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TP 7319 E

# **STANDARD FOR PYROTECHNIC DISTRESS SIGNALS AND SIMILAR DEVICES**

**MARINE SAFETY DIRECTORATE  
TRANSPORT CANADA  
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**Canada**



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## 1. SCOPE

- 1.1 This Standard applies to pyrotechnic signals intended to be used by mariners for the purpose of indicating distress and the need of assistance. Devices conforming to this Standard are in accord with the provisions of the Canada Shipping Act and of the 1974 International Convention for the Safety of Life at Sea (SOLAS 1974) as amended (1983). They are intended to be used where pyrotechnic distress signals are required as part of a vessel's mandatory equipment.

## 2. CLASSIFICATION

- 2.1 This standard applies to pyrotechnic distress signals of the following types:

Type A	--	Rocket Parachute Flares
Type B	--	Single or Twin Star Flares
Type C	--	Hand-held Flares
Type D	--	Buoyant Smoke Signals

## 3. GENERAL REQUIREMENTS

### 3.1 Water Resistance

- 3.1.1 Every type A, C and D signal shall be contained in a water-resistant casing.

- 3.1.2 Every type B signal, including the firing device and cartridges, if any, shall be waterproofed and packed in a waterproof container.

### 3.2 Means of Ignition

- 3.2.1 Every type A and C signal shall have an integral means of ignition.

### 3.3 Operation

- 3.3.1 Every signal shall be so designed as not to cause discomfort or injury to the person holding the device when used in accordance with the manufacturer's operating instructions.

3.3.2 Every type C signal shall be so designed as to not endanger any craft by burning or glowing residues when used in accordance with the manufacturer's operating instructions.

3.3.3 No type D signal shall ignite explosively when used in accordance with the manufacturer's operating instructions.

#### 4. **DETAIL REQUIREMENTS**

##### 4.1 **Performance**

##### 4.1.1 **TYPE A**

4.1.1.1 A type A distress signal shall consist of a rocket parachute flare capable of reaching an altitude of not less than 300 metres when fired vertically.

4.1.1.2 At or near the top of its trajectory, the rocket shall eject a parachute flare which shall,

- (a) burn with a bright red colour;
- (b) burn uniformly with an average luminous intensity of not less than 30,000 candela for a period of not less than 40 seconds;
- (c) have a rate of descent of not more than 5 metres per second;
- (d) not damage its parachute or attachments while burning; and
- (e) burn out at an altitude of not less than 45 metres from the sea level.

4.1.1.3 A type A distress signal shall be capable of functioning at an angle of 45° to the horizontal.

4.1.1.4 A type A distress signal shall be contained in a waterproof casing and shall not depend on any adhesive tapes or plastic envelopes for its water-resistant properties.

##### 4.1.2 **TYPE B**

4.1.2.1 A Type B distress signal shall be capable of producing, in rapid succession, and at intervals not greater than 15 seconds, two or more red stars.

- 4.1.2.2 Each red star shall burn with a bright red colour, and
- (a) be capable of being projected to an altitude of not less than 90 metres, burn with a luminosity of not less than 5 000 candela for a period not not less than 4 seconds, and burn out before touching the sea; or
  - (b) be capable of being projected to an altitude of not less than 60 metres burn with a luminosity of not less than 10 000 candela for a period of not less than 5.5 seconds, and burn out before touching the sea.
- 4.1.2.3 A Type B distress signal shall,
- (a) contain a firing device capable of throwing the stars automatically; or
  - (b) be provided with a cartridge-firing device that requires loading for each signal.
- 4.1.2.4 Where a type B distress signal contains a cartridge firing device, the vessel shall carry a sufficient number of cartridges to produce the number of signals required by the Regulations.
- 4.1.2.5 A type B distress signal, including the firing device and the cartridges, if any, shall be waterproofed and packed in a waterproof container.
- 4.1.3 **TYPE C**
- 4.1.3.1 A type C distress signal shall consist of a hand-held flare which shall,
- (a) burn with a bright red colour;
  - (b) burn uniformly with an average luminous intensity of not less than 15,000 candela for a period of not less than 1 minute; and
  - (c) continue to burn after having been immersed under 100 mm of water for a period of not less than 10 seconds.
- 4.1.3.2 A type C distress signal shall be contained in a waterproof casing and shall not depend on any adhesive tapes or plastic envelopes for its water-resistant properties.

4.1.3.3 A type C distress signal shall be sheathed to prevent any dripping of burning material when used in accordance with the manufacturer's operating instructions.

4.1.4 **TYPE D**

4.1.4.1 A type D distress signal shall consist of a buoyant smoke float which shall,

- (a) emit a dense volume of orange-coloured smoke for a period of not less than 3 minutes when floating in calm water;
- (b) not emit any flame during the entire emission time referred to in (a);
- (c) not be swamped by moderate seas; and
- (d) continue to emit smoke when submerged for a period of not less than 10 seconds under 100 mm of water.

4.1.4.2 A type D distress signal shall be contained in a waterproof casing and shall not depend on any adhesive tapes or plastic envelopes for its water-resistant properties.

**5. TESTING PROCEDURES**

5.1 Samples submitted for testing shall be representative of the devices as regularly manufactured and marketed.

The number of samples to be submitted for testing and inspection is indicated in Table 1.

5.2 **Temperature Cycling Tests**

5.2.1 Samples of Types A, C and D signals shall be subjected to the following temperature cycle:

- (a) 8 hours at 65°C followed by
- (b) 16 hours at 20°C plus or minus 2°C followed by
- (c) 8 hours at -30°C followed by
- (d) 16 hours at 20°C plus or minus 2°C.

Following ten such consecutive cycles, the samples of types A and C shall function effectively at 20°C plus or minus 2°C. The samples of type D signals shall function effectively under the conditions described in para. 5.9.1.

5.2.2 Samples of types A, C and D signals shall function effectively at -30°C following at least 48 hours in a cold chamber at that temperature.

5.2.3 Samples of types A, C and D signals shall function effectively at plus 65°C following at least 48 hours in a circulating air oven at that temperature.

5.2.4 Specimens of types A, C and D signals shall function efficiently at 20°C plus or minus 2° following:

- (a) at least 96 hours at plus 65°C and 90% relative humidity followed by
- (b) 240 hours at 23°C plus or minus 2° and 65% relative humidity.

- Note:
- 1. An insulated container is acceptable for a short transportation of the samples for testing in accordance with paras. 5.2.2 and 5.2.3 from the refrigerating or heating chamber to the test location, provided that all steps possible are taken to minimize any change of temperature.
  - 2. The refrigerating and heating chambers shall be provided with thermostatic control devices to maintain even temperatures.
  - 3. The samples shall not ignite spontaneously or decompose during the conditioning or the tests.

### 5.3 **Water and Corrosion Resistance Tests**

5.3.1 Samples of types A, C and D signals shall function effectively after being:

- .1 immersed horizontally for 24 hours under 1 metre of water;
- .2 immersed in the ready to fire condition for 5 minutes under 100 mm of water; and
- .3 subjected to a salt-spray test (20% Natrium Chloride solution) at a temperature of plus 35°C plus or minus 3°C for at least 100 hours. \* See note re test.

Note: The salt spray test shall be conducted in accordance with the requirements of ISO Standard 3768-1976 or ASTM B-117.

5.3.2 Samples of type B signals, including the firing device and cartridges if any, shall function effectively after being immersed for one minute under 1 metre of water.

#### 5.4 **Handling Safety Test**

5.4.1 Samples of types A, C and D signals shall:

- .1 be dropped in turn end on and horizontally from a height of 2 metres onto a steel plate having a thickness of not less than 6 mm; and
- .2 function effectively when activated in accordance with the manufacturer's operating instructions to establish that they can be operated without injury to the operator, or any person in close proximity, during firing or burning.

5.4.2 Samples of type B signals shall meet the requirement of para. 5.4.1.2.

#### 5.5 **Visual Safety Inspection**

5.5.1 It shall be established by visual inspection that each type of signal (as indicated):

- .1 is permanently marked with clear and precise instructions, in English and French, or by means of a diagram, indicating the correct method of operation. The operating end shall be identifiable by day or night. (Types A, B, C, and D)
- .2 is capable of being operated from the bottom (safe end) or contain an operational safety delay of 2 seconds (Types A, C, and D).
- .3 has an integral means of ignition (Types A and C).
- .4 has a simple means of ignition which requires the minimum of preparation and can be readily operated in adverse conditions without external aid and with wet, cold, or gloved hands (Types A, B, C, and D).

Note: This test should be carried out in conjunction with the tests required in sections 5.2 and 5.3 and, in the case of Types A, C and D, shall be carried out with the gloves of an approved immersion suit.

.5 does not depend on adhesive tapes or plastic envelopes for its water resistance (Types A, C and D); and

.6 is marked clearly and permanently with its lot number and date of manufacture (Types A, B, C, and D) .

Note: The inspections for marking and waterproofing shall be conducted before and after the conditioning requirements of sections 5.2 and 5.3 for temperature, and water-resistance and corrosion respectively.

## 5.6 **Rocket Parachute Flares Tests (Type A)**

5.6.1 Altitude and Burning Period - Samples of the device shall be fired vertically, and, by means of accurate measuring instruments, the following shall be determined:

.1 the altitude at which the parachute flare is ejected;

.2 the altitude at which the parachute flare burns out; and

.3 the length of the burning period between .1 and .2.

5.6.2 45° Function - Samples of the device shall be fired at an angle of 45° to the horizontal and the performance noted.

5.6.3 Recoil - If the samples are fired from a hand-held position, any recoil from the rocket shall be noted.

5.6.4 Luminosity - Samples of the device shall be tested in order to determine the average luminous intensity.

5.6.5 Flame Colour - Tests shall also be conducted to determine that the colour of the flame is a vivid red as defined by section 11 of the publication "Colour: Universal Language and Dictionary of Names" (Special Publication 440, National Bureau of Standards).

5.6.6 **Test Procedures -**

- .1 The tests in 5.6.1, and 5.6.2 and 5.6.3 shall be conducted in clear conditions with a minimum of wind deflection.
- .2 The tests in 5.6.4 and 5.6.5 shall be conducted by a suitable laboratory using a non-reflective chamber and a suitably calibrated photometer of an acceptable standard.

5.7 **Twin Star Flares Tests (Type B)**

5.7.1 Altitude; Burning Period - Samples of the device shall be fired vertically and by means of accurate measuring instruments, the following shall be determined:

- .1 the altitude at which the stars are ejected;
- .2 the length of the burning period of the stars;
- .3 the interval between ignition of individual stars, if more than one star is produced by a single firing.

5.7.2 Rapid Fire - If the device fires only single stars, it shall be determined that a second star can be fired rapidly following the first star. The time interval between firings shall be noted.

5.7.3 Luminosity - Samples of the device shall be tested in order to determine the average luminous intensity.

5.7.4 Flame Colour - Tests shall also be conducted to determine that the colour of the flame is a vivid red as defined by section 11 of the publication "Colour: Universal Language and Dictionary of Names" (Special Publication 440, National Bureau of Standards).

5.7.5 **Test Procedures**

- .1 The tests in 5.7.1 and 5.7.2 shall be conducted in clear conditions with a minimum of wind deflection.
- .2 The tests in 5.7.3 and 5.7.4 shall be conducted by a suitable laboratory using a non-reflective chamber and a suitably calibrated photometer of an acceptable standard.

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5.8 **Hand Flares Tests (Type C)**

5.8.1 Burning Time - Samples of the device shall be ignited and the total burning time shall be noted.

5.8.2 Immersion Test - After burning for 30 seconds, samples shall be immersed under 100 mm of water for a period of 10 seconds, following which period, they shall continue burning for a further period of not less than 20 seconds.

5.8.3 Luminosity - Samples of the device shall be tested in order to determine the average luminous intensity.

5.8.4 Flame Colour - Tests shall also be conducted to determine that the colour of the flame is a vivid red as defined by section 11 of the publication "Colour: Universal Language and Dictionary of Names" (Special Publication 440, National Bureau of Standards).

5.8.5 Dripping/slag - Samples of the devices shall be activated 1.2 metres above a test pan measuring 1 metre square containing 2 litres of Heptane floating on a layer of water. The samples shall be allowed to burn completely and the Heptane shall not be ignited by the flare or any material from the flare.

5.8.6 **Test Procedures**

- .1 Burning Time - Following ignition of the device according to the manufacturer's instructions, the burning time shall be measured from the time a distinct, sustained flame is emitted until it ceases.
- .2 The test in 5.8.3 and 5.8.4 shall be conducted by a suitable laboratory using a non-reflective chamber and a suitably calibrated photometer of an acceptable standard.
- .3 (a) The test in 5.8.5 shall be conducted using a metal pan, the sides of which shall extend not less than 175 mm above the surface of the water.  
  
(b) The test shall be conducted in a draught-free location and the ambient, water, and Heptane temperatures shall all be 23°C plus or minus 2° at the time of ignition.

- (c) The device shall be held with the flame end pointing upward at an angle of approximately 45°, 1.2 metres above the surface of the water, and over the centre of the pan. The device shall be ignited, by remote means, as soon as the Heptane is observed to spread out over the water in a continuous layer. The device shall be allowed to burn completely and shall not be moved until it has cooled.

## 5.9 **Buoyant Smoke Signals Tests (Type D)**

- 5.9.1 Operation Tests - Following the temperature cycling tests contained in 5.2.1, samples of the devices shall be activated as follows:
- .1 One sample shall be ignited and operate in seawater having a temperature of - 1°C;
  - .2 A second sample shall be ignited and operate in seawater having a temperature of +30°C.
- 5.9.2 Submersion Test - Following one minute of operation under the conditions in 5.9.1 the samples shall be fully immersed for a period of not less than 10 seconds and shall continue to emit smoke during and after submersion. The total emission time shall be noted.
- 5.9.3 Wave Test - It shall be demonstrated that samples of the devices function effectively for not less than 3 minutes in Waves having a height of not less than 300 mm.
- 5.9.4 Flammability Test - Samples of the device shall be activated and operate in water covered by a 2 mm layer of Heptane without igniting the Heptane.
- 5.9.5 Smoke Density Test - Laboratory testing of the device shall establish that at least 30% obscuration throughout the minimum emission time is attained when the smoke is drawn through a 190 mm diameter duct by a fan capable of producing an entrance air flow of 18.4 cubic metres/min.
- 5.9.6 Smoke Colour - It shall also be determined that the colour of the smoke shall be orange as defined by sections 34, 48, 49, or 50 of the publication "Colour: Universal Language and Dictionary of Names" (Special Publication 440, National Bureau of Standards).

5.9.7 **Test Procedures**

- .1 **Smoke Emission Time** - Following ignition of the device according to the manufacturer's directions, the smoke emission time shall be measured from the time of commencement of a distinct, sustained smoke emission until it ceases. There shall be no flame emission during this time.
- .2
  - (a) The test in 5.9.4 shall be conducted using a metal pan, the sides of which shall extend not less than 175 mm above the surface of the water.
  - (b) The test shall be conducted in a draught-free location, and the ambient, water, and Heptane temperatures shall all be 23°C plus or minus 2° at the time of ignition.
  - (c) The device shall be ignited, by remote means, as soon as the Heptane is observed to spread out over the water in a continuous layer. The device shall be allowed to burn completely and should not be removed until it has cooled.

6. **APPROVAL PROCEDURES AND DEFINITIONS**

- 6.1 **Approval Authority** - Board of Steamship Inspection, Department of Transport.
- 6.2 **Inspection Authority** - The Ship Safety Branch of the Canadian Coast Guard. This authority may be assigned to an independent inspection authority approved by the Board of Steamship Inspection. In the case of inspections conducted outside Canada, the independent inspection authority shall be recognized by the maritime administration of the country concerned.
- 6.3 Before approval of any device is granted to any manufacturer, the following procedures shall be followed:
  - .1 Samples of the prototype device, in the quantities indicated, in Table 1, shall be submitted to a testing laboratory, (acceptable to the approval authority) together with an affidavit specifying the component materials.

- .2 The tests may be conducted at the manufacturer's laboratory using the manufacturer's equipment. In this case, the persons conducting and witnessing the tests shall be independent of the manufacturer or any of its agents.
- .3 Applicants shall confirm with the approval authority, the acceptability of the laboratory or the independent witness before commencing prototype testing.
- .4 The prototypes shall be subjected to the relevant tests, prescribed in Section 5, and in the quantities for each test as indicated in Table 1.
- .5 Following testing, a copy of the test report together with six further samples of the prototype device shall be forwarded to the approval authority for consideration.
- .6 The approval authority shall review the test report and if the contents indicate compliance with the requirements of this Standard and the evaluation of the six additional samples is satisfactory, approval shall be granted.
- .7 The original approval certificate, containing a description of the device and an approval number shall be forwarded to the manufacturer.
- .8 The approval number shall be marked clearly and permanently on every device to which the approval certificate applies.
- .9 Approval is valid only when a production device is manufactured in accordance with the relevant requirements of this Standard and the approval certificate.

## 7. **QUALITY ASSURANCE/PRODUCTION TESTS**

### 7.1 **Requirements**

- 7.1.1 Manufacturers are required to establish and maintain quality assurance procedures to ensure that the pyrotechnics are manufactured to the same standard as, and are identical to, the approved prototype.

## 7.2 **Production Tests**

7.2.1 A statistically adequate sample of pyrotechnics from each batch, or lot, shall be activated and observed for proper operation. The tests in Part 5 of the Standards shall be conducted once for every 10 batches, or lots, of signals produced. Such tests, however, shall be conducted at least once per year, but need not be conducted more often than once in every calendar quarter.

7.2.2 In cases where production of a signal is continuous and where the quality assurance procedures and ongoing inspection by the manufacturer are to the satisfaction of the approval authority the tests in Part 5 of this Standard need only be conducted once every calendar year.

## 7.3 **Records**

7.3.1 Manufacturers are required to maintain records relating to quality control and production tests carried out in accordance with this Standard.

7.3.2 The records shall include:

- (a) Size of batch or lot,
- (b) Date when production of each batch, or lot, is commenced or terminated, if the production is not continuous,
- (c) Reason for interruption of lot production,
- (d) Number of failures in the production tests,
- (e) Detailed description of the failures in (d).

7.3.3 Manufacturers shall retain the records for at least 60 months following completion of the tests.

7.3.4 The records shall be available for inspection by, or submission to, the approval authority upon request.

## 7.4 **Random Inspections**

7.4.1 The inspection authority may conduct random periodic inspections in order to ensure that the pyrotechnics are being produced in compliance with the requirements of this Standard and in conformity to the approved prototype.

7.4.2 The approval authority shall acquire samples of each product by random purchase at the retail level. These samples shall be tested to ensure conformity with the approved prototype. Failure to meet this requirement may result in the cancellation of the approval of that device.

## 8. **INTERPRETATION**

### 8.1 **Powers of the Approval Authority**

8.1.1 The approval authority shall be the final arbiter of any dispute concerning the interpretation of this Standard, and may, at its discretion, modify the procedures outlined, vary the extent of testing required and grant or withhold approval of any device for reasons which may not be covered by the terms of this Standard.

## 9. **PUBLICATIONS**

### 9.1 **Definitions**

9.1.1 ASTM - American Society for Testing and Materials.

9.1.2 ISO - International Standards Organisation.

### 9.2 **References**

9.2.1 Reference to any publication or standard is to the latest issues unless otherwise specified by the authority applying this standard.

TEST	IMO SECTION	STD. SECTION	TYPE			
			A	B	C	D
Temperature Cycling	4.1.1	5.2.1	1,2,3		1,2,3	1,2
48 hr. exposure -30°C	4.1.2	5.2.2	4,5,6		4,5,6	3
48 hr. exposure +65°C	4.1.3	5.2.3	7,8,9		7,8,9	4
Temperature + Humidity Cycling	4.1.4	5.2.4	10,11,12		10,11,12	5
24 hr. immersion 5 min. immersion	4.2.1 4.2.2	{5.3.1.1 {5.3.1.2	13,14,15		13,14,15	6
Salt spray test	4.2.3	5.3.1.3	16,17,18		16,17,18	7
1 min. immersion	---	5.3.2		{1,2,3		
Drop Test Operating Test}	4.3.1 4.3.2	{5.4.1.1 {5.4.1.2	19,20,21	4,5,6	19,20,21	8
Altitude-Burn Time Minimum Recoil	4.5.1 4.5.4	{5.6.1 {5.6.3	22,23,24			
Luminosity Flame Colour	4.5.2	{5.6.4 {5.6.5	25,26,27			
Function at 45° Minimum Recoil	4.5.3	{5.6.2 {5.6.3	28,29,30			
Altitude/Burn/ Interval Single Star Interval	--- ---	{5.7.1 { {5.7.2 {		{7,8,9 or {7-12		
Luminosity Flame Colour	--- ---	{5.7.3 {5.7.4		{10,11,12 or {13,14,15		
Burning Time Burning/Immersion	4.6.1	{5.8.1 {5.8.2			22,23,24	
Luminosity Flame Colour	4.6.2	{5.8.3 {5.8.4			25,26,27	
Heptane Test	4.6.3	5.8.5			28,29,30	
Seawater Operation Seawater Immersion	4.7.1	{5.9.1 {5.9.2				1,2
Wave Test	4.7.4	5.9.3				9

Heptane Test	4.7.2	5.9.4				10
Smoke Density	4.7.3	5.9.5				11

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TEST	IMO SECTION	STD. SECTION	TYPE			
			A	B	C	D
Marking of Instructions	4.4.1	5.5.1.1	1-30	1-15	1-30	1-11
2 Sec. Delay/Bottom Op.	4.4.2	5.5.1.2	1-30		1-30	1-11
Integral Means of Ignition	4.4.3	5.5.1.3	1-30			
Simplicity of Operation	4.4.4	5.5.1.4	1-30	1-15	1-30	1-11
Waterproofing - No Tapes	4.4.5	5.5.1.5	1-30		1-30	1-11
Date of Mfg. + Lot Number	4.4.6	5.5.1.6	1-30	1-15	1-30	1-11
No. of Samples			30	15	30	11

Notes:

1. When conditioning of samples for testing, the samples should be marked.
2. The tests required by 5.9.1 and 5.9.2 for Type D devices shall be conducted immediately following the temperature cycling required by 5.2.1. The same two devices shall be used.
3. In order to meet the requirements of this Standard, all samples shall meet the requirements of the respective tests.