Demonstration and Validation phase.

(2) Prepare and submit information brief on weapon system requirements.

(3) Supply personnel knowledgeable in proposed weapon system and/or explosives to assist ESWG in reaching conclusion.

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- Ref: (a) NAVSEA SW010-AG-ORD-010
(b) CODE OF FEDERAL REGULATIONS, VOL 29, PART 1910
(c) MIL-STD-1751
(d) MIL-STD-2105
(e) JANNAF SOLID PROPELLANT MECHANICAL BEHAVIOR MANUAL,
CPIA PUB 21
(f) MIL-STD-286
(g) NAVSEAINST 8020.8
(h) MIL-STD-2100(OS)
(i) NAVSEA SW020-AE-SAF-010

1. General

a. The process for Qualification of an explosive is illustrated in Figure 1 and described within this document.

b. The Qualification data package for an explosive shall contain sufficient supporting data to show that it is judged to be safe and suitable for consideration in development, product improvement, or other programs leading to eventual service applications. Results of tests conducted in accordance with United States-ratified STANAGs are recognized as sufficient proof of level of sensitivity when compared to a recognized comparison explosive.

c. Blasting agents will be considered to be an end item munition and Qualification will include Final (Type) Qualification.

d. Prior to the beginning of testing, a review of the test plan by NAVORDSAFSECACT Code N6 is advised.

2. Required Documentation

a. The Qualification data package shall include:

(1) Mandatory data according to this instruction. Additional data may be required or mandatory data waived by NAVORDSAFSECACT Code N6 on a case-by-case basis. To establish any additional requirements, a review of the generated data with NAVORDSAFSECACT Code N6 prior to submission of the Qualification data package is recommended.

(2) Data in a format supplied as Appendix A for inclusion into reference (a).

(3) A justification for Qualification of explosive compositions stating a significant improvement in safety, performance, processability, environmental characteristics and/or cost over currently Qualified explosives. In order to control the proliferation of these compounds, Qualification will be denied without data showing a significant advantage over an existing explosive.

(4) A draft of a comprehensive technical report on the Qualification testing of the explosive (methods and results).

(5) A draft of the material specification or STANAG.

(6) A draft material safety data sheet in accordance with reference (b).

(7) Recommendation for Qualification by the Commanding Officer of the submitting activity or by an authorized representative.

(8) A preliminary environmental analysis statement shall be included in the request for Qualification package. The analysis shall include a review of the environmental issues associated with the life-cycle management of the explosive within existing DOD and Navy requirements.

(9) An interim or final hazard classification.

b. The requesting organization will publish within six months of Qualification a comprehensive technical report on the Qualification testing of the explosive.

3. Qualification Test Data

a. Mandatory data and assessments for high explosives, solid propellants, pyrotechnics, and blasting agents are listed in Table I. The test procedures and equipment are defined in reference (c). Test apparatus other than those required by reference (c) may be used to perform tests for shock, friction, impact, and electrostatic discharge sensitivity. If alternate

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apparatus or procedures are used, testing must be conducted on a comparison explosive (e.g., an explosive Qualified for use in that particular role and listed in reference (a)). Qualification tests shall be performed on fully cured samples. In addition, technical personnel at NAVSURFWARCENDIV CRANE, NAVSURFWARCENDIV INDIAN HEAD, NAVAIRWPNCENWPNDIV CHINA LAKE or NAVORDSAFSECACT Code N6 must concur that the test procedure and apparatus are adequate for Qualification purposes.

b. Test requirements for liquid propellants are addressed in paragraph 7.

c. Qualification tests for liquid, slurry, gel, and fuel-air explosives will be proposed in a test plan by the Office of Primary Responsibility (OPR) to NAVORDSAFSECACT Code N6 for comment 30 days prior to the commencement of Qualification testing.

d. Accelerated aging studies shall be considered prior to Qualification of new explosives. Figure 2 shows the aging protocol proposed for solid propellants, high explosives and pyrotechnic compositions. Upon submission of Qualification test plans for liquid, slurry, gel and fuel-air explosives to NAVORDSAFSECACT Code N6, the possible need and extent of an aging protocol will be established in cooperation between the Program Manager and NAVORDSAFSECACT Codes N6/N8. Deviations from the aging and test matrix in Figure 2 or assessments in lieu of testing must be approved by NAVORDSAFSECACT Codes N6/N8 prior to the start of the aging program. Test procedures and data evaluation shall be conducted as described in reference (c). The data, as well as safe-life and service-life predictions based on changes in the explosive properties, will be submitted with the Qualification package. Pass/fail criteria for the mechanical integrity of high explosives differ substantially from those of rocket propellants depending on projected applications (i.e., penetrator warhead, directional warhead, shaped charge, projectile fill). In predicting the expected service-life, several scenarios may have to be considered. Because of the inherent sensitivity and intended end-item application of primary high explosives and some pyrotechnic compositions, acceptance criteria for these materials are largely determined from thermal stability data. A low temperature aging study at 25°C with humidity control shall be started with the Qualification testing

with final results reported in the Final (Type) Qualification package. Interim results shall be reported in the Qualification package.

e. Data from the aging studies, safe-life and service-life predictions and Qualification packages shall also be provided to NAVORDSAFSECACT Code N8. This information will be used to generate a Navy-wide Quality Evaluation (aging and surveillance) database that will enable the exchange of technical data and "lessons learned" across program lines. This information will then be available when determining the extent of aging protocols necessary for new but similar explosives and can be used when making assessments in lieu of actual testing.

4. Generic Insensitive Munitions Tests. Insensitive munitions testing in accordance with reference (d) conducted in generic test hardware is strongly recommended for Qualification. A review of the test plan by NAVORDSAFSECACT Code N6 is required. NAVORDSAFSECACT Code N6 may waive some insensitive munitions tests on a case-by-case basis.

5. Additional Tests. Additional tests, listed in references (c), (e), and (f), provide desirable background information and may be requested by NAVORDSAFSECACT Code N6 on a case-by-case basis for use in assessing safety and suitability for service use.

6. Procedures and Additional Data Requirements for Solid Explosives Qualification

a. High Explosives

(1) Primary explosives shall be tested in accordance with reference (c).

(2) Qualification testing of booster explosives shall be conducted in accordance with reference (c), which also assigns pass/fail criteria. NAVORDSAFSECACT Code N6 may waive some of these criteria based on overall material characteristics or other ameliorating circumstances. In such case, the Qualification record for the explosive will note any special restrictions resulting from such an action. Failure to pass one or more of these criteria will generally prevent the Qualification of a booster explosive. The request for approval submission shall

contain a comparison of the results of the mandatory tests with those obtained from at least two approved booster explosives listed in reference (a).

(3) Qualification testing of main charge explosives shall be conducted as described in reference (c), which also assigns pass fail criteria. NAVORDSAFSECACT Code N6 may waive some of these criteria based on overall material characteristics or other ameliorating circumstances. In such case, the Qualification record for the explosive will note any special restrictions resulting from such an action. Failure to pass one or more of these criteria will generally prevent the Qualification of a main charge explosive. A comparison of the data from the above tests shall be made with results obtained from at least two approved main charge explosives listed in reference (a), and one booster explosive listed as permissible in reference (a).

(4) Test data submitted to NAVORDSAFSECACT Code N6 in the Qualification package must be generated on explosive samples taken from a batch made using representative production techniques.

b. Propellants (Solid Rocket, Gas Generator, and Gun)

(1) Solid propellants shall be tested in accordance with procedures listed in references (c), (e), (f), (g) and (h). The data will be compared with those generated on at least two similar solid propellants that have shown to be safe and suitable for service use.

(2) Test data submitted to NAVORDSAFSECACT Code N6 in the Qualification package must be generated on propellant samples taken from a batch made using representative production techniques.

c. Pyrotechnics

(1) Tests shall be performed according to procedures listed in references (c) and (g).

(2) Test data which will be submitted to NAVORDSAFSECACT Code N6 in the Qualification package must be generated on

pyrotechnic samples taken from a batch made using representative production techniques.

d. Explosives for Cartridges, Cartridge-Actuated Devices (CADS), Propellant-Actuated Devices (PADS), and Aircrew Escape Propulsion Systems (AEPS). Depending on the rate of energy release at application, these explosives shall be tested as described under paragraphs 6.a, 6.b, or 6.c of this enclosure.

e. Producibility. A statement shall be made on the producibility of the explosive based on availability of material, properties, mix histories, production batch size, and overall production risk assessment.

7. Qualification of Liquid, Gel, and Slurry Explosives

a. Mandatory tests for Qualification are determined on a case-by-case basis. For novel applications, new tests may be developed and employed when approved in advance by NAVORDSAFSECACT Code N6. Tests listed below and conducted according to procedures listed in references (c) and (g) are generally required to evaluate the overall safety characteristics of a liquid explosive.

- (1) Impact sensitivity.
- (2) Shock sensitivity.
- (3) Thermal stability (75°C/48 Hrs).
- (4) External fire.
- (5) Self heating ((Differential Scanning Calorimetry (DSC)) or autoignition temperature.
- (6) Detonation velocity.
- (7) Minimum pressure for vapor phase ignition.
- (8) Flash point.
- (9) Toxicity statement based on assessments of ingredients, combustion products and by-products of processing.

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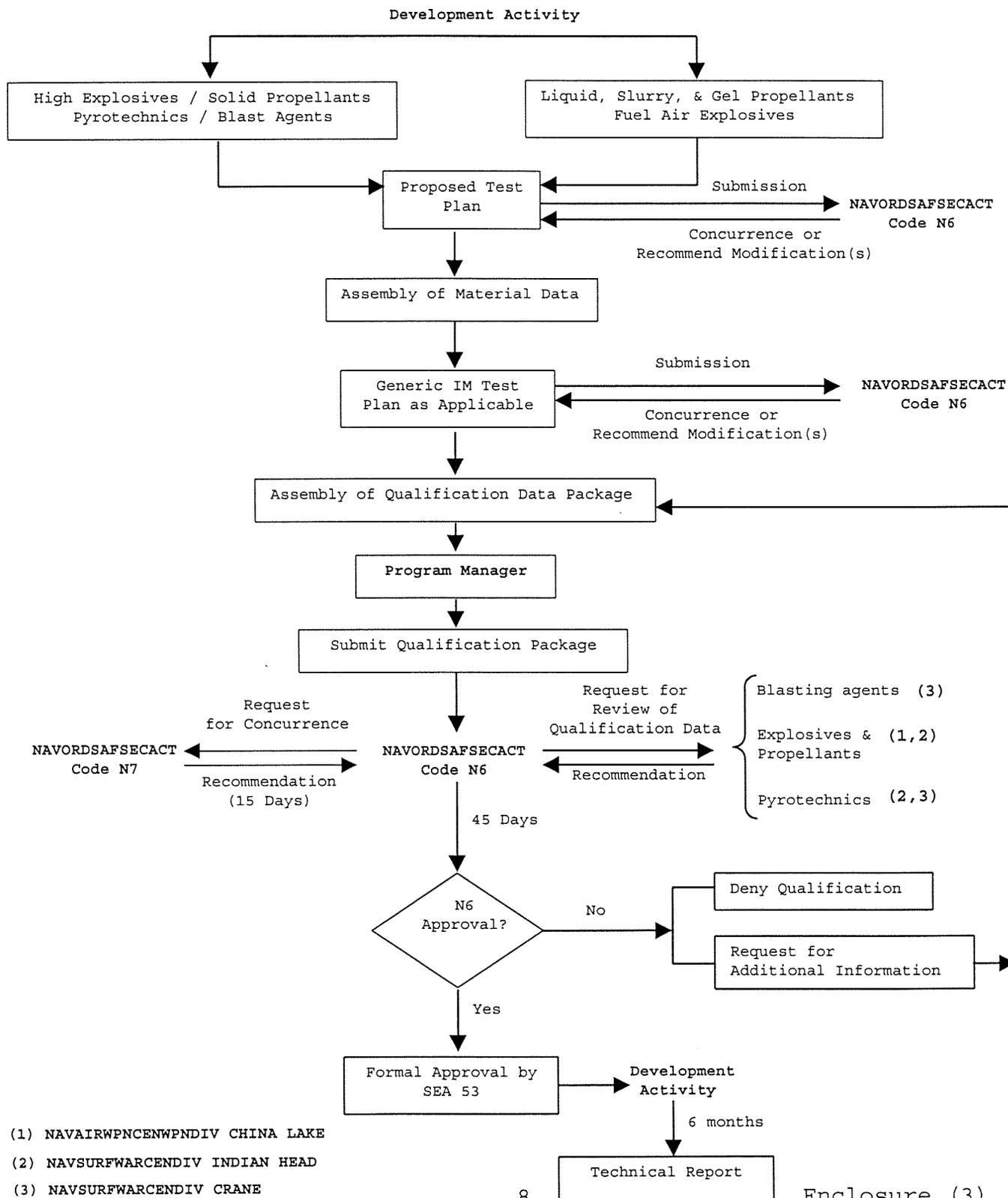
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b. Depending on the composition of the explosive, additional test data, e.g., vacuum stability, density, melting/boiling point, vapor pressure, flammability/detonability limits, friction sensitivity, electrostatic sensitivity, thin film properties, compatibility with various materials may be required.

(1) Upon submission of Qualification test plans for liquid, gel, and slurry explosives to NAVORDSAFSECACT Code N6, the possible need and extent of an aging protocol will be established in cooperation between the program manager and NAVORDSAFSECACT Code N6.

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FIGURE 1. QUALIFICATION PROCEDURES FOR NAVY EXPLOSIVES



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Appendix A: FORMAT FOR SUBMISSION OF QUALIFICATION
TEST DATA TO BE INCLUDED IN NAVSEA SW010-AG-ORD-010

1. DEVELOPMENTAL EXPLOSIVE NAME: [e.g. PBXW-11, PBXC-129]
[include specification number]
2. EXPLOSIVE NOMINAL COMPOSITION:

<u>Ingredient</u>	<u>Wt%</u>
-------------------	------------
3. POSSIBLE PURPOSE: [e.g. Special purpose flare composition]
4. ADVANTAGES: [e.g. Ease of processing, sensitivity features]
5. EXPLOSIVE PREPARATION INSTRUCTIONS:
6. QUALIFICATION TESTS: [Note: List of tests may be different from below depending on type of explosive. See Table I.]

a. Small Scale Tests

<u>TEST</u>	<u>RESULT</u>	<u>PASS CRITERIA</u>
Impact Sensitivity (50% pt.)	[Also report result of standard]	
Cap Test		
Gap Test	[Also report type of test; i.e., NOL Large-Scale Gap Test, Small-Scale Gap Test, etc.]	
Thermal Stability		
Ignition/Unconfined Burn		
Vacuum Stability		
Self Heating	[Report critical temperature for a given mass and geometry]	

Friction Sensitivity	[Also report result of standard]
Electrostatic Sensitivity	[Also report result of standard]
Detonation Velocity	[Report density]
Critical Diameter	[Report density]
Bulk-Self Heating Properties (Blasting Agents Only)	
Compatibility Data	

b. Generic Tests

<u>TEST</u>	<u>RESULT</u>
Fast Cook-Off	
Slow Cook-Off	
Bullet Impact	
Fragment Impact	

7. AGING CHARACTERISTICS:

<u>a. Rocket Propellant, Gas Generators, Booster/Main-Charge High Explosives</u>	<u>Acceptance Criteria</u>
(1) Ignition temperature (DTA: 2 gms, 1°C/min, baseline/after completion of accelerated aging)	No substantial changes. Technical assessment required.
(2) Impact (baseline/after completion of accelerated aging)	No substantial changes. Technical assessment required.
(3) Friction (baseline/after completion of accelerated aging)	No substantial changes. Technical assessment required.

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- | | |
|---|--|
| (4) Shock sensitivity
(baseline/as specified in Figure 2) | No substantial changes.
Technical assessment
required. |
| (5) Cube-cracking test
(X-ray results) | No fissures after 30
days at 60°C. Technical
assessment required. |
| (6) Stabilizer/Antioxidant
level (% change at elevated
temperatures) | No substantial changes.
Technical assessment
required. |
| (7) Safe (Shelf) Life
prediction at 25°C (based on
extrapolated high temperature
depletion rates) | 20 years with at least
20% stabilizer
remaining. Technical
assessment required. |
| (8) Mechanical Properties
(% change at elevated temperatures) | Changes >20% may require
further tests. Technical
assessment required. |
| (9) Safe Use (Service) life
predicted at 25°C (based on
extrapolated mechanical properties,
cube-cracking results, shock values,
mechanical properties) | ≤ 20% change in mech.
properties postcure (30
days) or when inter-
secting anticipated
specification limits.
No substantial changes
in shock sensitivity.
No fissures after 30
days at 60°C. Technical
assessment required. |

b. Gun Propellants

- | | |
|--|--|
| (1) Ignition temperature
(DTA: 2 gms, 1°C/min, baseline/after
completion of accelerated aging) | <u>Acceptance Criteria</u>

No substantial changes.
Technical assessment
required. |
| (2) Impact (baseline/after | No substantial changes. |

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completion of accelerated aging)

Technical assessment
required.

(3) Friction (baseline/after
completion of accelerated aging)

No substantial changes.
Technical assessment
required.

(4) Stabilizer/Antioxidant
level (% change at elevated
temperatures)

No substantial changes.
Technical assessment
required.

(5) Safe (Shelf) Life
prediction at 25°C (based on
extrapolated high temperature
depletion rates)

20 years safe storage
at 25°C without failing
minimum criteria of
ref (i). Technical
assessment required.

(6) Mechanical Properties
(compressive strength, % change at
elevated temperatures)

Changes >20% in failure
modulus may require
additional tests.
Technical assessment
required.

c. Primary Explosives

Acceptance Criteria

(1) Impact

No substantial changes.
Technical assessment
required.

(2) Friction

No substantial changes.
Technical assessment
required.

(3) Hot Wire Initiability

No substantial changes.
Technical assessment
required.

(4) Priming Ability

No substantial changes.
Technical assessment
required.

<u>d. Pyrotechnics</u>	<u>Acceptance Criteria</u>
(1) Ignition Temperature	No substantial changes. Technical assessment required.
(2) Ignitability	No substantial changes. Technical assessment required.

8. ENVIRONMENTAL/TOXICITY ANALYSIS:

[components/formulation/combustion products]

9. OTHER TESTS: (Variable Confinement Cook-Off Test, Growth and Exudation, etc.)

10. BATCH SIZE: [provide maximum batch size produced]

11. PHYSICAL PROPERTIES:

a. Physical state (solid, liquid, gel) at ambient conditions

b. Color

c. Density

d. Hardness

e. Vapor pressure

f. Boiling point

g. Freezing point

h. Glass transition temperature

i. Coefficient of Thermal Expansion

12. ADDITIONAL DATA/COMMENTS/INFORMATION:

13. REFERENCES:

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TABLE I. MANDATORY QUALIFICATION TESTS/ASSESSMENTS

TESTS	HIGH EXPLOSIVES			PROPELLANTS	PYRO-TECHNICS	BLASTING AGENTS
	PRIMARY	BOOSTER	MAIN CHARGE	SOLID ROCKET, GAS GENERATOR & SOLID GUN		
IMPACT SENSITIVITY	X	X	X	X	X	X
CAP TEST (1)	-	X	X	X	X	X
GAP TEST	-	X	X	X	-	-
THERMAL STABILITY (2)	-	X	X	X	X	X
IGNITION AND UNCONFINED BURNING (3)	-	X	X	X	-	X
VACUUM STABILITY	X	X	X	X	X	-
SELF HEATING (DSC/DTA) (4)	X	X	X	X	X	X
FRICTION SENSITIVITY	X	X	X	X	X	X
ELECTROSTATIC SENSITIVITY	X	X	X	X	X	X
DETONATION VELOCITY	-	X	X	-	-	-
AGING CHARACTERISTICS (5)	X	X	X	X	X	-
CRITICAL DIAMETER	-	X	X	X	-	-
TOXICITY (6)	X	X	X	X	X	X
BULK SELF-HEATING PROPERTIES (7)	-	-	-	-	-	X
COMPATIBILITY DATA (8)	-	-	-	-	-	X

(1) NO. 8 CAP, 2" CUBES, CYLINDERS (2" DIAMETER, 2" LONG) MAY BE SUBSTITUTED

(2) 75°C, 2" CUBES, CYLINDERS (2" DIAMETER, 2" LONG) MAY BE SUBSTITUTED

(3) 2" CUBES, CYLINDERS (2" DIAMETER, 2" LONG) MAY BE SUBSTITUTED

(4) ROGERS, RN, THERMOCHEMICA ACTA, NO. 11 (1975) PP. 131-139

(5) SEE ENCLOSURE (3), PARAGRAPH 3.d.

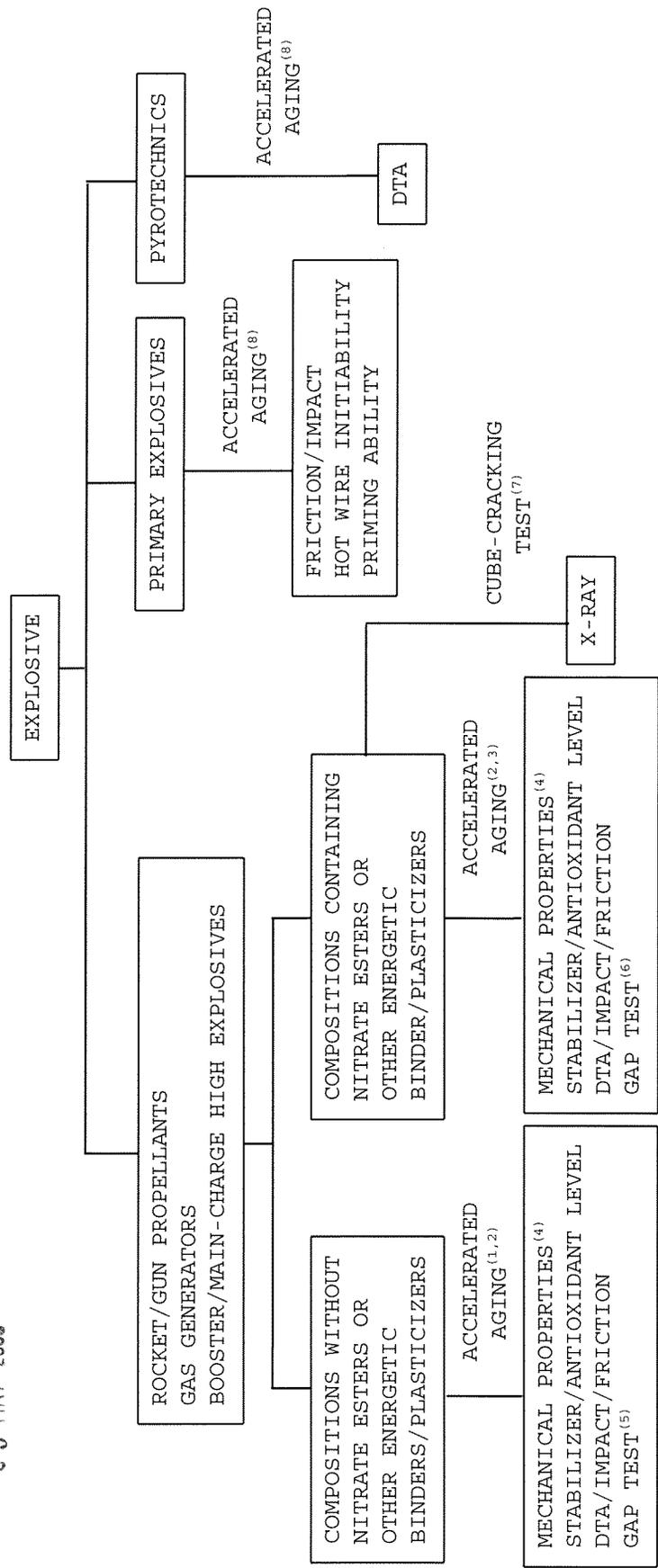
(6) ASSESSMENTS OF INGREDIENTS, COMBUSTION PRODUCTS, AND BY-PRODUCTS OF PROCESSING

(7) CONTACT NAVORDSAFSEC ACT CODE N6 IF CALCULATION INSTRUCTIONS ARE NEEDED

(8) COMPATIBILITY DATA WITH COMMON MATERIALS, E.G., METALS, ACIDS, BASES

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FIGURE 2. AGING PROTOCOL FOR SOLID EXPLOSIVES



(1) 60°C - 1, 2, 4, 6, 8 MONTHS, SEALED CONTAINERS
 70°C - 1, 2, 4, 6 MONTHS, SEALED CONTAINERS
 25°C, 30%RH - UNTIL FINAL (TYPE) QUAL

(2) COMPOSITIONS BASED ON POLYESTER BINDERS WILL BE AGED UNDER CONTROLLED HUMIDITY (30%RH)
 (3) 50°C - 1, 3, 6, 9, 12 MONTHS, SEALED CONTAINERS
 60°C - 1, 2, 4, 6, 8 MONTHS, SEALED CONTAINERS
 25°C, 30%RH - UNTIL FINAL (TYPE) QUAL

(4) HIGH RATE COMPRESSIVE STRENGTH FOR GUN PROPELLANTS. ALL OTHERS UNIAXIAL AT THREE TEMPERATURES.
 (5) 60°C - 8 MONTHS
 70°C - 6 MONTHS
 25°C, 30%RH - UNTIL FINAL (TYPE) QUAL
 GUN PROPELLANTS EXCLUDED

(6) 50°C - 12 MONTHS
 60°C - 8 MONTHS
 25°C, 30%RH - UNTIL FINAL (TYPE) QUAL
 GUN PROPELLANTS EXCLUDED

(7) 60°C
 3" CUBE FOR BOOSTER COMPOSITION
 6" CUBE FOR OTHERS
 GUN PROPELLANTS EXCLUDED

(8) 70°C - 6, 12 MONTHS, SEALED CONTAINERS
 25°C, 30%RH - UNTIL FINAL (TYPE) QUAL

NOTE: UNLESS OTHERWISE STATED, NO HUMIDITY CONTROL

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FINAL (TYPE) QUALIFICATION PROCEDURES FOR EXPLOSIVES

- Ref: (a) NAVSEAINST 8010.5
(b) NAVSEAINST 8020.6
(c) MIL-STD-882
(d) MIL-STD-2105
(e) MIL-STD-286
(f) NATO STANAG 4170
(g) MIL-D-21625 (AS)
(h) MIL-D-21615 (AS)
(i) MIL-STD-1751

1. General

a. The process for Final (Type) Qualification of an explosive is illustrated in Figure 1 and described within this document.

b. Data required for Final (Type) Qualification of an explosive shall be submitted to NAVORDSAFSECACT Code N6 by the Office of Primary Responsibility and shall contain sufficient supporting data to show that the explosive is judged, by the submitting activity, to be safe and suitable in the intended application and a statement regarding compliance with reference (a). The supporting document may include minutes or reports from the NAVSURFWARCENDIV DAHLGREN Insensitive Munitions Review Board (IMRB) or NAVAIRWPNCENWPNDIV CHINA LAKE Ordnance Hazard Evaluation Board (OHEB). Requests for Final (Type) Qualification shall also contain an advisory statement on processing and safe handling characteristics from one of the following:

(1) Commanding Officer, NAVSURFWARCENDIV INDIAN HEAD, for high explosives, propellants and pyrotechnics.

(2) Commanding Officer, NAVAIRWPNCENWPNDIV CHINA LAKE, for high explosives and propellants.

(3) Commander, NAVSURFWARCENDIV CRANE, for pyrotechnics and blasting agents.

c. Whenever in-house processing experience is not available, technical representatives of a Navy pilot plant should witness processing operations at the vendor facility prior to providing

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an advisory statement. Contact NAVORDSAFSECACT Code N6 for a determination if Navy in-house loading validation is required.

2. Required Documentation

a. Data package presented to or to be presented to the WSESRB in accordance with reference (b) which includes:

(1) Data in the format of Appendix A.

(2) A statement of completion of a system safety program per references (b) and (c).

(3) Supporting test and analysis results per Table I plus additional test data requested by the WSESRB at reviews prior to engineering and manufacturing development (E&MD).

(4) A statement of the degree of compliance with references (a) and (d) with supporting data.

(5) Approved finalized materials documentation or description, such as materials specification, STANAG, etc.

(6) Approved finalized Navy munitions document for booster and main-fill high explosives in accordance with reference (e).

(7) Advisory statements on the processing and safe-handling of explosives.

(8) A final hazard classification.

(9) A threat hazard assessment if the mandatory tests listed in Table I are modified or deleted from the data package.

(10) Final draft of a comprehensive technical report on (1)-(9) above.

b. Recommendation for Final (Type) Qualification signed by the Commanding Officer of the submitting activity or by an authorized representative.

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c. Within six months of submission of the data package, the requesting organization will publish the technical report described in paragraphs 2.a.(10) above.

3. Mandatory Test Data

a. Compliance matrix for system specific requirements, e.g., MIL-STD-1316 for safe-arm devices.

b. Mandatory data and assessments listed in Table I apply to explosives in all-up surface, air- and underwater-launched non-nuclear ordnance, and explosive devices. As indicated in reference (d), some tests may be performed on storage configuration ordnance or on subsystems, as long as extrapolation of vulnerability characteristics to all-up ordnance can be justified.

c. Planned tests, including deviations from mandatory requirements and required additional tests, shall be approved by NAVORDSAFSECACT Code N6 prior to the start of the E&MD phase.

d. Chemical compatibility testing of the explosive being considered for Final (Type) Qualification shall be conducted between the explosive and all materials (both energetic and inert) with which it may come in contact in production and in the end-item configuration. This test program shall be submitted to NAVORDSAFSECACT Code N6 for review and approval at least 60 days prior to start of the compatibility test.

e. Assessments may be used to satisfy testing requirements in some instances with prior concurrence from NAVORDSAFSECACT Code N6. Justification for the assessment with supporting data shall be included in the Final (Type) Qualification data package. Any information requested on an assessment basis may be changed to a requirement of actual testing of the all-up round if deemed necessary by NAVORDSAFSECACT Code N6.

f. Final results from low temperature with humidity aging studies as shown in Enclosure (3), Figure 2 shall be reported when completed.

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g. Batch analysis data for the explosives/propellants used in the mandatory Final (Type) Qualification tests (Table I) shall be reported.

4. Procedures for Obtaining Mandatory Data and Additional Data Requirements

a. High Explosives

(1) Final (Type) Qualification consists of two sets of tests.

(a) Component level: to characterize the handling safety and functioning sensitivity of the component, e.g., primers, detonators, and squibs. Requirements specific to these devices, e.g., MIL-I-23659 for electric initiators, shall be met and proof of compliance submitted.

(b) System level: those in the end-item usage, e.g., in arm-fire devices, exploders, and safety-and-arming devices. Requirements specific to these devices, e.g., MIL-STD-1316 for safety-and-arming devices, shall be met and a compliance matrix submitted. In addition, testing requirements listed in Table I shall be met or assessed as applicable.

(2) Booster explosives shall be tested in ordnance in accordance with reference (d) in the same configuration as will be used in the intended application.

(3) The Final (Type) Qualification of main charge explosives shall be performed in the same configuration as will be used in the service application. Procedures for mandatory tests are specified in references (a) and (d).

(4) All units in Final (Type) Qualification must be manufactured to the requirements of the approved finalized NMD. Allowance will be made for circumstances requiring Final (Type) Qualification data for generation of the NMD.

b. Rocket/Gas Generator/Gun Propellants

(1) Final (Type) Qualification shall be performed in the same configuration as will be used in the intended application and in accordance with reference (d).

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(2) The propellant batch size that is used to fill the test hardware must represent the planned propellant batch size that is planned to be used in production. All production-level mixing and loading procedures must be followed when manufacturing test units for Final (Type) Qualification tests.

c. Pyrotechnics

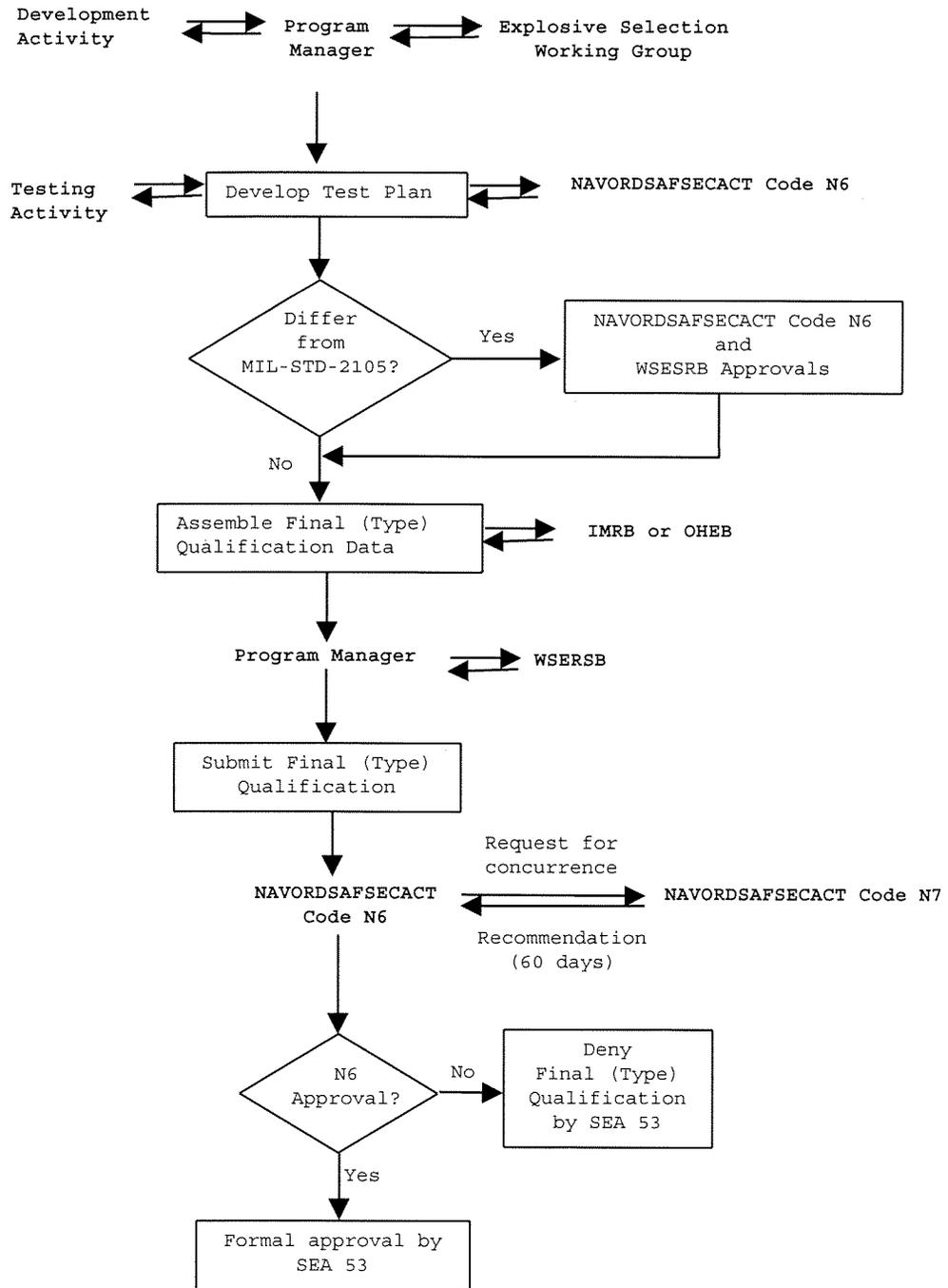
(1) Final (Type) Qualification shall be performed in the same configuration as will be used in the intended application and in accordance with reference (d).

(2) The pyrotechnics batch size that is used to fill the test hardware must represent the pyrotechnic batch size that is planned to be used in production. All production-level mixing and loading procedures must be followed when manufacturing test units for Final (Type) Qualification tests.

d. Explosives for Cartridges, CADs and PADs. Final (Type) Qualification shall be performed in the same configuration as will be used in the intended role and in accordance with procedures listed in references (d), (g), and (h).

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FIGURE 1. FINAL (TYPE) QUALIFICATION PROCEDURES FOR NAVY EXPLOSIVES



**Appendix A: FORMAT FOR SUBMISSION OF FINAL (TYPE)
 QUALIFICATION TEST DATA TO BE INCLUDED IN NAVSEA
 SW010-AG-ORD-010**

1.

Application Nomenclature*	Application Drawing/ Specification*	Qualified Explosive Name**	Qualified Explosive Specification**	Explosive Weight

* List the application nomenclature and drawing or specification for the munition, component, or subcomponent (e.g., primer, detonator, booster, lead, etc.), as applicable, that contains an explosive material.
 ** List all explosive materials that are being Final (Type) Qualified in the munition, by application. Include specification number. If not previously Qualified, provide explosive nominal composition (by ingredient and weight %).

2.

Final (Type) Qualification Test Data: (If Applicable)	Reaction
Temperature & Humidity Vibration 40-Foot Drop 5-Foot Drop Fast Cook-off Slow Cook-off Bullet Impact Jolt Jumble Fragment Impact Sympathetic Detonation Spall Impact Shaped Charge Impact	

3. CHEMICAL AND PHYSICAL COMPATIBILITY DATA:

4. AGING CHARACTERISTICS:

[Report final aging results of low temperature with humidity aging studies using the format provided for explosive Qualification in enclosure (3).]

5. REFERENCES:

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TABLE I. MANDATORY FINAL (TYPE) QUALIFICATION TESTS

TESTS	HIGH EXPLOSIVES				PROPELLANTS SOLID ROCKET, GAS GENERATOR & SOLID GUN	PYRO- TECHNICS	CARTRIDGE EXPLOSIVE	CAD, PAD EXPLOSIVE
	PRIMARY		BOOSTER	MAIN CHARGE				
	SYSTEM LEVEL (1)	COMPONENT LEVEL (2)						
TEMPERATURE & HUMIDITY (3)	X	X	X	X	X	X	X	
VIBRATION	X	-	X	X	X	X	X	
40 FOOT DROP	X	X (4)	X	X	X	X	X	
5 FOOT DROP (5)	-	X (4)	-	-	-	-	X (5)	
FAST COOK-OFF	X (6)	-	X (7)	X	X	X (7)	X (7)	
SLOW COOK-OFF (3)	-	X (8)	X (7)	X	X	X (8)	X (8)	
BULLET IMPACT (3)	-	-	X (7)	X	X	-	-	
JOLT	X	X (4)	X	-	-	X	X (9)	
JUMBLE (9)	X	-	X	-	-	X	X	
FRAGMENT IMPACT (11)	-	-	X	X	X	-	X	
SYMPATHETIC DETONATION (11)	X (10)	-	X	X	X	-	X	
SPALL IMPACT (9,11)	-	-	X	X	X	-	X	
SHAPED CHARGE JET IMPACT (9,11)	-	-	X	X	X	-	X	
CHEMICAL AND PHYSICAL COMPATIBILITY	X	X	X	X	X	X	X	
LOW TEMP/HUMIDITY AGING (12)	-	X	X	X	X	X	X	

- (1) FUZES, EXPLODERS, SAFETY AND ARMING DEVICE, ETC.
(2) DETONATOR, PRIMER, SQUIB, ETC.
(3) MAY BE PERFORMED ON SUB-SYSTEMS (REFERENCE (A))
(4) CONDUCTED IN HARDWARE SIMULATING END ITEM
(5) SIX-FOOT DROP TEST FOR CARTRIDGES AND CADS. 3-FOOT DROP TEST FOR PADS PER MIL-P-83126A
(6) ASSESSMENT OF RESPONSE IN ALL-UP-ROUND FOR PRIMARY HIGH EXPLOSIVES
(7) CONDUCTED IN INERT ALL-UP-ROUND AS REQUESTED BY NAVORDSAFSECACT CODE N6 ON A CASE-BY-CASE BASIS
(8) ISOTHERMAL TESTS LISTED IN REFERENCE (I) AND MIL-D-21625 MAY BE SUBSTITUTED
(9) ONLY IF INDICATED BY THREAT HAZARD ANALYSIS
(10) FOR SYSTEMS WHICH HAVE A STOWAGE CONFIGURATION AND THE PRIMARY IS NOT OUT-OF-LINE WITH LEADS OR BOOSTERS
(11) TEST PERFORMED IN STOWAGE/STORAGE CONFIGURATION FOR BOOSTER AND MAIN CHARGE HIGH EXPLOSIVES, PROPELLANTS AND CARTRIDGE EXPLOSIVES
(12) SEE ENCLOSURE (3), PARAGRAPH 3.d. AND ENCLOSURE (4), PARAGRAPH 3.f.

Enclosure (4)