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Guideline for USCG Approval of Domestic Pyrotechnic Signals and Line-Throwing Appliances

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This guideline has been assembled from several relevant sources, in order to present a complete document which fully describes the approval requirements for these products. The source is generally identified at the section heading.

General

Hand Red Flare Distress Signal (Approval Series 160.021)

Floating Orange Smoke Distress Signal (5 minute) (Approval Series 160.022)

Signal Pistol for Red Flare Distress Signals (Approval Series 160.028)

Hand-Held Rocket-Propelled Parachute Red Flare Signal(Approval Series 160.036)

Hand Orange Smoke Distress Signal (Approval Series 160.037)

Floating Orange Smoke Distress Signal (15 minute) (Approval Series 160.057)

Distress Signal for Boats, Red Aerial Pyrotechnic Flare (Approval Series 160.066)

70 USCG requirements for red aerial pyrotechnic flares.
77 USCG approval/production testing of red aerial pyrotechnic flares.

Line-Throwing Appliances (Approval Series 160.031 and 160.40)

80 USCG requirements for shoulder gun type line-throwing appliances.
87 USCG approval/production testing of shoulder gun type line-throwing appliances.
90 USCG requirements for impulse projected rocket line-throwing appliances.
97 USCG approval/production testing of impulse projected rocket line-throwing appliances.

General

1 Scope.

These guidelines describe the process for U.S. Coast Guard approval of pyrotechnic distress signals meeting the requirements of 46 Code of Federal Regulations Part 160 – Lifesaving Equipment. These devices are generally known as "Domestic" pyrotechnic devices because they are approved on for use on vessels that operate in U.S. waters only.

Transportation of hazardous materials in the United States is governed by the Department of Transportation's Hazardous Materials Regulations at Title 49 of the Code of Federal Regulations, Subchapter C (Parts 171 to 180). The regulations are based in part on the Recommendations of the United Nations Committee of Experts on the Transport of Dangerous Goods. Nothing in these guidelines pre-empts the manufacturer from any additional requirements or tests necessary to offer pyrotechnic devices for transportation in the United States.

2 Relationship to SOLAS approved pyrotechnics.

The International Maritime Organization (IMO) has created requirements for pyrotechnic devices on commercial ships on international voyages. These requirements are separate from the US Coast Guard's regulations and can be found in the IMO's Life-Saving Appliances Code (LSA Code). These devices are generally known as "SOLAS" pyrotechnic devices because the IMO's International Convention for the Safety of Life at Sea (SOLAS) first published these requirements for international ships. The US Coast Guard is a signatory member of the IMO and enforces the LSA Code requirements on these ships. These products (See Table 1) are similar in performance and testing to domestic products and generally are approved with both a domestic and SOLAS approval number.
The SOLAS specific testing can be found in our Guideline for USCG Approval of SOLAS Pyrotechnic Signals and Line Throwing Devices.

Table 1

Domestic Product	Similar SOLAS Product
Hand Red Flare Distress Signal (160.021)	Hand Flare – Red (160.121)
Floating Orange Smoke Distress Signal (160.022)	Buoyant Smoke Signal-3 Minute (160.122)
Hand-Held Rocket-Propelled Parachute Red Flare Signal (160.036)	Rocket Parachute Flares (160.136)
Floating Orange Smoke Distress Signal (160.057)	Self-Activating Distress Signal-15 Minute (160.157)
Line Throwing Appliance (160.040)	Line Throwing Appliance (160.040)

3 Incorporations by reference.

(a) "The Universal Color Language" and "The Color Names Dictionary" in Color: Universal Language and Dictionary of Names, National Bureau of Standards Special Publication 440, December 1976.

(b) NBS Special Publication 440 may be obtained by ordering from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402 (Order by SD Catalog No. C13.10:440).

5 Marking. *(46 CFR 160.021-5, 160.022-5, 160.028-5, 160.036-5, 160.037-5, 160.040-6, 160.057-5, and 160.066-9)*

Each [pyrotechnic device] shall be legibly marked or labeled with the following, as appropriate:

- Company name, location, and brand or style designation
- Type of pyrotechnic device
- Intensity in candela (for flares only)
- Burning time (for flares and smoke signals only)
- "Use Only When Aircraft or Vessel Is Sighted." (for flares and 3-min smoke signals only)
- "Approved for daytime use only" (for smoke signals only)
- Simple operation instructions (in paragraphs or pictographs)
- Expiration Date (month and year to be inserted by manufacturer – not more than 42 months after date of manufacture (48 months in the case of line-throwing appliance components containing pyrotechnic material))
- Date of Manufacture (Month and year to be inserted by manufacturer)
- Lot No. ----
- Serial Number (for signal pistol and line throwing appliance only)
- U.S. Coast Guard Approval No. ----.

The expiration date, date of manufacture, and lot number must also be marked on or clearly visible through the package in which the device is sold.

Note: Compliance with the labeling requirements of this section does not relieve the manufacturer of the responsibility of complying with the label requirements of 15 U.S.C. 1263, the Federal Hazardous Substances Act.

7 Approval process.

Pyrotechnics are approved by the U.S. Coast Guard under the process described in Title 46 of the Code of Federal Regulations, Subpart 159.005. All approval and production testing must be completed by an independent laboratory accepted by the USCG under Subpart 159.010. Production testing of approved pyrotechnics is required under Subpart 159.007. A list of accepted laboratories for each product can be found at our website: http://cgmix.uscg.mil/Default.aspx

Hand Red Flare Distress Signal *(46 CFR 160.021)*

10 USCG requirements for hand red flares.

General Description: - Hand red flare distress signals shall consist essentially of a wooden handle to which is attached a tubular casing having a sealing plug at the handle end, the casing being filled with a flare composition and having a button of ignition material at the top, with a removable cap having a friction striking material on its top which may be exposed for use by pulling a tear strip. Alternative arrangements which conform to all performance requirements will be given special consideration.

Specific material, workmanship, and construction requirements can be found in 46 CFR 160.021-3.

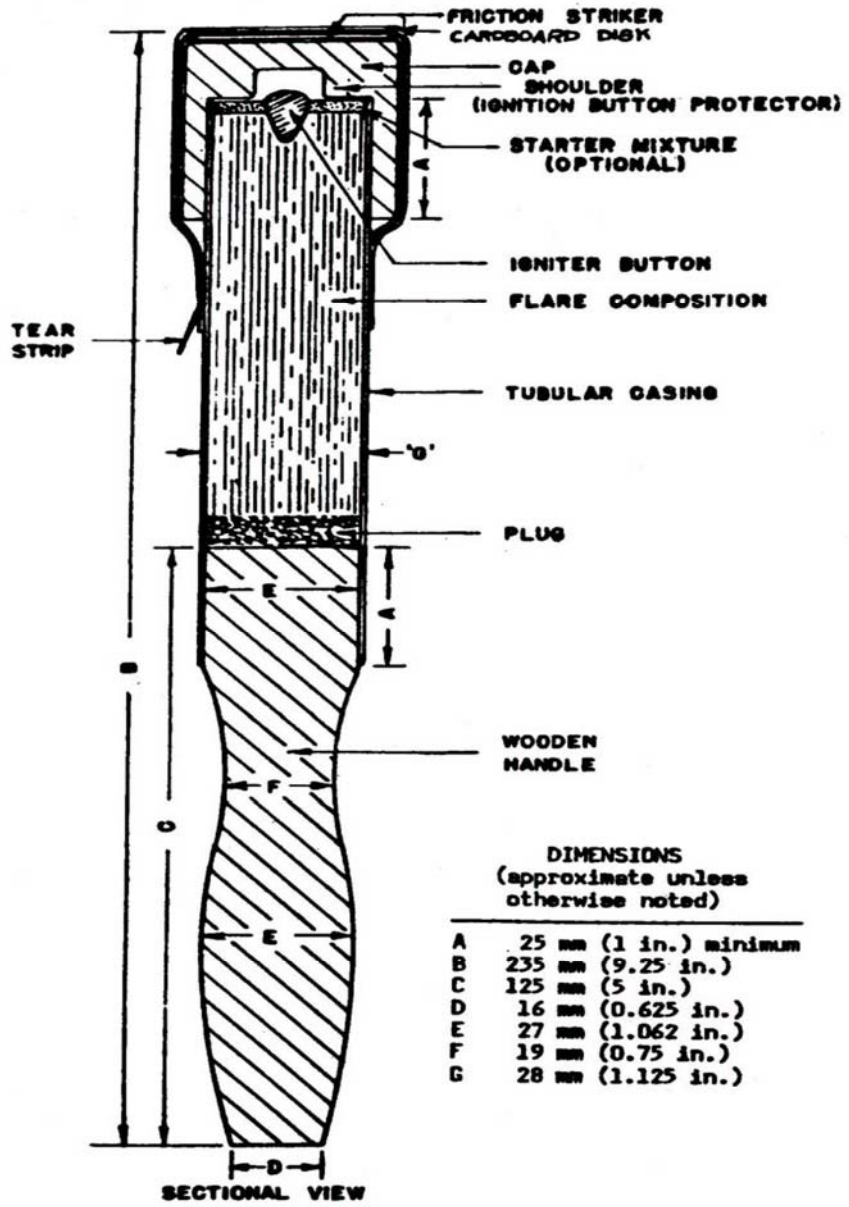

Figure 160.021-2(a). Hand Red Flare Distress Signal - General Arrangement.

17 USCG approval/production testing of hand red flares.

The approval testing shall be conducted by an accepted independent laboratory and shall consist of all the testing in 46 CFR 160.021-4(c) Operational Tests and (d) Technical Tests.

The production testing must also be completed by an accepted independent laboratory and shall consist of all the testing in 46 CFR 160.021-4(c).

The following is an excerpt from 46 CFR 160.021-4 which provides the process for selecting samples for production testing and gives the requirements for the number of signals that must pass all the testing in order to accept that lot of signals. This information is for Hand Red Flares but is very similar to the production testing requirements for each of the other products. When a table differs for the other products covered in this guideline it is provided in that products specific section.

46 CFR 160.021-4 Approval and production testing (excerpt)

(b) Production inspections and tests. Production inspections and tests of each lot (batch) of signals produced must be conducted under the procedures in 46 CFR 159.007. Signals from a rejected lot must not be represented as meeting Coast Guard requirements or as being approved by the Coast Guard. If the manufacturer identifies the cause of the rejection of a lot of signals, the signals in the lot may be reworked by the manufacturer to correct the problem. Samples from the rejected lot must be retested in order to be accepted. Records shall be kept of the reasons for rejection, the reworking performed on the rejected lot, and the results of the second test.

(1) Lot size. For the purposes of sampling the production of signals, a lot must consist of not more than 30,000 signals. Lots must be numbered serially by the manufacturer. A new lot must be started with:

(i) Any change in construction details,

(ii) Any changes in sources of raw materials, or

(iii) The start of production on a new production line or a previously discontinued production line. *(Weekend, holiday, and overnight production stoppages are not considered as discontinued production.)*

(2) Inspections and tests by the manufacturer. The manufacturer's quality control procedures must include inspection of materials entering into construction of the signals and inspection of the finished signals, to determine that signals are being produced in accordance with the approved plans. Samples from each lot must be tested in accordance with the operational tests in paragraph (c) of this section.

(3) Inspections and test by an independent laboratory. An independent laboratory accepted by the Commandant under 46 CFR 159.010 must perform or supervise the inspections and tests under paragraph (b)(2) of this section at least four times a year. In addition, the laboratory must perform or supervise the technical tests in paragraph (d) of this section at least once for every ten lots of signals produced. If a lot of signals tested by the independent laboratory is rejected, the laboratory must perform or supervise the inspections and tests of the reworked lot and the next lot of signals produced. The tests of each reworked lot and the next lot produced must not be counted for the purpose of meeting the requirement for the annual number of inspections and tests performed or supervised by the independent laboratory.

(c) Operational tests. Each lot of signals must be sampled and tested as follows:

(1) Sampling procedure and accept/reject criteria. A sample of signals must be selected at random from the lot. The size of the sample must be the individual sample size in Table 17(1) corresponding to the lot size. Each signal in the sample is tested as prescribed in the test procedure in paragraph (c)(2) of this section. Each signal that has a defect listed in the table of defects (Table

17(2)) is assigned a score (failure percent) in accordance with that table. In the case of multiple defects, only the score having the highest numerical value is assigned to that signal. If the sum of all the failure percents (cumulative failure percent) for the number of units in the sample is less than or equal to the accept criterion, the lot is accepted. If this sum is equal to or more than the reject criterion the lot is rejected. If the cumulative failure percent falls between the accept and reject criteria, another sample is selected from the production lot and the operational tests are repeated. The cumulative failure percent of each sample tested is added to that of the previous samples to obtain the cumulative failure percent for all the signals tested (cumulative sample size). Additional samples are tested and the tests repeated until either the accept or reject criterion for the cumulative sample size is met. If any signal in the sample explodes when fired or ignites in a way that could burn or otherwise injure the person firing it, the lot is rejected without further testing.

Figure 17 – Operational test procedure

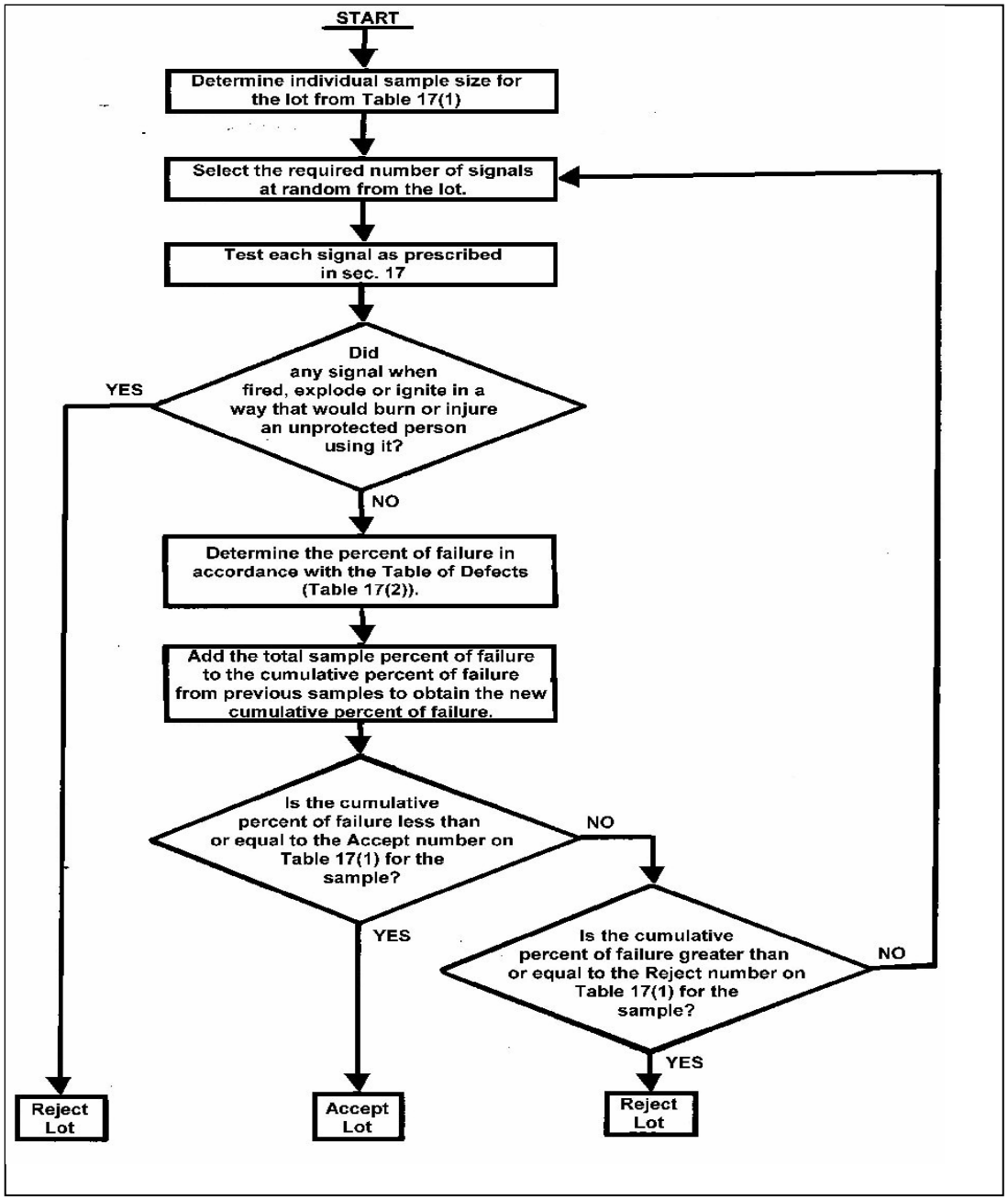

Table 17(1)--Accept and Reject Criteria for Operational Test Lots

Lot Size	Individual sample size	Sample	Cumulative sample size	Accept [1]	Reject [1]
280 or less	8	First	8	--[2]	400
		Second	16	100	500
		Third	24	200	600
		Fourth	32	300	700
		Fifth	40	500	800
		Sixth	48	700	900
		Seventh	56	950	951
281 to 500	13	First	13	0	400
		Second	26	100	600
		Third	39	300	800
		Fourth	52	500	1,000
		Fifth	65	700	1,100
		Sixth	78	1,000	1,200
		Seventh	91	1,350	1,351
501 to 1200	20	First	20	0	500
		Second	40	300	800
		Third	60	600	1,000
		Fourth	80	800	1,300
		Fifth	100	1,100	1,500
		Sixth	120	1,400	1,700
		Seventh	140	1,850	1,851
1,201 to 3,200	32	First	32	100	700
		Second	64	400	1,000
		Third	96	800	1,300
		Fourth	128	1,200	1,700
		Fifth	160	1,700	2,000
		Sixth	192	2,100	2,300
		Seventh	224	2,550	2,551
More than 3,200	50	First	50	200	900
		Second	100	700	1,400
		Third	150	1,300	1,900
		Fourth	200	1,900	2,500
		Fifth	250	2,500	2,900
		Sixth	300	3,100	3,300
		Seventh	350	3,750	3,751

[1] Cumulative failure percent
[2] Lot may not be accepted. Next sample must be tested.

Table 17(2) – Table of defects

Kind of defect	Percentage of failure
a Failure to ignite	100
b Ignites or burns dangerously	50
c Nonuniform burning intensity	50
d Chimneys so as to materially obscure the flame	25
e Fire flashes down between casing and handle so as to endanger burning the hand	50
f Burning time less than 70 pct of specified time	100
g Burning time at least 70 pct but less than 80 pct of specified time	75
h Burning time at least 80 pct but less than 90 pct of specified time	50
i Burning time at least 90 pct but less than 100 pct of specified time	25

Floating Orange Smoke Distress Signal (5 minute)

20 USCG requirements for floating orange smoke signals. *(46 CFR 160.022)*

General Description: - Floating orange smoke distress signals specified by this subpart shall be of one type which shall consist essentially of an outer container, ballast, an air chamber, an inner container, the smoke producing composition and an igniter mechanism. Alternative arrangements which conform to all performance requirements will be given special consideration.

Specific material, workmanship, and construction requirements can be found in 46 CFR 160.022-3.

27 USCG approval/production testing of floating orange smoke signals. *(46 CFR 160.022-4)*

The approval testing shall be conducted by an accepted independent laboratory and shall consist of all the testing in 46 CFR 160.022-4(c) Operational Tests and (d) Technical Tests.

The production testing must also be completed by an accepted independent laboratory and shall consist of all the testing in 46 CFR 160.022-4(c) and (d) Technical Tests at specified intervals. An example of the requirements for production inspection procedures can be found in section 17 of this guideline. Table 27 below lists the defects specific to floating orange smoke signals and replaces Table 17(2) for this products testing.

Table 27 – Table of defects

Kind of defect	Percentage of failure
a. Failure to ignite.	100
b. Ignites or burns dangerously	50
c. Nonuniform smoke emitting rate	50
d. Smoke-emitting time less than 70 pct of specified time	100
e. Smoke-emitting time at least 70 pct but less than 80 pct of specified time	75
f. Smoke-emitting time at least 80 pct but less than 90 pct of specified time	50
g. Smoke-emitting time at least 90 pct but less than 100 pct of specified time	25

Signal Pistol for Red Flare Distress Signals

30 USCG requirements for signal pistols. *(46 CFR 160.028)*

General Description – A signal pistol for launching an aerial flare may have any chamber and bore dimensions if they are not the same dimensions for a conventional round of ammunition. Aerial flares for these signal pistols are approved under 160.066. The parachute distress signals described in 160.028-2(a) are now obsolete.

Specific material, workmanship, and construction requirements can be found in 46 CFR 160.028-3.

37 USCG approval/production testing of signal pistols. *(46 CFR 160.028-4)*

The approval testing shall be conducted by an accepted independent laboratory and shall consist of submitting three signal pistols to all the testing in 46 CFR 160.028-4(c) Operational Tests.

The production testing must also be completed by an accepted independent laboratory and shall consist of all the testing in 46 CFR 160.028-4(c). The accepted independent laboratory must inspect and test three signal pistols at least once a year.

Hand-Held Rocket-Propelled Parachute Red Flare Signal

40 USCG requirements for hand-held parachute flares. *(46 CFR 160.036)*

General Description: - Handheld rocket-propelled parachute red flare signals shall consist essentially of a completely self-contained device which can be fired from the hand to provide a rocket-propelled parachute red flare.

Specific material, workmanship, and construction requirements can be found in 46 CFR 160.036-3.

47 USCG approval/production testing of hand-held parachute flares. *(46 CFR 160.036-4)*

The approval testing shall be conducted by an accepted independent laboratory and shall consist of all the testing in 46 CFR 160.036-4(c) Operational Tests and (d) Technical Tests.

The production testing must also be completed by an accepted independent laboratory and shall consist of all the testing in 46 CFR 160.036-4(c) and (d) Technical Tests at specified intervals. An example of the requirements for production inspection procedures can be found in section 17 of this guideline. Table 47 below lists the defects specific to floating orange smoke signals and replaces Table 17(2) for this products testing.

Table 47 – Table of defects

Kind of defect	Percentage of failure
a. Failure to fire	100
b. Failure to eject projectile contents	100
c. Failure to ignite pyrotechnic candle	100
d. Failure of parachute to open completely	75
e. Complete carrying away or destruction of parachute	75
f. Altitude less than 70 % of that required	100
g. Altitude less than 70 % but less than 80 % of that required	75
h. Altitude at least 80 % but less than 90 % of that required	50
i. Altitude at least 90 % but less than 100 % of that required	25
j. Average rate of descent greater than four times maximum permitted	100
k. Average rate of descent less than 4 but greater than 3 times maximum permitted	75
l. Average rate of descent less than 3 but greater than 2 times maximum permitted	50
m. Average rate of descent less than twice but greater than maximum permitted	25
n. Burning time less than 70 % of that required	100
o. Burning time at least 70 % but less than 80 % of that required	75
p. Burning time at least 80 % but less than 90 % of that required	50
q. Burning time at least 90 % but less than 100 % of that required	25

Hand Orange Smoke Distress Signal

50 USCG requirements for hand orange smoke signals. *(46 CFR 160.037)*

General Description: - Hand orange smoke distress signals shall consist essentially of a wooden handle to which is attached a tubular casing having a sealing plug at the handle end, the casing being filled with a smoke producing composition and fuse with a button of ignition material at the top, and a removable cap having a friction striking material on its top which may be exposed for use by pulling a tear strip. Alternative arrangements which conform to all performance requirements will be given special consideration.

Specific material, workmanship, and construction requirements can be found in 46 CFR 160.037-3.

57 USCG approval/production testing of hand orange smoke signals. *(46 CFR 160.037-4)*.

The approval testing shall be conducted by an accepted independent laboratory and shall consist of all the testing in 46 CFR 160.037-4(c) Operational Tests and (d) Technical Tests.

The production testing must also be completed by an accepted independent laboratory and shall consist of all the testing in 46 CFR 160.037-4(c) and (d) Technical Tests at specified intervals. An example of the requirements for production inspection procedures can be found in section 17 of this guideline. Table 57 below lists the defects specific to floating orange smoke signals and replaces Table 17(2) for this products testing.

Table 57 – Table of defects

Kind of defect	Percentage of failure
a. Failure to ignite.	100
b. Ignites or burns dangerously	50
c. Nonuniform smoke emitting rate	50
d. Smoke-emitting time less than 70 pct of specified time	100
e. Smoke-emitting time at least 70 pct but less than 80 pct of specified time	75
f. Smoke-emitting time at least 80 pct but less than 90 pct of specified time	50
g. Smoke-emitting time at least 90 pct but less than 100 pct of specified time	25

Floating Orange Smoke Distress Signal (15 minute)

60 USCG requirements for floating orange smoke signals. *(46 CFR 160.057)*

General Description: - Floating orange smoke distress signals specified by this subpart shall consist essentially of an outer container, ballast, an air chamber, an inner container, the smoke producing composition and an igniter mechanism. Alternative arrangements which conform to all performance requirements will be given special consideration.

Specific material, workmanship, and construction requirements can be found in 46 CFR 160.022-3.

67 USCG approval/production testing of floating orange smoke signals. *(46 CFR 160.057-4)*

The approval testing shall be conducted by an accepted independent laboratory and shall consist of all the testing in 46 CFR 160.057-4(c) Operational Tests and (d) Technical Tests.

The production testing must also be completed by an accepted independent laboratory and shall consist of all the testing in 46 CFR 160.057-4(c) and (d) Technical Tests at specified intervals. An example of the requirements for production inspection procedures can be found in section 17 of this guideline. Table 67(1) lists the Accept and Reject Criteria for Operational Test Lots and replaces Table 17(1) due to the difference in lot sizes for hand flares. Table 67(2) below lists the defects specific to floating orange smoke signals and replaces Table 17(2) for this products testing.

Table 67(1)--Accept and Reject Criteria for Operational Test Lots

Lot Size	Individual sample size	Sample	Cumulative sample size	Accept [1]	Reject [1]
150 or less	2	First	2	--[2]	200
		Second	4	--[2]	200
		Third	6	0	200
		Fourth	8	0	300
		Fifth	10	100	300
		Sixth	12	100	300
		Seventh	14	299	300
151 to 500	3	First	3	--[2]	200
		Second	6	0	300
		Third	9	0	300
		Fourth	12	100	400
		Fifth	15	200	400
		Sixth	18	300	500
		Seventh	21	499	500
More than 501	5	First	5	--[2]	300
		Second	10	0	300
		Third	15	100	400
		Fourth	20	200	500
		Fifth	25	300	600
		Sixth	30	400	600
		Seventh	35	699	700

[1] Cumulative failure percent

[2] Lot may not be accepted. Next sample must be tested.

Table 67(2) – Table of defects

Kind of defect	Percentage of failure
a. Failure to ignite.	100
b. Ignites or burns dangerously	50
c. Nonuniform smoke emitting rate	50
d. Smoke-emitting time less than 70 pct of specified time	100
e. Smoke-emitting time at least 70 pct but less than 80 pct of specified time	75
f. Smoke-emitting time at least 80 pct but less than 90 pct of specified time	50
g. Smoke-emitting time at least 90 pct but less than 100 pct of specified time	25

Distress Signal for Boats, Red Aerial Pyrotechnic Flare

70 USCG requirements for red aerial pyrotechnic flares. *(46 CFR 160.066)*

General Description: - Red aerial pyrotechnic distress signals must be either self contained or pistol launched, and either meteor or parachute assisted type.

Specific material, workmanship, and construction requirements can be found in 46 CFR 160.066-5. Performance requirements can be found in 160.066-7.

77 USCG approval/production testing of red aerial pyrotechnic flares. *(46 CFR 160.066-11 thru 160.066-15)*

The approval testing shall be conducted by an accepted independent laboratory and shall consist of all the testing in 46 CFR 160.066-12 Operational Tests and 160.066-13 Technical Tests.

The production testing described in 46 CFR 160.066-15 must also be completed by an accepted independent laboratory and shall consist of all the testing in 46 CFR 160.066-12 Operational Tests and 160.066-13 Technical Tests at specified intervals. An example of the requirements for production inspection procedures can be found in section 17 of this guideline. Table 17(2) would not be used during this products production testing as it does not have a table listing specific defects.

Line Throwing Appliances

80 USCG requirements for shoulder gun type line throwing appliances. *(46 CFR 160.031)*

General Description: - The shoulder gun type lie throwing appliance shall be breech-loading for the cartridge and muzzle loading for the projectile, of not more than 13 mm caliber, chambered for blank rifle cartridges, smooth bored and properly stocked, with shot line canister attached in a position below the barrel.

Specific material, workmanship, construction, and performance requirements can be found in 46 CFR 160.031-3. Specific equipment requirements are describer in 46 CFR 160.031-4.

87 USCG approval/production testing of shoulder gun type line throwing appliances. *(46 CFR 160.031-5)*

The approval testing shall be conducted by an accepted independent laboratory and shall consist of all the testing in 46 CFR 160.031-5(c) Operational Tests.

The production testing must also be completed by an accepted independent laboratory and shall consist of all the testing in 46 CFR 160.031-5(c) Operational Tests at least once per year. Appliance acceptance criteria are described in 46 CFR 160.040-5(c) Operaional Tests

90 USCG requirements for impulse projected rocket line throwing appliances. *(46 CFR 160.040)*

General Description: - Impulse-projected rocket type line-throwing appliances shall consist essentially of a pistol or launcher, which can be hand held and hand directed, or suitably supported and hand directed. The appliance, one rocket, bridle, and leader shall weigh not more than 16 lbs and shall be of a size easily manageable by one person. Alternative arrangements which meet the performance requirements will be given special consideration.

Specific material, workmanship, construction, and performance requirements can be found in 46 CFR 160.040-4.

97 USCG approval/production testing of impulse projected line throwing appliances. *(46 CFR 160.040-5)*

The approval testing shall be conducted by an accepted independent laboratory and shall consist of all the testing in 46 CFR 160.040-5(c) Performance Tests for both the appliance and the rockets.

The production testing must also be completed by an accepted independent laboratory and shall consist of all the testing in 46 CFR 160.040-5(c) Performance Tests at least once per year. Appliance or rocket lot acceptance criteria are described in 46 CFR 160.040-5(c) Performance Tests