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Revision to a Request for a Standing Offer
Révision à une demande d'offre à commandes
National Master Standing Offer (NMSO)
Offre à commandes principale et nationale (OCPN)

The referenced document is hereby revised; unless otherwise indicated, all other terms and conditions of the Offer remain the same.

Ce document est par la présente révisé; sauf indication contraire, les modalités de l'offre demeurent les mêmes.

Comments - Commentaires

Vendor/Firm Name and Address
Raison sociale et adresse du
fournisseur/de l'entrepreneur

Issuing Office - Bureau de distribution
Marine Emergency Response Division/Division des
Interventions en cas d'urgence maritime
Centennial Towers 7th Floor - 7W11
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Title - Sujet AToN: Plastic Buoys(RFSO)		
Solicitation No. - N° de l'invitation F7047-231212/B		Date 2024-04-25
Client Reference No. - N° de référence du client F7047-231212		Amendment No. - N° modif. 003
File No. - N° de dossier 008erd.F7047-231212	CCC No./N° CCC - FMS No./N° VME	
GETS Reference No. - N° de référence de SEAG PW-\$ERD-008-29331		
Date of Original Request for Standing Offer Date de la demande de l'offre à commandes originale		2024-03-28
Solicitation Closes - L'invitation prend fin at - à 02:00 PM Eastern Daylight Saving Time EDT on - le 2024-05-07 Heure Avancée de l'Est HAE		
Address Enquiries to: - Adresser toutes questions à: Bakhos, Maya		Buyer Id - Id de l'acheteur 008erd
Telephone No. - N° de téléphone (613) 292-3550 ()		FAX No. - N° de FAX () -
Delivery Required - Livraison exigée		
Destination - of Goods, Services, and Construction: Destination - des biens, services et construction:		
Security - Sécurité This revision does not change the security requirements of the Offer. Cette révision ne change pas les besoins en matière de sécurité de la présente offre.		

Instructions: See Herein

Instructions: Voir aux présentes

Acknowledgement copy required Accusé de réception requis	Yes - Oui <input type="checkbox"/>	No - Non <input type="checkbox"/>
The Offeror hereby acknowledges this revision to its Offer. Le proposant constate, par la présente, cette révision à son offre.		
Signature	Date	
Name and title of person authorized to sign on behalf of offeror. (type or print) Nom et titre de la personne autorisée à signer au nom du proposant. (taper ou écrire en caractères d'imprimerie)		
For the Minister - Pour le Ministre		

SOLICITATION AMENDMENT 003

This Solicitation Amendment is raised to:

1. Answer questions that were received from industry and to amendment Annex B- Plastic Buoys Technical Specification of Requirements
2. Insert Annex C- Basis Of Payment to reflect changes made in Amendment 001

1. QUESTIONS AND ANSWERS:

Question 1

Can you please confirm if the following Calculation is the correct format to be used to prove the buoy will not sink when there is no buoyancy material:

(Example values)

Mass of the Buoy	200 kg
+ Maximum Mooring Mass	300 kg
+ Anticipated Lantern Weight	15 kg
+ Anticipated Marine Growth	15 kg
+ Anticipated Ice Load	15 kg

Total Mass 545 kg

This mass would then be used to confirm that the volume of the remaining hull float section in litres (for freshwater) exceeds the mass to be displaced and ensure sinking does not occur.

Response to Question 1

The calculation provided in question 1 can be used to confirm the buoy will not sink when there is no buoyancy material

Question 2

a. Will CCG remove the implied definition of SWL being a safety factor of 5x (something ?)

b. Will CCG require that the "Calculations of the Safe Working Load of the Mechanical Lifting Connection between the Lifting Eye and the Mooring Eye" must be performed and stamped by an independent Professional Engineer in Canada or by a Professional Engineer that states that the Calculations were performed in accordance with a standard recognized in Canada.

Response to Question 2

- a. TR.35 updated as per follow; highlighted in yellow;

TR.35	Safe Working Load (SWL)	<p>All lifting and mooring attachments and related assemblies must have a minimum safety factor of 5 (Ultimate Tensile Strength) for the life of the buoy. The items to consider for the SWL for each eye type are as follows:</p> <p>Loads on the Lifting Assembly - the sum of the equivalent air mass of:</p> <ul style="list-style-type: none">• the buoy (including any internal ballast), as purchased;• all payload items, e.g. Lantern weight and Marine Growth.• the maximum mooring load.
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- b. As per Annex D – OFFER EVALUATION MATRIX, for TC13 – Offeror shall: Submit Data (SD): Provide Engineering Drawings/Documentation to validate that this requirement has been met.

Question 3

What is the required calculation to prove that an AtoN Buoy will not sink if it is damaged in handling, struck by a vessel, debris, or ice.

Response to Question 3

The offeror must meet the requirement Annex B-TR.23 and Annex D-TC07

Question 4

A collision on a seam between two sections typically punctures both sections. What is the minimum number of compartments or floatation sections required? Three or more than three?

Response to Question 4

CCG would accept a design that utilizes multiple watertight compartments or float sections to keep the buoy upright in the event of a hull breach, rather than requiring the buoy to be filled with a buoyancy material and as per Annex B-TR.23; The buoy hull must remain afloat at all times in the damaged condition.

Question 5

What is the reserve buoyancy required in the damaged state that exceeds the maximum mass that could cause sinking, stated as a safety factor multiplier or a percentage ?

Response to Question 5

CCG does not specify the reserve buoyance in a damaged state as per Annex B-TR.23; the buoy hull must remain afloat at all times in the damaged condition.

Question 6

Does the Lifting Eye have to be accessible (above water) in the damaged state to enable safe recovery of the partially submerged buoy?

Response to Question 6

No the lifting eye does not need to be accessible in the damaged state.

Question 7

Is there a specification for the size or maintenance of the fasteners required for buoys with multiple float sections or water-tight compartments ? Are the fasteners expected to last as long as the 15-year life of existing monohull buoys?

Response to Question 7

There is no specification for the size or maintenance of the fasteners required for buoys with multiple float sections or water-tight compartments. As per Annex B-TR.40; All metallic fittings (fasteners, bushings and inserts) must be of stainless steel AISI type 316 or equivalent. The fittings must be designed to be dismantled using standard tools and equipment.

Question 8

Is it a requirement for Modular Buoys to be delivered in the fully assembled state, ready for use at the Coast Guard Base upon unloading?

Response to Question 8:

All regions have requested fully assembled state.

Question 9

Considering complexity of the requested units and number of technical and contractual requirements more time is required to finalize this project. Supply chain is also taking longer than usual to provide pricing and lead time. Will Canada accept three weeks extension to the closing date?

Response to Question 9

The Solicitation has been extended to May 7th, 2024 at 2:00 p.m. EST

Solicitation No. - N° de l'invitation
F7047-231212/B
Client Ref. No. - N° de réf. du client
F7047-231212/B

Amd. No. - N° de la modif.
003
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008erd
CCC No./N° CCC - FMS No./N° VME

2. Amendments to Annex B – Plastic Buoys Technical Specification of Requirements

Delete: Annex B in its entirety.
Insert: Annex B as attached

3. Amendment to Annex C – Plastic Buoys Basis Of Payment

Delete: Annex C in its entirety.
Insert: Annex C as attached

All other Terms and Conditions remain unchanged



Plastic Buoys

Technical Specification of Requirements Annex B





Title of Manual

CCG/Plastic Buoys

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Available on the CCG intranet site

*Disponible en français: Bouées côtières ou
portuaires en plastique de taille moyenne—
Spécification sur le rendement*

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Abbreviations

Abbreviation	Definition
CCG	Canadian Coast Guard
cd	Candelas
DFO	Fisheries and Oceans Canada
IALA	International Association of Marine Aids to Navigation and Lighthouse Authorities
IEC	International Electrotechnical Commission
IHO	International Hydrographic Organization
IP	Ingress Protection
kg	Kilograms
LED	Light Emitting Diode
lx	Lux
m	Meters
MIL STD	US Military Standard
nm	Nautical miles
NOTMAR	Notice to mariners
SCOLL	Self-Contained LED Lantern
TR	Technical Requirement
TSoR	Technical Specification of Requirements

1. INTRODUCTION

1.1. Purpose

As a part of services provided to the public, the Canadian Coast Guard (CCG) deploys and maintains numerous types of buoys as floating aids to navigation (AtoNs) for the purpose of ensuring safety of navigation. Buoys are used to demarcate boundaries of traffic lanes and also to indicate obstacles to navigation, such as underwater rocks and shoals.

This specification states the requirements for the Canadian Coast Guard's '**Commercial Off The Shelf**' (COTS) plastic buoys for marine navigational purposes. In keeping with the CCG's concept of extending the service cycle for buoys, the goal for periodic service is a 5-year schedule. This specification is applicable to the supply of the following plastic buoys of the following sizes:

1. *Small Spar* with hull diameters of 0.25 to 0.38 metres (see Appendix A.2.1),
2. *Small Marker* with hull diameters of 0.35 to 0.55 metres (see Appendix A.2.2),
3. *Medium Spar* with hull diameters of 0.50 to 0.70 metres (see Appendix A.2.3),
4. *Medium Marker* with hull diameters of 0.70 to 0.80 metres (see Appendix A.2.4),
5. *River Buoy* with hull diameters of 0.75 to 1.30 metres (see Appendix A.2.5),
6. *Low Draft River Buoy* with a hull diameter of 1.0 metre (see Appendix A.2.6),
7. *Medium-Large Marker* with hull diameters of 0.8 to 1.0 metres (see Appendix A.2.7),
8. *Large Marker* with hull diameters of 1.1 to 1.3 metres (see Appendix A.2.8), and
9. *Pillar Buoy* with hull diameters of 1.4 to 1.5 metres (see Appendix A.2.9)
10. *Funnel Buoy* with hull diameters of 0.8 to 1.0 metres (see Appendix A.2.10)

This specification addresses the following issues:

- Operational requirements including environmental conditions, operational service, operational criteria and stability requirements.
- Technical requirements including materials, design, structural capabilities, colours and markings.
- Appendix A, which provides detailed performance requirements for the various categories of plastic buoys.

2. TECHNICAL REQUIREMENTS

2.1. General

Buoys covered within this specification are typically capable of unattended operation for 5 years with no preventive maintenance, other than periodic cleaning of external surfaces.

These buoys are typically resistant to the rigors of normal handling during deployment and retrieval operations as well as damage from incidental contact from vessels and floating debris. The colour on the visible portion of the buoy is homogenous and stable for the life of the buoy and all its components (e.g. radar reflector, adhesives, all structure, fittings, lifting and mooring eyes) endure for the life of the buoy.

2.1.1. Buoy Categories

To satisfy the various operational requirements of the Canadian Coast Guard ten (10) buoy categories will be required as defined in detail in Appendix A of this specification.

2.2. Operational Requirements

2.2.1. Areas of Operation

These buoys will be deployed in Canadian Navigational Waters and principally used in rivers, lakes and coastal sheltered and partially protected waters.

2.2.2. Environmental Conditions

The buoy must either operate and/or survive as per the conditions listed in Appendix A.

Table 1: Environmental specifications

Reference Number	Criteria Description	Requirement or Value
TR.1	Water Temperature	The buoy must withstand and survive exposure to water temperatures of -2 °C to +30°C.
TR.2	Air Temperature	The buoy must operate in and survive exposure to air temperatures of -40 °C to +40°C.
TR.3	Water Type	The buoy must withstand exposure to continuous fresh, or saline or brackish waters for the duration of the specified life of the buoy.
TR.4	Operational Wind Speed	The buoy must operate in wind speeds up to 30 knots.
TR.5	Survival Wind Speed	The buoy must withstand wind speeds up to 80 knots.
TR.6	Operational Current Speed	Buoys must operate in water currents listed in Appendix A.

Reference Number	Criteria Description	Requirement or Value
TR.7	Survival Current Speed	Buoys must be able to withstand the current speeds listed in Appendix A .
TR.8	Maximum Operational Buoy Tilt Angle	For the maximum operational current the buoy must not tilt more than the angle as listed in Appendix A .
TR.9	Humidity	Buoys must withstand exposure to relative humidity levels from 0 to 100%.
TR.10	Salt Air and Seawater Spray	Buoys must withstand exposure of continuous salt air and seawater spray for the duration of the specified life of the buoy.
TR.11	Ultraviolet (UV) Exposure	Buoys must be able to withstand continuous exposure to ultraviolet (UV) light typical of the levels encountered in Amherstburg, Ontario (1250 hours per year) for the duration of the specified service life of the buoy as specified in Table 5 .
TR.12	Marine Growth	The buoy must withstand an accumulation of marine growth on its underwater portion during operational and survival conditions as listed in Appendix A .
TR.13	Ice Exposure and Ice Accumulation	Buoys must withstand ice exposures and ice accumulations as listed in Appendix A .
TR.14	Abrasion Resistance	The buoy will be subjected to abrasion due to drifting ice floes, logs, floating debris and must conform to the survival conditions as listed in Table 7 .

2.2.3. Operational Service

Buoys must be capable of unattended operation and will be subjected to the following operational conditions:

Table 2: Operational Service

Reference Number	Criteria Description	Requirement or Value
TR.15	Deployment and Retrieval	The buoy and all of its components must be capable of withstanding the static and dynamic loads associated with buoy deployment and retrieval operations.
TR.16	Periodic Maintenance	The buoy must endure the routine maintenance activities which are:

Reference Number	Criteria Description	Requirement or Value
		a) Pressure washing up to 20 MPa (3,000 psi) to remove fouling, typically every five years or as required; b) Removal of ice accumulation with the use of a non-metallic mallet (e.g. wood or rubber) as required; c) Replacement or re-application of retro-reflective material as required;
TR.17	Storage	The buoy must withstand storage in unsheltered conditions when not in service. These conditions include exposure to direct sunlight, rain, hail, sleet, snow, wind, blowing sand, temperature extremes, and any combination thereof. The buoy may also be stored on dirt, concrete, wood, or asphalt surfaces.

2.2.4. Life Expectancy

Aside from the need for periodic maintenance as described in **Table 2**, the buoys must have a minimum expected maintenance-free service life of fifteen (15) years.

2.2.5. Functional Criteria

Table 3: Life cycle specifications

Reference Number	Criteria Description	Requirement or Value
TR.18	Visual Range	The buoy must meet the visual range criteria specified within Appendix A . The visual range assumes that the observer is 3m above the water level in clear weather with calm seas and a meteorological visibility of 10 nautical miles. It is also assumed that there are no background features to obscure the buoy.
TR.19	Radar Range	The buoys must have a radar reflector with a minimal cross sectional area in accordance with reference [19] of Table 17, ref 19 ('Target item # 3') – 'Aids to Navigation with Radar Reflector' to ensure that it meets the target height requirements of this specification.
TR.20	Visible Height	Buoys must have sufficient operational reserve buoyancy to ensure that they meet the minimum visible height criteria specified within Appendix A .
TR.21	Buoy Type	Buoys used as navigational aids in this specification must be of the type lateral, cardinal or special conforming to the requirements of reference [20] of Table 18 . Colour requirements are defined in Table 10 .

2.2.6. Stability Criteria

The plastic buoy must meet the stability criteria at sea described below. Stability is to be assessed such that the buoy is able to meet the functional criteria defined in **Table 3** under the minimum and maximum limiting environmental conditions defined herein.

Table 4: Stability Criteria at Sea

Reference Number	Criteria Description	Requirement or Value
TR.22	Stability– Undamaged Condition	The buoys must remain upright at all times in undamaged condition; and not list in calm waters. Calm waters are defined as waters that are nearly or completely motionless and undisturbed This criterion is to be met considering all required payload items (e.g. LED lanterns, solar panels mooring) and minimum and maximum surcharge items (e.g. marine growth).
TR.23	Stability– Damaged Condition	The buoy hull must remain afloat at all times in the damaged condition. The damaged condition constitutes any condition wherein the buoy no longer functions as an aid to navigation.
TR.24	Operational Reserve Buoyancy	The operational reserve buoyancy (Rb) corresponds to a stable design deployment configuration range (see Appendix C). All operational criteria must be met within this range.

2.3. DESIGN REQUIREMENTS

2.3.1. Materials

Table 5: Materials specifications

Reference Number	Criteria Description	Requirement or Value
TR.25	General	All materials used in buoy construction are to meet the appropriate reference standards listed in Appendix B. Novel materials, or materials not addressed may be acceptable, but will require approval by CCG. The interior hull of the buoys must contain buoyancy material or utilize multiple watertight compartments or float sections without the use of buoyancy material. All ballast material and radar reflector must be internal.
TR.26	Material Certifications	A certificate must be provided to validate that manufactured buoys do not contain any materials identified in reference [21] of Table 18- Appendix B identified for control or elimination on the CEPA Registry website
		The contractor must provide material certifications from the material manufacturer (MM) identifying the mechanical properties of the material or a certified independent testing laboratory (TL), indicating that the final materials used in the manufacturing of the buoy and described in the following sections meet the requirements of this specification over the life of the product: <ul style="list-style-type: none">• UV stabilizers rated for 15 a year life (18,750 hours)(TL);• buoy shell material (MM);• inserts and fittings (MM);• internal/external ballast material (MM); and• buoyancy material (MM).

2.3.2. Design, Dimensions and Surface Finish

Table 6: Life cycle specifications

Reference Number	Criteria Description	Requirement or Value
TR.27	General	The buoy's centre of gravity must be along the vertical axis and shown on the supplier's drawings.
		The buoy hull must be watertight.

Reference Number	Criteria Description	Requirement or Value
TR.28	Buoy Hull Construction	If the buoy hull is used to support any of the mooring loads associated with the buoy (i.e. counterweights or mooring chain) it must provide the SWL as outlined in Table 7 .
		The buoy structure must be strong enough not to sustain any cracks or breakage during operation, handling or during the removal of ice with a hard rubber or wooden mallet.
TR.29	Approved Shape	Buoys must have the above water shape meeting the requirements of reference [20] of Table 18- Appendix B . See buoy type definitions in Appendix A .
TR.30	Overall Dimensions	The overall dimension limits, including minimum Visible Height and Maximum Draft are defined in Appendix A for each buoy type.
TR.31	Mass in Air	The maximum mass in air of the buoy and associated standard outfit must not exceed the weight as referenced in Appendix A . This excludes the weight of additional payload items e.g. LED lantern.
TR.32	Surface Finish (Plastic)	The buoy must be free from blemishes, bumps, indentations, ragged edges, cracks, scales, pits and blisters. All corners and edges must be rounded with minimum radii of not less than 3 mm.
TR.33	Surface Finish (Metallic)	Metallic surface finishes must be free of any burrs or sharp edges with all corners and edges to be rounded with minimum radii of 3 mm.

2.3.3. Structural Capabilities

Buoys must be designed to meet the requirements of this section and maintain these throughout the specified life expectancy.

Table 7: Structural Capabilities specifications

Reference Number	Criteria Description	Requirement or Value
TR.34	The Lifting Assembly	<p>The Lifting Assembly shall be known as:</p> <ul style="list-style-type: none"> In one piece designs where the mooring eye is attached to an internal mechanism joining the mooring eye to the lifting eye. In modular design where the mooring eye is linked directly to the lifting eye via an external structural member.

Reference Number	Criteria Description	Requirement or Value
		In all cases the Lifting Assembly shall contain a minimum number of components to transfer loading from the lifting to the mooring eye.
TR.35	Safe Working Load (SWL)	<p>All lifting and mooring attachments and related assemblies must have a minimum safety factor of 5 (Ultimate Tensile Strength) for the life of the buoy. The items to consider for the SWL for each eye type are as follows:</p> <p>Loads on the Lifting Assembly - the sum of the equivalent air mass of:</p> <ul style="list-style-type: none"> the buoy (including any internal ballast), as purchased; all payload items, e.g. Lantern weight and Marine Growth. the maximum mooring load.
TR.36	Lifting and Mooring Attachment Points	The capacity of each Lifting eye attachment must be clearly identified as per Table 12 .
TR.37	Abrasion Resistance	The buoys' shell must be abrasion tested in accordance with the standard test as specified in Table 14 reference [7] of Appendix B (Taber Test) with Wheel CS 17, Load of 1 kg and be capable of resisting any wear when subjected to the conditions as detailed in Appendix A .

2.3.4. Exterior Outfit

Table 8: Exterior Outfit specifications

Reference Number	Criteria Description	Requirement or Value
TR.38	Buoy Shell	The buoy shell, or outer skin, must be made from plastic.
TR.39	Colour Uniformity	The colour of the buoy shell must be homogenous throughout and have a 'high gloss' finish.
		Ultraviolet stabilizers must be added to the plastic to protect the material from degradation due to continuous sun exposure as defined in Table 1 above. Unless otherwise specified, the shell must be uniform in colour.

Reference Number	Criteria Description	Requirement or Value
TR.40	Fasteners, Bushings and Inserts	<ul style="list-style-type: none"> a) All metallic fittings (fasteners, bushings and inserts) must be of stainless steel AISI type 316 or equivalent. b) The fittings must be designed to be dismantled using standard tools and equipment. c) All parts must be free of cracks and other material defects and all sharp corners and edges must be rounded. d) Lantern inserts must not break free of their encapsulation nor pull out when subjected to a torque of 27.1 N-m (20 ft-lb). e) Wear bushings, if present must be designed to remain functional over the buoys specified life expectancy.
TR.41	Mooring Eye Attachment Points	<p>The buoy must be fitted with the specified number of mooring attachment points specified in Appendix A, symmetrically opposite to each other.</p> <p>Each mooring eye must be fitted with a stainless steel bushing insert not less than the dimension specified in Appendix A.</p>
TR.42	Lifting Eye and Handling Attachment Points	<p>The buoy must be fitted with the specified number of lifting and/or handling attachment points as identified in Appendix A.</p> <p>Lifting eyes must be made from stainless steel AISI type 316 or equivalent or marine grade aluminum capable of meeting the requirements of Table 5 and the minimum dimensional tolerances defined for this buoy in Appendix A.</p>
TR.43	Lantern Mounting	<p>The buoy must provide mounting bolt patterns as shown in Figure A-2.11</p> <p>The buoy must have a flat top and be fitted with stainless steel inserts AISI type 316 or equivalent.</p>
TR.44	Lantern Adapter	The buoy must be capable of meeting all operational requirements when mounted with a lantern with a maximum weight of 15 kg. including the additional weight of an adapter plate if needed.

2.3.5. Interior Outfit

Table 9: Interior Outfit specifications

Reference Number	Criteria Description	Requirement or Value
TR.45	Internal Ballast	All non modular buoy design must have an internal ballast. The use of an internal ballast is to achieve compliance with the functional and stability criteria of the buoy.
		Internal Ballast: Ballast material which is internal to the buoy and is not in direct contact with water must be non-toxic and non-polluting.
TR.46	Buoyancy Material	The buoyancy material used must be closed cell foam; preference will be given to recyclable materials as per Table 13 .
		The buoyancy material must be free of cracks, gouges, and embedded foreign material.
		There must be no internal voids of such quantity or size that could cause the buoy to be susceptible to flooding.
		When the buoyancy material is the principal method of containing interior outfit items, namely ballast and radar reflectors, it is to be of a density and strength adequate for the task.

2.3.6. Colour

Table 10: Colour specifications

Reference Number	Criteria Description	Requirement or Value
TR.47	Buoy Colour	The visible part of the buoy above the waterline must be one uniform colour throughout. In the case of segmented coloured buoys (i.e. Cardinal or Safe water buoys) the separate colours must be homogenous and uniform.
TR.48	Colour Fastness	Colour stability must be measured in accordance with Table 17 reference [17] of Appendix B section 1.2 where the allowable colour change must not exceed ΔE^*_{ab} 4.0, after 1000 hours of exposure using a Xenon Weatherometer.
TR.49	Colour Pigment	The CIE 1931 chart as shown in Figure 1 below defines the desired IALA-108 E Chromaticity values for x and y for each of the colours used in the buoy plastic. Buoy colours must be within their preferred zones.

Reference Number	Criteria Description	Requirement or Value
		Colour pigmentation will be measured for the geometry of 45°/0° with a 2 degree observation angle and an Illuminant of D65 and excludes UV.

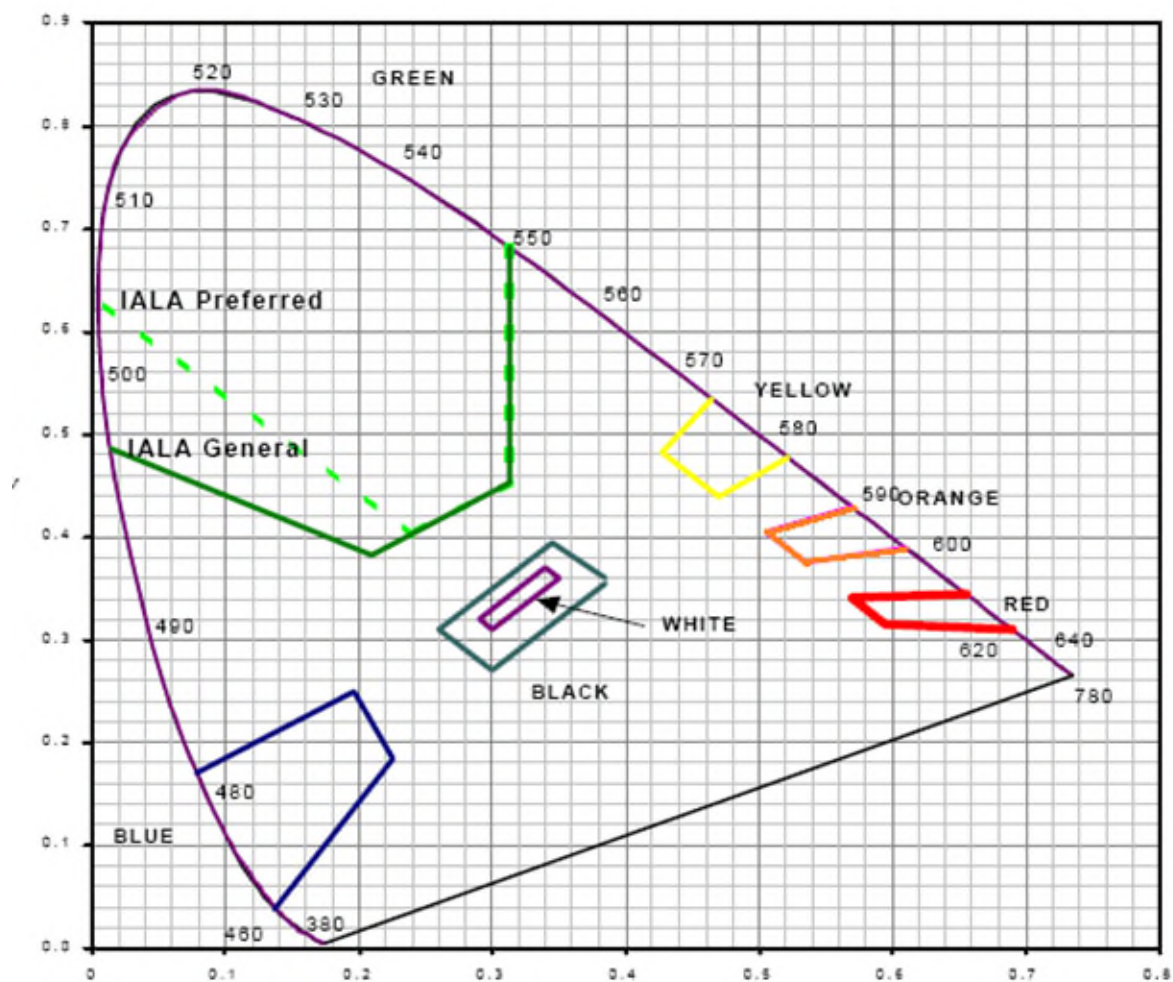


Figure 1: IALA-108-CIE 1931 Chromaticity Chart

2.3.7. Markings

Table 11: Markings

Reference Number	Criteria Description	Requirement or Value
TR.50	General	All markings must be clearly, legibly and permanently engraved.
		The method and placement of all markings must not affect the structural integrity of the buoy.
		The markings must be in French and English and must be shown on delivered drawings.
		All buoys must be marked by a plastic recycling mark as identified in Figure A-2.12
TR.51	Buoy Markings	<p>The letters Coast Guard Markings:</p> <p style="text-align: center;">CANADIAN COAST GUARD GARDE CÔTIÈRE CANADIENNE 20XX</p> <p>where “20xx” is the year of manufacture, must be inscribed in block digits on each buoy above the waterline. The letters must not be less than twenty-five (25) mm tall in ARIAL font. For buoy dimensions too small to accommodate the entire inscription; only the year of manufacture will have 25 mm tall letters. The remaining title will be sized as appropriate, according to the buoy dimensions.</p>

2.3.8. Life Cycle Specifications

Table 12: Life cycle specifications

Reference Number	Criteria Description	Requirement or Value
TR.52	Identification	Every plastic buoy must be fitted with a unique Serial Number assigned by the manufacturer.
		The size of lettering must be at least 12 mm high, clearly legible and located in an area above the waterline
TR.53	Operational Reserve Buoyancy (Rb)	Two engraved or raised line markings identifying the Operational Reserve Buoyancy limits of the buoy must be clearly and permanently marked around the entire circumference of the hull.
		Each of the lines must be marked with 12 mm high lettering indicating either the “MIN’ or “MAX’ levels of the Reserve Buoyancy (Rb).

Reference Number	Criteria Description	Requirement or Value
		These markings must not in any way affect the buoys structural integrity.
TR.54	Radar Reflector	Type 1 tower sections must have the letter “R” inscribed on the tower to indicate that there is a radar reflector within.
TR.55	Retro Reflective Material	Area for Retro reflective materials must be placed at the highest possible location on the tower. The marking must encompass the entire circumference of the buoy.
TR.56	SWL	The safe working load (SWL) associated with all lifting and mooring points must be marked using SI units adjacent to each lifting point.
		The size of lettering must be at least 12 mm high and clearly legible.

2.3.9. Environmental Impact

Table 13: Environmental Impact

Reference Number	Criteria Description	Requirement or Value
TR.57	Buoy Design and Materials	Buoy designs and materials must be selected to minimize their environmental impact upon disposal at the end of their useful life.
TR.58	Ease of Disposal	Considerations will be given to buoy designs that facilitate the ease of disposal. Designs that incorporate easy separation of materials will be favoured.

APPENDIX A BUOY PERFORMANCE REQUIREMENTS

A.1 SCOPE

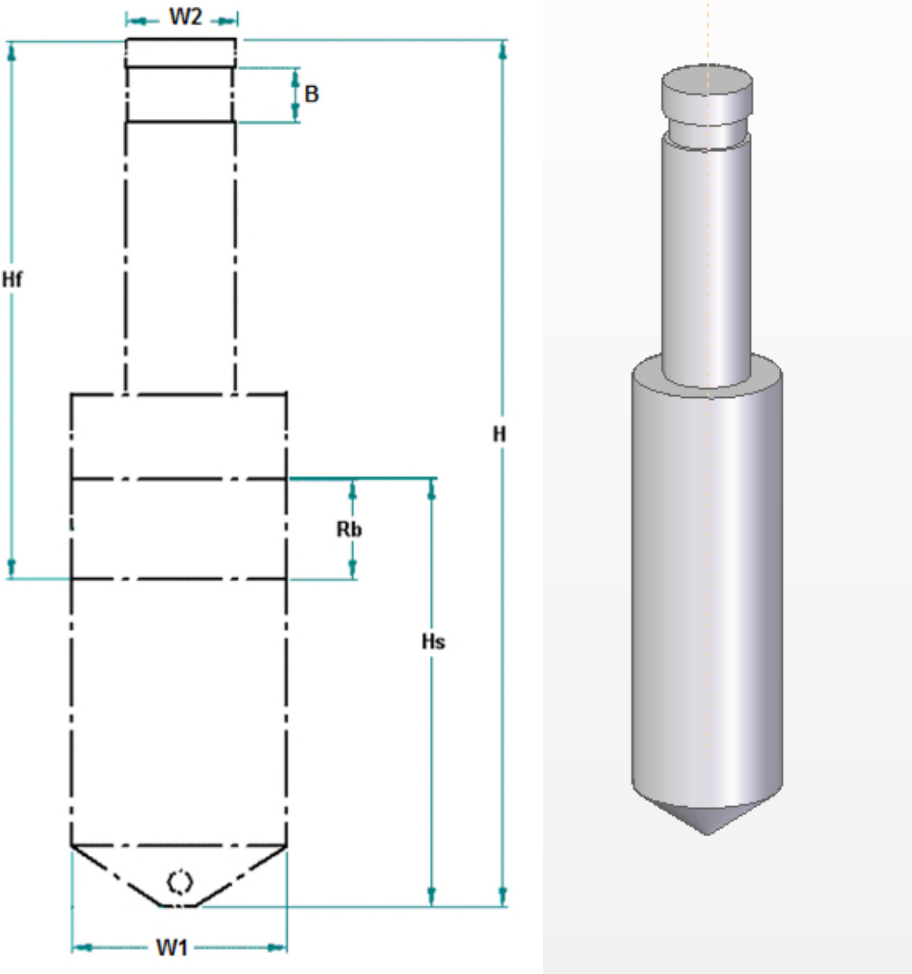
This appendix states the supplementary requirements which the buoy is required to meet in addition to the requirements of the main body of the specification.

A.2 PERFORMANCE REQUIREMENTS

This section defines the environmental conditions under which the Plastic Buoys must function as an aid to navigation. It also defines functional criteria and supplementary requirements, which the Plastic Buoys must meet in order to meet the requirements of this section.

A.2.1 Small Spar

Item	Dimensional Requirements	Units	Value
A.2.1.1	Minimum / Maximum Hull Diameter (W)	m	0.25/0.38
A.2.1.2	Minimum / Maximum Tower Section Diameter	-	170/190
A.2.1.3	Maximum Buoy Height (H)	m	3.0
A.2.1.4	Buoy Weight Range (including internal ballast)	kg	34 - 42
A.2.1.5	Expected Lantern Weight ⁷	kg	5.0
A.2.1.6	Buoy Hull Shell Abrasion Resistance	mg	< 150 mg weight loss after 10,000 cycles
A.2.1.7	Overall Buoy Silhouette	-	Figure A-2.1
A.2.1.8	Threaded lantern supports @150mm Bolt Circle	-	Figure A-2.11
Functional Criteria			
A.2.1.9	Minimum Visual Range ¹ [at max mooring load]	nm	n/a
A.2.1.10	Minimum Radar Range ²	nm	n/a
A.2.1.11	Minimum Radar Cross Sectional Area	m ²	2.0
A.2.1.12	Minimum Visible Height ³ (Hf) [@max mooring load]	m	1.10
A.2.1.13	Can Top	-	Yes
A.2.1.14	Conical Top	-	Optional
A.2.1.15	Retro-Reflective Area (B)	mm	155
A.2.1.16	Buoy Tilt Angle @ Maximum Operational Current	°	6.0
Equipment Requirements			
A.2.1.17	Radar Reflector ⁴	-	Mandatory
A.2.1.18	Lantern Mount ⁵	-	Yes
A.2.1.19	Lantern Type Generally Used	-	1.5 to 2 nm LED*
Lifting and Mooring Eyes			
A.2.1.20	Minimum Number of Handling Eyes	-	1
A.2.1.21	Minimum Number of Lifting Eyes	-	0
A.2.1.22	Minimum Number of Mooring eyes	-	1
A.2.1.23	Lifting Eye Safe Working Load (SWL)	kg	-
A.2.1.24	Lifting Assembly Break Load	-	-
A.2.1.25	Mooring Eye Break Load	kg	-
A.2.1.26	Minimum Mooring Eye Internal Diameter	mm	35
A.2.1.27	Maximum Mooring Lug Width	mm	75
A.2.1.28	Minimum Handling Eye Internal Diameter	mm	40
A.2.1.29	Minimum/Maximum Mooring Load	kg	20/55
Environmental Conditions			
A.2.1.30	Maximum Marine Growth ⁶ – Operational	kg	10
A.2.1.31	Maximum Current – Operational	knots	2.0
A.2.1.32	Maximum Current – Survival	knots	10.0

A.2.1.33	Ice Accumulation	kg	10
Buoy Markings			
A.2.1.34	Operation Reserve Buoyancy (R_b)	-	Yes
<div></div> <p>Figure A-2.1: Small Spar Buoy Silhouette</p>			

A.2.2 Small Marker

Item	Dimensional Requirements	Units	Value
A.2.2.1	Minimum / Maximum Hull Diameter (W)	m	0.35/0.55
A.2.2.2	Minimum / Maximum Tower Section Diameter	-	n/a
A.2.2.3	Maximum Buoy Height (H)	m	1.30
A.2.2.4	Buoy Weight Range (including internal ballast)	kg	9-12
A.2.2.5	Expected Lantern Weight ⁷	kg	5.0
A.2.2.6	Buoy Hull Shell Abrasion Resistance	mg	< 150 mg weight loss after 10,000 cycles
A.2.2.7	Overall Buoy Silhouette	-	Figure A-2.2
A.2.2.8	Threaded lantern supports @150mm Bolt Circle	-	Figure A-2.11
Functional Criteria			
A.2.2.9	Minimum Visual Range ¹ [at max mooring load]	nm	n/a
A.2.2.10	Minimum Radar Range ²	nm	n/a
A.2.2.11	Minimum Radar Cross Sectional Area	m ²	2.0
A.2.2.12	Minimum Visible Height ³ (Hf) [@ max mooring load]	m	0.60
A.2.2.13	Can Top	-	Yes
A.2.2.14	Conical Top	-	Optional
A.2.2.15	Retro-Reflective Area (B)	mm	155
A.2.2.16	Buoy Tilt Angle @ Maximum Operational Current	°	6.0
Equipment Requirements			
A.2.2.17	Radar Reflector ⁴	-	Mandatory
A.2.2.18	Lantern Mount ⁵	-	Optional
A.2.2.19	Lantern Type Generally Used	-	1.5 to 2 nm LED*
Lifting and Mooring Eyes			
A.2.2.20	Minimum Number of Handling Eyes	-	Optional (0 or 1)
A.2.2.21	Minimum Number of Lifting eyes	-	0
A.2.2.22	Minimum Number of Mooring eyes	-	1
A.2.2.23	Lifting Eye Safe Working Load (SWL)	kg	n/a
A.2.2.24	Lifting Assembly Break Load	kg	n/a
A.2.2.25	Mooring Eye Break Load	kg	n/a
A.2.2.26	Minimum Mooring Eye Internal Diameter	mm	35
A.2.2.27	Maximum Mooring Eye Width	mm	75
A.2.2.28	Minimum Lifting /Handling Eye Internal Diameter	mm	100
A.2.2.29	Minimum/Maximum Mooring Load	kg	5/25
Environmental Conditions			

A.2.2.30	Maximum Marine Growth ⁶ – Operational	kg	5
A.2.2.31	Maximum Current – Operational	knots	2.0
A.2.2.32	Maximum Current – Survival	knots	10.0
A.2.2.33	Ice Accumulation	kg	5

Buoy Markings

A.2.2.34	Operation Reserve Buoyancy (R_{∞})	-	Yes
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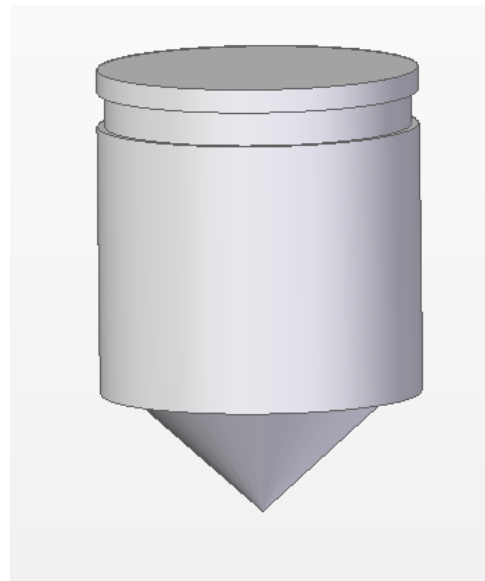
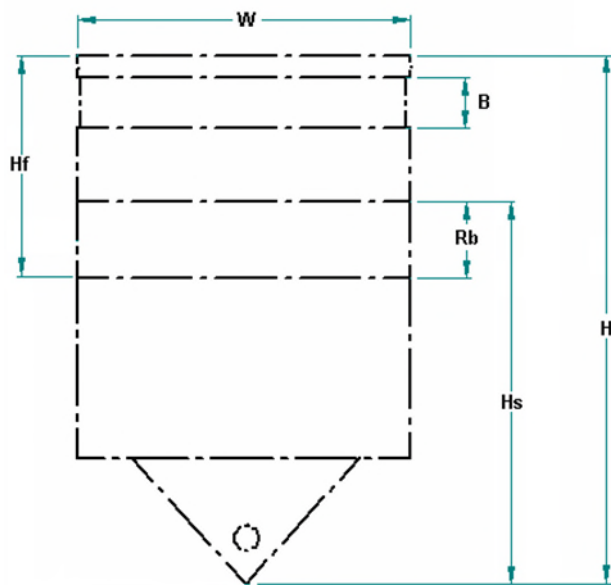


Figure A-2.2: Small Marker Buoy Silhouette

A.2.3 Medium Spar

Item	Dimensional Requirements	Units	Value
A.2.3.1	Minimum / Maximum Hull Diameter (W)	m	0.50/0.70
A.2.3.2	Minimum / Maximum Tower Section Diameter	-	n/a
A.2.3.3	Maximum Buoy Height (H)	m	4.5
A.2.3.4	Buoy Weight Range (including internal ballast)	kg	81-110
A.2.3.5	Expected Lantern Weight ⁷	kg	15.0
A.2.3.6	Buoy Hull Shell Abrasion Resistance	mg	< 150 mg weight loss after 10,000 cycles
A.2.3.7	Overall Buoy Silhouette	-	Figure A-2.3
A.2.3.8	Threaded lantern supports @200mm Bolt Circle	-	Figure A-2.11
Functional Criteria			
A.2.3.9	Minimum Visual Range ¹ [at max mooring load]	nm	n/a
A.2.3.10	Minimum Radar Range ²	nm	n/a
A.2.3.11	Minimum Radar Cross Sectional Area	m ²	10.0
A.2.3.12	Minimum Visible Height ³ (Hf) [at max mooring load]	m	1.10
A.2.3.13	Can Top	-	Yes
A.2.3.14	Conical Top	-	Optional
A.2.3.15	Retro-Reflective Area (B)	mm	205
A.2.3.16	Buoy Tilt Angle @ Maximum Operational Current	°	6.0
Equipment Requirements			
A.2.3.17	Radar Reflector ⁴	-	Mandatory
A.2.3.18	Lantern Mount ⁵	-	Yes
A.2.3.19	Lantern Type Generally Used	-	3 to 4 nm LED*
Lifting and Mooring Eyes			
A.2.3.20	Minimum Number of Handling Eyes	-	0
A.2.3.21	Minimum Number of Lifting Eyes	-	1
A.2.3.22	Minimum Number of Mooring eyes	-	1
A.2.3.23	Lifting Eye Safe Working Load (SWL)	kg	See Table 7
A.2.3.24	Lifting Assembly Break Load	kg	See Table 7
A.2.3.25	Mooring Eye Break Load	kg	See Table 7
A.2.3.26	Minimum Mooring Eye Internal Diameter	mm	35
A.2.3.27	Maximum Mooring Eye Width	mm	75
A.2.3.28	Minimum Lifting /Handling Eye Internal Diameter	mm	100

A.2.3.29	Minimum/Maximum Mooring Load	kg	200/450
Environmental Conditions			
A.2.3.30	Maximum Marine Growth ⁶ – Operational	kg	20
A.2.3.31	Maximum Current – Operational	knots	2.0
A.2.3.32	Maximum Current – Survival	knots	10.0
A.2.3.33	Ice Accumulation	kg	15
Buoy Markings			
A.2.3.34	Operation Reserve Buoyancy (R_b)	-	Yes

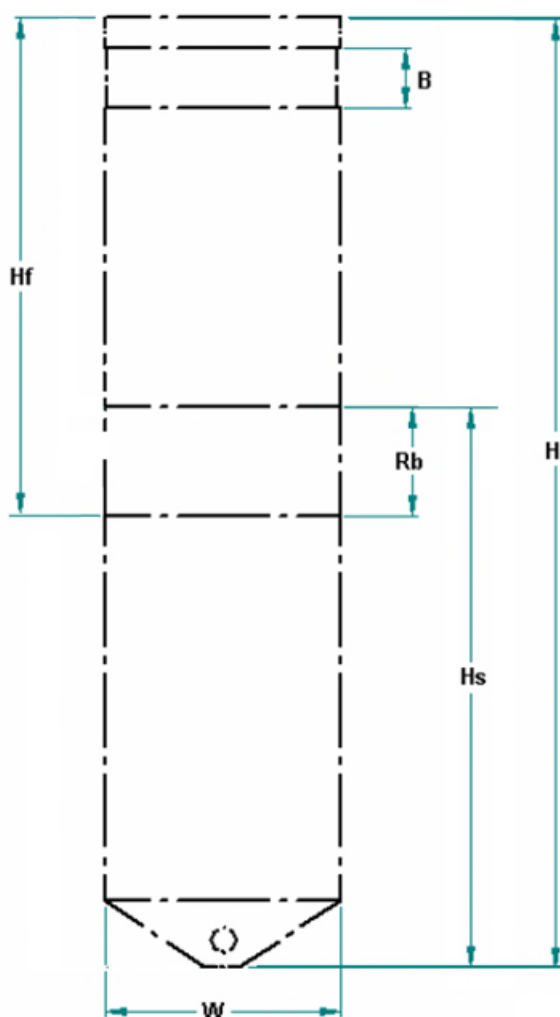


Figure A-2.3: Medium Spar Silhouette

A.2.4 Medium Marker

Item	Dimensional Requirements	Units	Value
A.2.4.1	Minimum / Maximum Hull Diameter (W)	m	0.70/0.80
A.2.4.2	Minimum / Maximum Tower Section Diameter	-	n/a
A.2.4.3	Maximum Buoy Height (H)	m	1.8
A.2.4.4	Buoy Weight Range (including internal ballast)	kg	30 - 37
A.2.4.5	Expected Lantern Weight ⁷	kg	15.0
A.2.4.6	Buoy Hull Shell Abrasion Resistance	mg	< 150 mg weight loss after 10,000 cycles
A.2.4.7	Overall Buoy Silhouette	-	Figure A-2.4
A.2.4.8	Threaded lantern supports @200mm Bolt Circle	-	Figure A-2.11
Functional Criteria			
A.2.4.9	Minimum Visual Range ¹ [at max mooring load]	nm	n/a
A.2.4.10	Minimum Radar Range ²	nm	n/a
A.2.4.11	Minimum Radar Cross Sectional Area	m ²	2.0
A.2.4.12	Minimum Visible Height ³ (Hf) [at max mooring load]	m	0.6
A.2.4.13	Can Top	-	Yes
A.2.4.14	Conical Top	-	Optional
A.2.4.15	Retro-Reflective Area (B)	mm	205
A.2.4.16	Buoy Tilt Angle @ Maximum Operational Current	°	6.0
Equipment Requirements			
A.2.4.17	Radar Reflector ⁴	-	Mandatory
A.2.4.18	Lantern Mount ⁵	-	Optional
A.2.4.19	Lantern Type Generally Used ¹	-	3 to 4 nm LED*
Lifting and Mooring Eyes			
A.2.4.20	Minimum Number of Handling Eyes	-	Optional (0 or 1)
A.2.4.21	Minimum Number of Lifting eyes	-	0
A.2.4.22	Minimum Number of Mooring eyes	-	1
A.2.4.23	Lifting Eye Safe Working Load (SWL)	kg	n/a
A.2.4.24	Lifting Assembly Break Load	kg	n/a
A.2.4.25	Mooring Eye Break Load	kg	n/a
A.2.4.26	Minimum Mooring Eye Internal Diameter	mm	35
A.2.4.27	Maximum Mooring Eye Width	mm	75
A.2.4.28	Minimum Lifting /Handling Eye Internal Diameter	mm	100

A.2.4.29	Minimum/Maximum Mooring Load	kg	75/160
Environmental Conditions			
A.2.4.30	Maximum Marine Growth ⁶ – Operational	kg	20
A.2.4.31	Maximum Current – Operational	knots	2.0
A.2.4.32	Maximum Current – Survival	knots	10.0
A.2.4.33	Ice Accumulation	kg	15
Buoy Markings			
A.2.4.34	Operation Reserve Buoyancy (R_b)	-	Yes

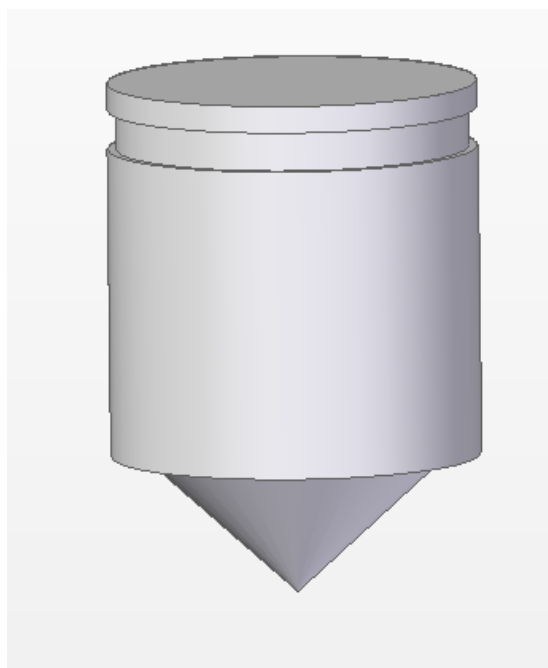
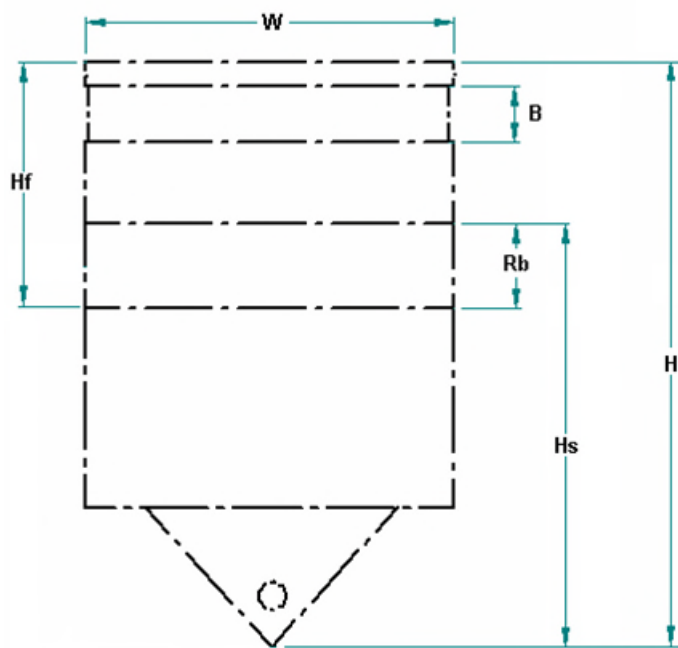


Figure A-2.4: Medium Marker Silhouette

A.2.5 River Buoy

Item	Dimensional Requirements	Units	Value
A.2.5.1	Minimum / Maximum Hull Diameter (W)	m	Fig.2.5 0.75/ 1.3
A.2.5.2	Minimum / Maximum Tower Section Diameter	-	n/a
A.2.5.3	Maximum Buoy Height (H)	m	2.2
A.2.5.4	Buoy Weight Range (including internal ballast)	kg	Fig.2.5 45 - 55
A.2.5.5	Expected Lantern Weight ⁷	kg	5.0
A.2.5.6	Buoy Hull Shell Abrasion Resistance	mg	< 150 mg weight loss after 10,000 cycles
A.2.5.7	Overall Buoy Silhouette	-	Figure A-2.5
A.2.5.8	Threaded lantern supports @150 mm Bolt Circle	-	Figure A-2.11
Functional Criteria			
A.2.5.9	Minimum Visual Range ¹ [at max mooring load]	nm	n/a
A.2.5.10	Minimum Radar Range ²	nm	n/a
A.2.5.11	Minimum Radar Cross Sectional Area	m ²	10.0
A.2.5.12	Minimum Visible Height ³ (Hf) [@ max mooring load]	m	0.5
A.2.5.13	Can Top	-	Yes
A.2.5.14	Conical Top	-	Optional
A.2.5.15	Retro-Reflective Area (B)	mm	155
A.2.5.16	Buoy Tilt Angle @ Maximum Operational Current	°	6.0
Equipment Requirements			
A.2.5.17	Radar Reflector ⁴	-	Mandatory
A.2.5.18	Lantern Mount ⁵	-	Optional
A.2.5.19	Lantern Type Generally Used	-	1.5 to 2 nm LED*
Lifting and Mooring Eyes			
A.2.5.20	Minimum Number of Handling Eyes	-	Optional (0 or 1)
A.2.5.21	Minimum Number of Lifting Eyes	-	1
A.2.5.22	Minimum Number of Mooring eyes	-	2
A.2.5.23	Lifting Eye Safe Working Load (SWL)	kg	See Table 7.
A.2.5.24	Lifting Assembly Break Load	kg	See Table 7
A.2.5.25	Mooring Eye Break Load	kg	See Table 7
A.2.5.26	Minimum Mooring Eye Internal Diameter	mm	35
A.2.5.27	Maximum Mooring Eye Width	mm	75
A.2.5.28	Minimum Lifting /Handling Eye Internal Diameter	mm	45
A.2.5.29	Minimum/Maximum Mooring Load	kg	Fig. 2.5 100/150

Environmental Conditions			
A.2.5.30	Maximum Marine Growth ⁶ – Operational	kg	Fig.2.5 10
A.2.5.31	Maximum Current – Operational	knots	4.0
A.2.5.32	Maximum Current – Survival	knots	10.0
A.2.5.33	Ice Accumulation	kg	15
Buoy Markings			
A.2.5.34	Operation Reserve Buoyancy (R_b)	-	Yes

Figure A-2.5: River Buoy Silhouette

A.2.6 Low Draft River Buoy

Item	Dimensional Requirements	Units	Value
A.2.6.1	Minimum / Maximum Hull Diameter (W)	m	Fig.2.6 n/a/ 1.0
A.2.6.2	Minimum / Maximum Tower Section Diameter	-	n/a
A.2.6.3	Maximum Buoy Height (H)	m	2.2
A.2.6.4	Buoy Weight Range (including internal ballast)	kg	65 - 110
A.2.6.5	Expected Lantern Weight ⁷	kg	5.0
A.2.6.6	Buoy Hull Shell Abrasion Resistance	mg	< 150 mg weight loss after 10,000 cycles
A.2.6.7	Overall Buoy Silhouette	-	Figure A-2.6
A.2.6.8	Threaded lantern supports @150 mm Bolt Circle	-	Figure A-2.11
Functional Criteria			
A.2.6.9	Minimum Visual Range ¹ [at max mooring load]	nm	n/a
A.2.6.10	Minimum Radar Range ²	nm	n/a
A.2.6.11	Minimum Radar Cross Sectional Area	m ²	10.0
A.2.6.12	Minimum Visible Height ³ (Hf) [@ max mooring load]	m	0.5
A.2.6.13	Can Top	-	Yes
A.2.6.14	Conical Top	-	Optional
A.2.6.15	Retro-Reflective Area (B)	mm	155
A.2.6.16	Buoy Tilt Angle @ Maximum Operational Current	°	6.0
Equipment Requirements			
A.2.6.17	Radar Reflector ⁴	-	Mandatory
A.2.6.18	Lantern Mount ⁵	-	Optional
A.2.6.19	Lantern Type Generally Used	-	1.5 to 2 nm LED*
Lifting and Mooring Eyes			
A.2.6.20	Minimum Number of Handling Eyes	-	Optional (0 or 1)
A.2.6.21	Minimum Number of Lifting Eyes	-	0
A.2.6.22	Minimum Number of Mooring eyes	-	1
A.2.6.23	Lifting Eye Safe Working Load (SWL)	kg	See Table 7.
A.2.6.24	Lifting Assembly Break Load	kg	See Table 7
A.2.6.25	Mooring Eye Break Load	kg	See Table 7
A.2.6.26	Minimum Mooring Eye Internal Diameter	mm	35
A.2.6.27	Maximum Mooring Eye Width	mm	75
A.2.6.28	Minimum Lifting /Handling Eye Internal Diameter	mm	45
A.2.6.29	Minimum/Maximum Mooring Load	kg	Fig.2.6 0/50

Environmental Conditions			
A.2.6.30	Maximum Marine Growth ⁶ – Operational	kg	Fig.2.6 10
A.2.6.31	Maximum Current – Operational	knots	4.0
A.2.6.32	Maximum Current – Survival	knots	10.0
A.2.6.33	Ice Accumulation	kg	15
Buoy Markings			
A.2.6.34	Operation Reserve Buoyancy (R_b)	-	Yes

Figure A-2.6: Low Draft River Buoy Silhouette

A.2.7 Medium-Large Marker

Item	Dimensional Requirements	Units	Value
A.2.7.1	Minimum / Maximum Hull Diameter (W)	m	0.81 /1.0
A.2.7.2	Minimum / Maximum Tower Section Diameter	-	n/a
A.2.7.3	Maximum Buoy Height (H_s)	m	2.0
A.2.7.4	Buoy Weight Range (including internal ballast)	kg	60 - 70
A.2.7.5	Expected Lantern Weight ⁷	kg	15.0
A.2.7.6	Buoy Hull Shell Abrasion Resistance	mg	< 150 mg weight loss after 10,000 cycles
A.2.7.7	Overall Buoy Silhouette		Figure A-2.7
A.2.7.8	Threaded lantern supports @200mm Bolt Circle	-	Figure A-2.11
Functional Criteria			
A.2.7.9	Minimum Visual Range ¹ [at max mooring load]	nm	n/a
A.2.7.10	Minimum Radar Range ²	nm	n/a
A.2.7.11	Minimum Radar Cross Sectional Area	m ²	10.0
A.2.7.12	Minimum Visible Height ³ (H_f) [@ max mooring load]	m	1.0
A.2.7.13	Can Top	-	Yes
A.2.7.14	Conical Top	-	Optional
A.2.7.15	Retro-Reflective Area (B)	mm	205
A.2.7.16	Buoy Tilt Angle @ Maximum Operational Current	°	6.0
Equipment Requirements			
A.2.7.17	Radar Reflector ⁴	-	Mandatory
A.2.7.18	Lantern Mount ⁵	-	Optional
A.2.7.19	Lantern Type Generally Used	-	3 to 4 nm LED*
Lifting and Mooring Eyes			
A.2.7.20	Minimum Number of Handling Eyes	-	Optional (0 or 1)
A.2.7.21	Minimum Number of Lifting Eyes	-	0
A.2.7.22	Minimum Number of Mooring eyes	-	1
A.2.7.23	Lifting Eye Safe Working Load (SWL)	kg	n/a
A.2.7.24	Lifting Assembly Break Load	kg	n/a
A.2.7.25	Mooring Eye Break Load	kg	n/a
A.2.7.26	Minimum Mooring Eye Internal Diameter	mm	40
A.2.7.27	Maximum Mooring Eye Width	mm	55
A.2.7.28	Minimum Lifting /Handling Eye Internal Diameter	mm	n/a
A.2.7.29	Minimum/Maximum Mooring Load	kg	150/300
Environmental Conditions			

A.2.7.30	Maximum Marine Growth ⁶ – Operational	kg	20
A.2.7.31	Maximum Current – Operational	knots	2.0
A.2.7.32	Maximum Current – Survival	knots	10.0
A.2.7.33	Ice Accumulation	kg	15
Buoy Markings			
A.2.7.34	Operation Reserve Buoyancy (R_{ω})	-	Yes

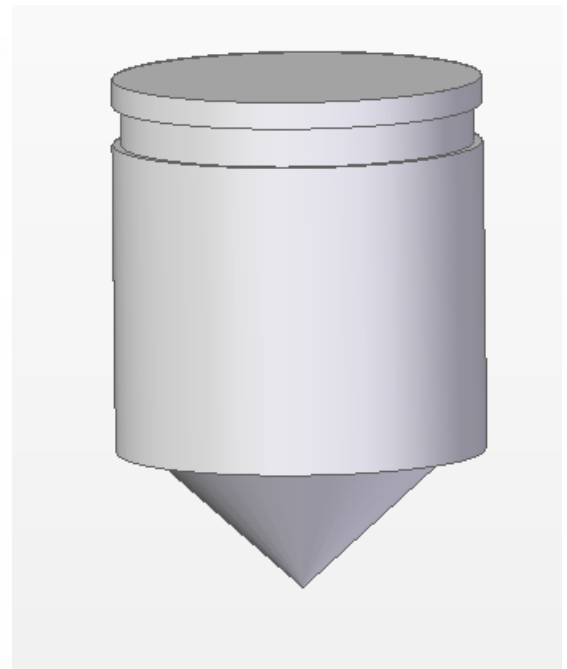
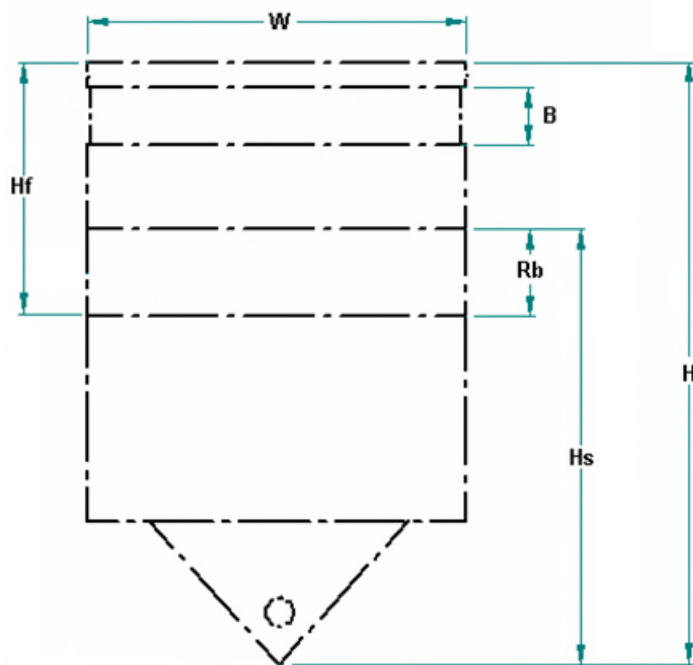


Figure A-2.7: Medium-Large Marker Silhouette

A.2.8 Large Marker

Item	Dimensional Requirements	Units	Value
A.2.8.1	Minimum / Maximum Hull Diameter (W)	m	1.1 /1.3
A.2.8.2	Minimum / Maximum Tower Section Diameter	-	n/a
A.2.8.3	Maximum Buoy Height (H _s)	m	2.4
A.2.8.4	Buoy Weight Range (including internal ballast)	kg	110 - 140
A.2.8.5	Expected Lantern Weight ⁷	kg	15.0
A.2.8.6	Buoy Hull Shell Abrasion Resistance	mg	< 150 mg weight loss after 10,000 cycles
A.2.8.7	Overall Buoy Silhouette	-	Figure A-2.8
A.2.8.8	Threaded lantern supports @200mm Bolt Circle	-	Figure A-2.11
Functional Criteria			
A.2.8.9	Minimum Visual Range ¹ [at max mooring load]	nm	n/a
A.2.8.10	Minimum Radar Range ²	nm	n/a
A.2.8.11	Minimum Radar Cross Sectional Area	m ²	10.0
A.2.8.12	Minimum Visible Height ³ (H _f) [@ max mooring load]	m	1.0
A.2.8.13	Can Top	-	Yes
A.2.8.14	Conical Top	-	Optional
A.2.8.15	Retro-Reflective Area (B)	mm	205
A.2.8.16	Buoy Tilt Angle @ Maximum Operational Current	°	6.0
Equipment Requirements			
A.2.8.17	Radar Reflector ⁴	-	Mandatory
A.2.8.18	Lantern Mount ⁵	-	Optional
A.2.8.19	Lantern Type Generally Used	-	3 to 4 nm LED*
Lifting and Mooring Eyes			
A.2.8.20	Minimum Number of Handling Eyes	-	Optional (0 or 1)
A.2.8.21	Minimum Number of Lifting Eyes	-	0
A.2.8.22	Minimum Number of Mooring eyes	-	1
A.2.8.23	Lifting Eye Safe Working Load (SWL)	kg	n/a
A.2.8.24	Lifting Assembly Break Load	kg	n/a
A.2.8.25	Mooring Eye Break Load	kg	n/a
A.2.8.26	Minimum Mooring Eye Internal Diameter	mm	40
A.2.8.27	Maximum Mooring Eye Width	mm	55
A.2.8.28	Minimum Lifting /Handling Eye Internal Diameter	mm	n/a
A.2.8.29	Minimum/Maximum Mooring Load	kg	200/500
Environmental Conditions			

A.2.8.30	Maximum Marine Growth ⁶ – Operational	kg	20
A.2.8.31	Maximum Current – Operational	knots	2.0
A.2.8.32	Maximum Current – Survival	knots	10.0
A.2.8.33	Ice Accumulation	kg	15
Buoy Markings			
A.2.8.34	Operation Reserve Buoyancy (R_{ω})	-	Yes

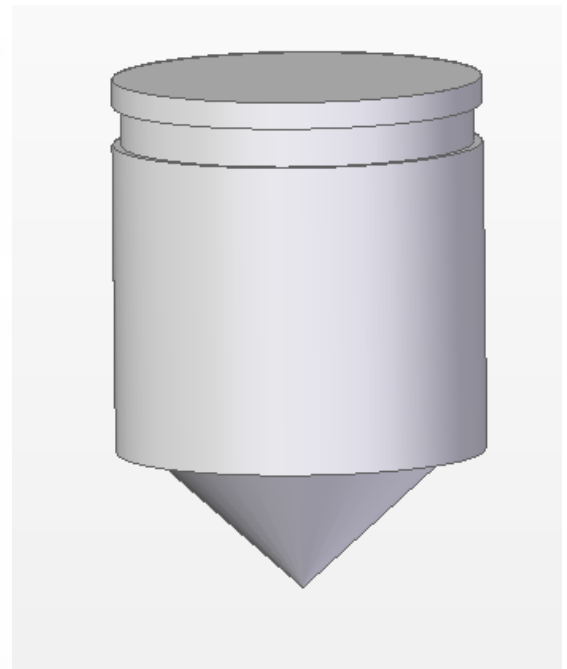
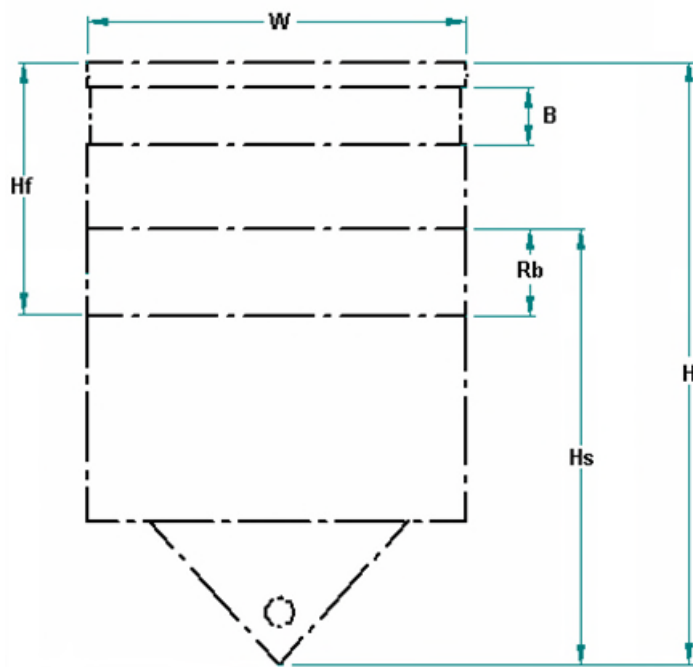


Figure A-2.8: Large Marker Silhouette

A.2.9 Pillar Buoy

Item	Dimensional Requirements	Units	Value
A.2.9.1	Minimum / Maximum Hull Section Diameter (W2)	m	1.4 /1.50
A.2.9.2	Minimum / Maximum Tower Section Diameter (W1)	m	0.5 /0.7
A.2.9.3	Maximum Buoy Height (H)	m	2.4
A.2.9.4	Buoy Weight Range (including internal ballast)	kg	235 - 287
A.2.9.5	Expected Lantern Weight ⁷	kg	15.0
A.2.9.6	Buoy Hull Shell Abrasion Resistance	mg	< 150 mg weight loss after 10,000 cycles
A.2.9.7	Overall Buoy Silhouette	-	Figure A-2.9
A.2.9.8	Threaded lantern supports @200mm Bolt Circle	-	Figure A-2.11
Functional Criteria			
A.2.9.9	Minimum Visual Range ¹ [at max mooring load]	nm	n/a
A.2.9.10	Minimum Radar Range ²	nm	n/a
A.2.9.11	Minimum Radar Cross Sectional Area	m ²	10.0
A.2.9.12	Minimum Visible Height ³ (Hf) [at max mooring load]	m	1.0
A.2.9.13	Can Top	-	Yes
A.2.9.14	Conical Top	-	Optional
A.2.9.15	Retro-Reflective Area (B)	mm	155
A.2.9.16	Buoy Tilt Angle @ Maximum Operational Current	°	6.0
Equipment Requirements			
A.2.9.17	Radar Reflector ⁴	-	Mandatory
A.2.9.18	Lantern Mount ⁵	-	Yes
A.2.9.19	Lantern Type Generally Used ¹	-	3 to 4 nm LED*
Lifting and Mooring Eyes			
A.2.9.20	Minimum Number of Steering Eyes	-	1
A.2.9.21	Minimum Number of Lifting Eyes	-	1
A.2.9.22	Minimum Number of Mooring eyes	-	1
A.2.9.23	Lifting Eye Safe Working Load (SWL)	kg	See Table 7.
A.2.9.24	Lifting Assembly Break Load	kg	See Table 7.
A.2.9.25	Mooring Eye Break Load	kg	See Table 7.
A.2.9.26	Minimum Mooring Eye Internal Diameter	mm	40
A.2.9.27	Maximum Mooring Eye Width	mm	55
A.2.9.28	Minimum Lifting /Handling Eye Internal Diameter	mm	100
A.2.9.29	Minimum/Maximum Mooring Load	kg	180/540
Environmental Conditions			
A.2.9.30	Maximum Marine Growth ⁶ – Operational	kg	20

A.2.9.31	Maximum Current – Operational	knots	2.0
A.2.9.32	Maximum Current – Survival	knots	10.0
A.2.9.33	Ice Accumulation	kg	20

Buoy Markings

A.2.9.34	Operation Reserve Buoyancy (R_b)	-	Yes
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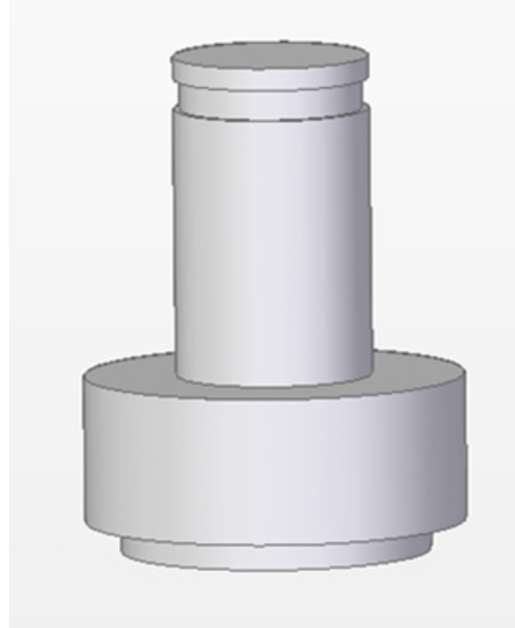
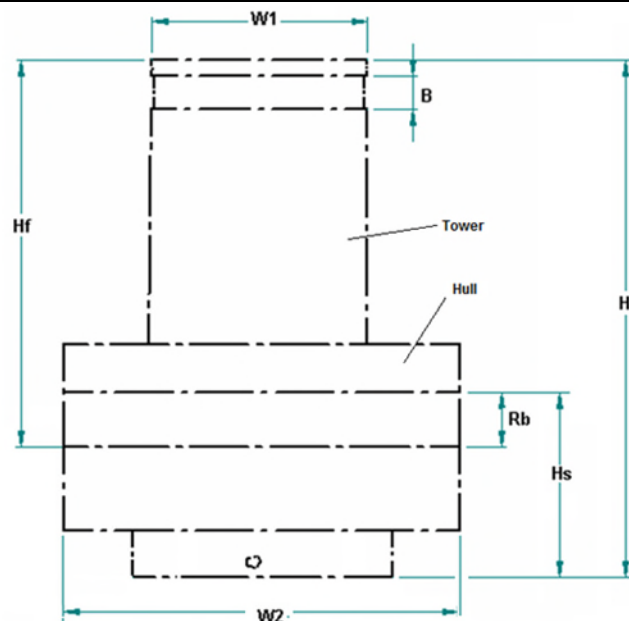


Figure A-2.9: Pillar Buoy Silhouette

A.2.10 Funnel Marker

Item	Dimensional Requirements	Units	Value
A.2.10.1	Minimum / Maximum Hull Diameter (W1)	m	0.80/1.00
A.2.10.2	Minimum / Maximum Tower Section Diameter(W2)	-	0.2/ 0.4
A.2.10.3	Maximum Buoy Height (H)	m	1.30
A.2.10.4	Buoy Weight Range (including internal ballast)	kg	15-23
A.2.10.5	Expected Lantern Weight ⁷	kg	5.0
A.2.10.6	Buoy Hull Shell Abrasion Resistance	mg	< 150 mg weight loss after 10,000 cycles
A.2.10.7	Overall Buoy Silhouette	-	Figure A-2.10
A.2.10.8	Threaded lantern supports @150mm Bolt Circle	-	Figure A-2.11
Functional Criteria			
A.2.10.9	Minimum Visual Range ¹ [at max mooring load]	nm	n/a
A.2.10.10	Minimum Radar Range ²	nm	n/a
A.2.10.11	Minimum Radar Cross Sectional Area	m ²	2.0
A.2.10.12	Minimum Visible Height ³ (Hf) [@ max mooring load]	m	0.50
A.2.10.13	Can Top	-	Yes
A.2.10.14	Conical Top	-	Optional
A.2.10.15	Retro-Reflective Area (B)	mm	50
A.2.10.16	Buoy Tilt Angle @ Maximum Operational Current	°	6.0
Equipment Requirements			
A.2.10.17	Radar Reflector ⁴	-	Optional
A.2.10.18	Lantern Mount ⁵	-	Optional
A.2.10.19	Lantern Type Generally Used	-	1.5 to 2 nm LED*
Lifting and Mooring Eyes			
A.2.10.20	Minimum Number of Handling Eyes	-	Optional (0 or 1)
A.2.10.21	Minimum Number of Lifting eyes	-	1
A.2.10.22	Minimum Number of Mooring eyes	-	1
A.2.10.23	Lifting Eye Safe Working Load (SWL)	kg	See Table 7
A.2.10.24	Lifting Assembly Break Load	kg	See Table 7
A.2.10.25	Mooring Eye Break Load	kg	See Table 7
A.2.10.26	Minimum Mooring Eye Internal Diameter	mm	35
A.2.10.27	Maximum Mooring Eye Width	mm	35
A.2.10.28	Minimum Lifting /Handling Eye Internal Diameter	mm	35
A.2.10.29	Minimum/Maximum Mooring Load	kg	10/ 90
Environmental Conditions			

A.2.10.30	Maximum Marine Growth ⁶ – Operational	kg	5
A.2.10.31	Maximum Current – Operational	knots	2.0
A.2.10.32	Maximum Current – Survival	knots	10.0
A.2.10.33	Ice Accumulation	kg	5
Buoy Markings			
A.2.10.34	Operation Reserve Buoyancy (R_{∞})	-	Yes

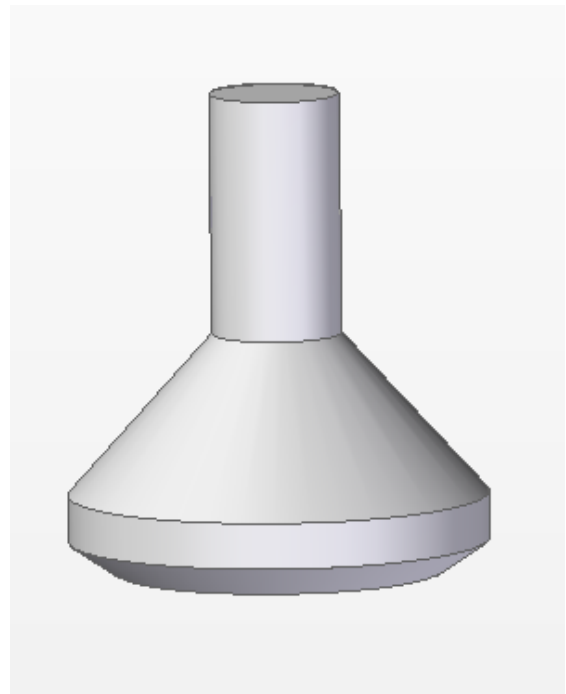
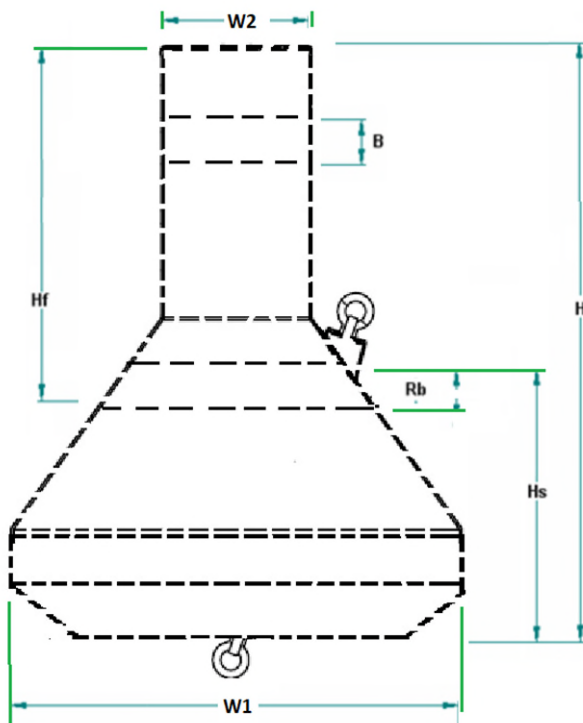


Figure A-2.106: Small Funnel Buoy Silhouette

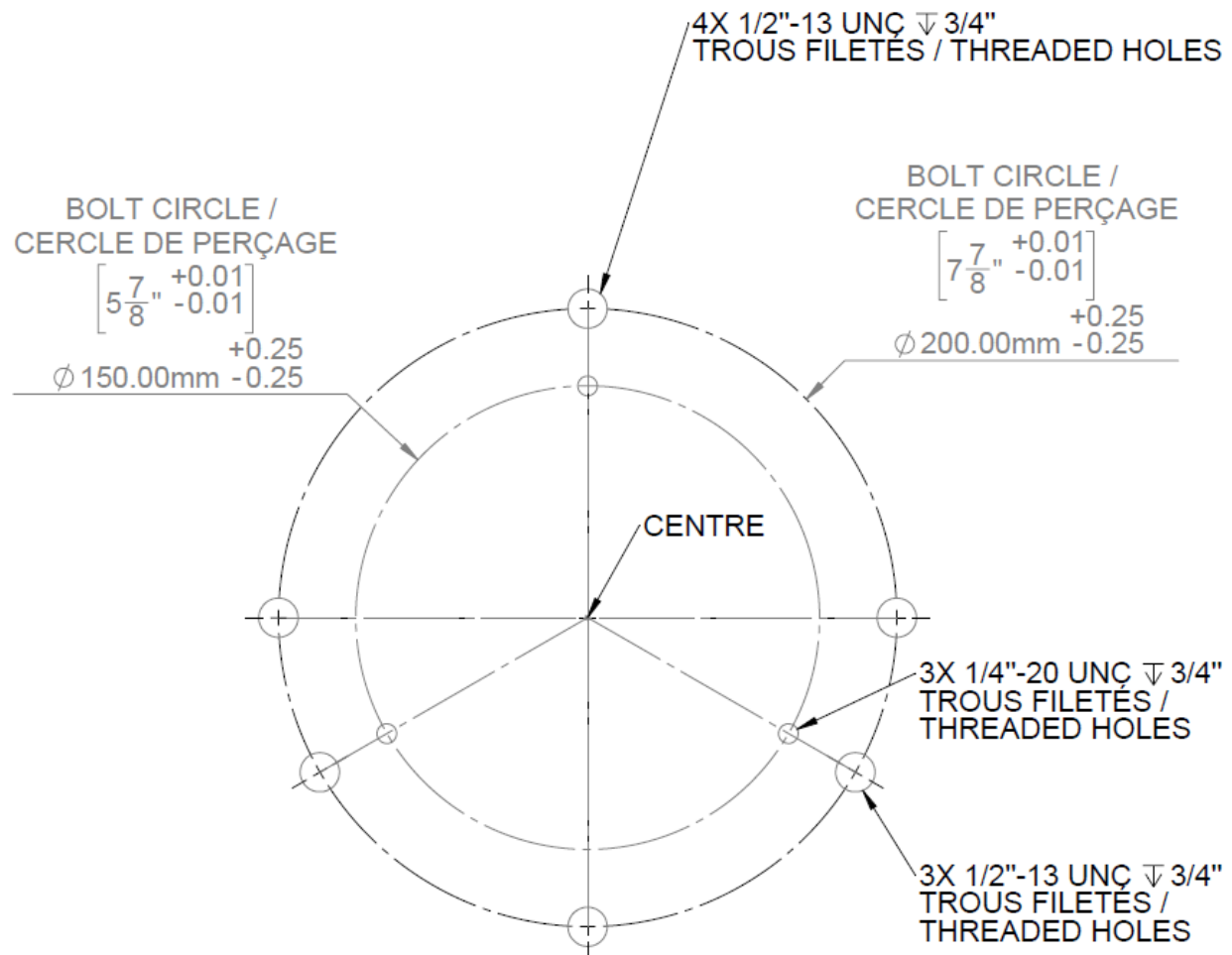
* LED: Light Emitting Diode

† River Buoy Silhouette

‡ Low Draft River Buoy Silhouette

- 1) Visual Range assumes that the observer is 3m above the water level in clear weather with calm seas and an nominal visibility of 10 nautical miles. It is also assumed that there are no background features to obscure the buoy.
- 2) Radar Range assumes an X-Band radar antenna 3m above the water level in clear weather and calm seas.
- 3) Visible height is defined as the distance from the waterline to the top of the buoy. The waterline calculated in the delivered condition when floated in fresh water, including radar reflector and excluding the mooring.
- 4) Radar Reflectors, where required shall be internally mounted.
- 5) Lantern Mount, where required shall allow for the mounting of a self-contained LED lantern at the top of the buoy without interference with the lifting eyes.
- 6) Marine growth includes any accumulated annual marine growth on the buoy or chain.
- 7) Expected lantern weight does not include the weight of the adaptor plate or any interface to the top of the buoy.

A.2.11 Lantern Bolt Pattern



CCG STANDARD MOUNTING PATTERNS /
CERCLES DE MONTAGE STANDARDS DE LA GCC

Figure A-2.11: Threaded Lantern Area

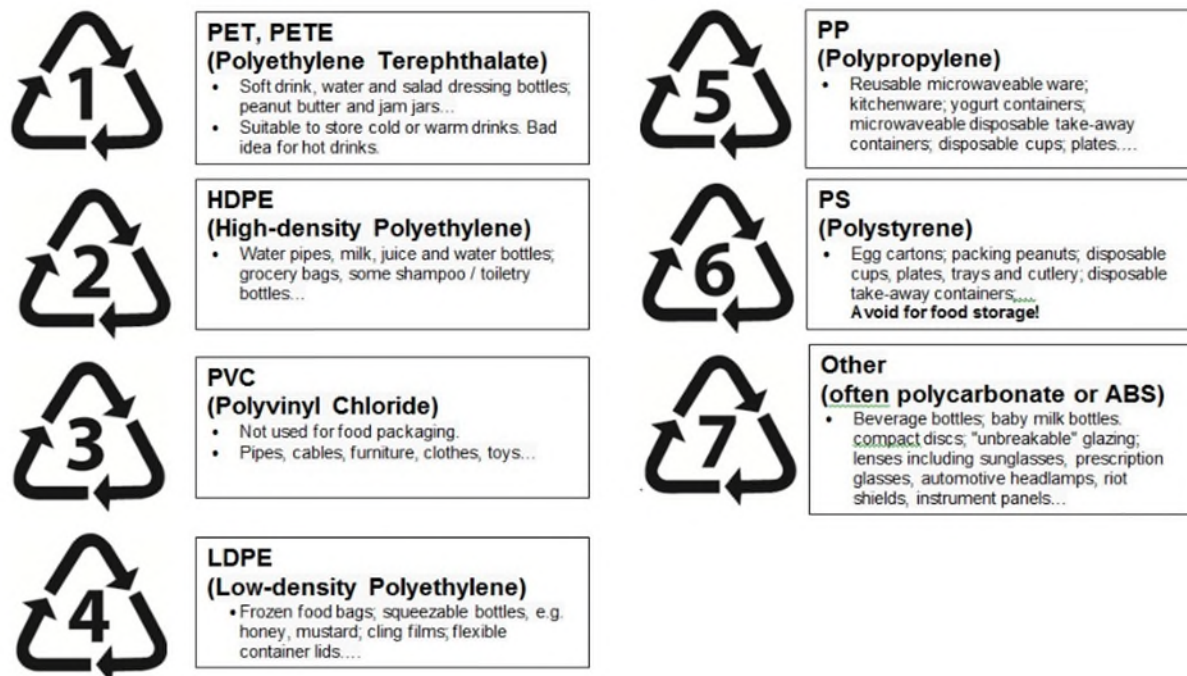


Figure A-2. 12: Typical Plastic recycling marks

APPENDIX B REFERENCED STANDARDS

The documents listed in this appendix are to be referenced in Section 2 of this specification. This section does not include documents cited in other sections of this specification. The following is a sample list of standards to adhere to in the manufacturing of these buoys. Vendors/manufacturers are to meet the most recent version of each standard.

Table 14: Referenced Standards and Tests for Plastic

1.	ASTM D4020	Standard Specification for Ultra-High-Molecular-Weight Polyethylene Molding and Extrusion Materials
2.	MIL-P-24249A(1)	Plastic Material, Cellular Polyurethane, Foam in Place, Rigid Void Filler, Foam-in-place Large scale and installation.
3.	ASTM D3350	Standard Specification for Polyethylene Plastics Pipe and Fittings Materials
4.	ASTM A123/123M	Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
5.	ASTM D4976	Standard Specification for Polyethylene Plastics Moulding and Extrusion Materials
6.	ASTM D3935	Standard Specification for Polycarbonate (PC) Unfilled and Reinforced Material
7.	ISO 9352	Plastics-Determination of resistance to wear by abrasive wheels,
8.	ASTM D2412	Standard Test Method for Determination of External Loading Characteristics of Plastic Pipe by Parallel-Plate Loading

Table 15: Referenced Standards for Metals

9.	ASTM A36	Standard Specification for Carbon Structural Steel
10.	ASTM A276	Standard Specification for Stainless Steel Bars and Shapes
11.	ASTM B209	Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
12.	ASTM B221	Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes

Table 16: Referenced Standards for Concrete

13.	CAN/CSA –A23.1	Concrete Materials and Methods of Concrete Construction
14.	ASTM C33	Standard Specification for Concrete Aggregates
15.	ASTM C150	Standard Specification for Portland Cement

Table 17: Referenced Standards for Colour

16.	IALA E-108	Recommendations for the surface colours used as visual signals on aids to navigation
17.	ASTM D2244	Standard Practice for Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates
18.	ASTM D2565	Standard Practice for Xenon-Arc Exposure of Plastics Intended for Outdoor Applications

19	IALA V-128	Technical Performance Requirements for VTS Systems
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Table 18: Miscellaneous Departmental Publications

20.	TP-968 E/F	The Canadian Aids to Navigation System.
21	Schedule I	Canadian Environmental Protection Act (CEPA) Toxic Substance list
22	Schedule 6	Transport Canada SOR-2007-128 -Tackle Regulations

APPENDIX C DEFINITIONS

Table 19: General Definitions

Draft	The vertical distance between the waterline and the bottom most part of the buoy, usually expressed in meters. Maximum draft - is obtained when the <i>Reserve Buoyancy</i> is zero Minimum draft - is obtained when the <i>Reserve Buoyancy</i> is at its greatest
Visible Height	The vertical distance from the waterline to the top of the buoy. Maximum Visible Height - is obtained when the minimum mooring mass is used and highest available reserve buoyancy. Minimum Visible Height - is obtained when the recommended maximum mooring mass is used and lowest available reserve buoyancy.
Operational Surcharge Load	Sum of all loads incurred in service, i.e. marine growth and ice accumulation. Maximum values to be used for design are defined in Appendix A for each buoy type.
Reserve Buoyancy (Rb)	Defined as difference in buoyancy between minimum and maximum design waterline levels depending on overall mooring mass conditions.
Plastic	Synthetic organic polymer material capable of being moulded, formed, extruded, or cast into various shapes.
Safe Working Load (SWL)	The Safe Working Load (SWL) is a safety factor imposed onto a lifting mechanism and is dictated by ref.22.
Survival Environmental Conditions	Environmental conditions over and above the specified performance requirements in which the buoy is capable of functioning once operational conditions return without damage.
Waterline	The line of water along the buoy hull in the water.
Undamaged Condition	Undamaged means a buoy in good condition retaining its original shape and a watertight hull. The buoy must be recognizable as an aid to navigation in all operational conditions defined herein.
Damaged Condition	Damaged means a buoy can no longer perform as an aid to navigation in the prescribed operational conditions.
Buoy Tilt Angle	The Buoy's tilt angle (α) is defined as the angle that is swept from vertical.

Ice Exposure	<p>Ice exposure is the frequency at which a buoy may come in contact with particles of ice.</p> <p>Light exposure is when buoys that are left in sheltered areas over the winter see some ice formation on the water but where there is no ice movement.</p> <p>Occasional exposure indicates that these buoys may come in contact with ice fragments at the end of the navigation season.</p>
Ice Accumulation	The load on a buoy surface as a result of ice buildup.
Operational Load	Mass that includes the weight of the mooring chain, lantern external counterweights, accumulated sea growth and ice accumulation and excludes the anchor weight.
Damage	A damaged buoy is one that has been compromised and no longer functions as a Navigational Aid. It no longer displays the correct visible height above water or tilts heavily such that the lantern light is not very visible by mariners at night.
Modular	A modular buoy is a buoy where at a minimum the hull and the tower sections of the buoy are separate pieces that are structurally joined together via a supporting frame.

Table 20: Definitions: Hardware

Handling Eye	An attachment point above the water line that may be part of or separate from the buoy hull that can be grappled and facilitates buoy handling activities; not rated for lifting.
Lifting Eye	An attachment point above the water line rated to lift the maximum buoy and mooring assembly loads.
Mooring Eye	An attachment point below the water line, to which the mooring is connected, rated to lift the maximum mooring assembly loads.
Lifting Assembly	The lifting assembly is composed of the <i>Lifting Eye(s)</i> , the <i>Mooring Eye</i> , and a mechanical linkage connecting the two or more components. The full assembly is rated to lift the maximum loads with the safety allowance.

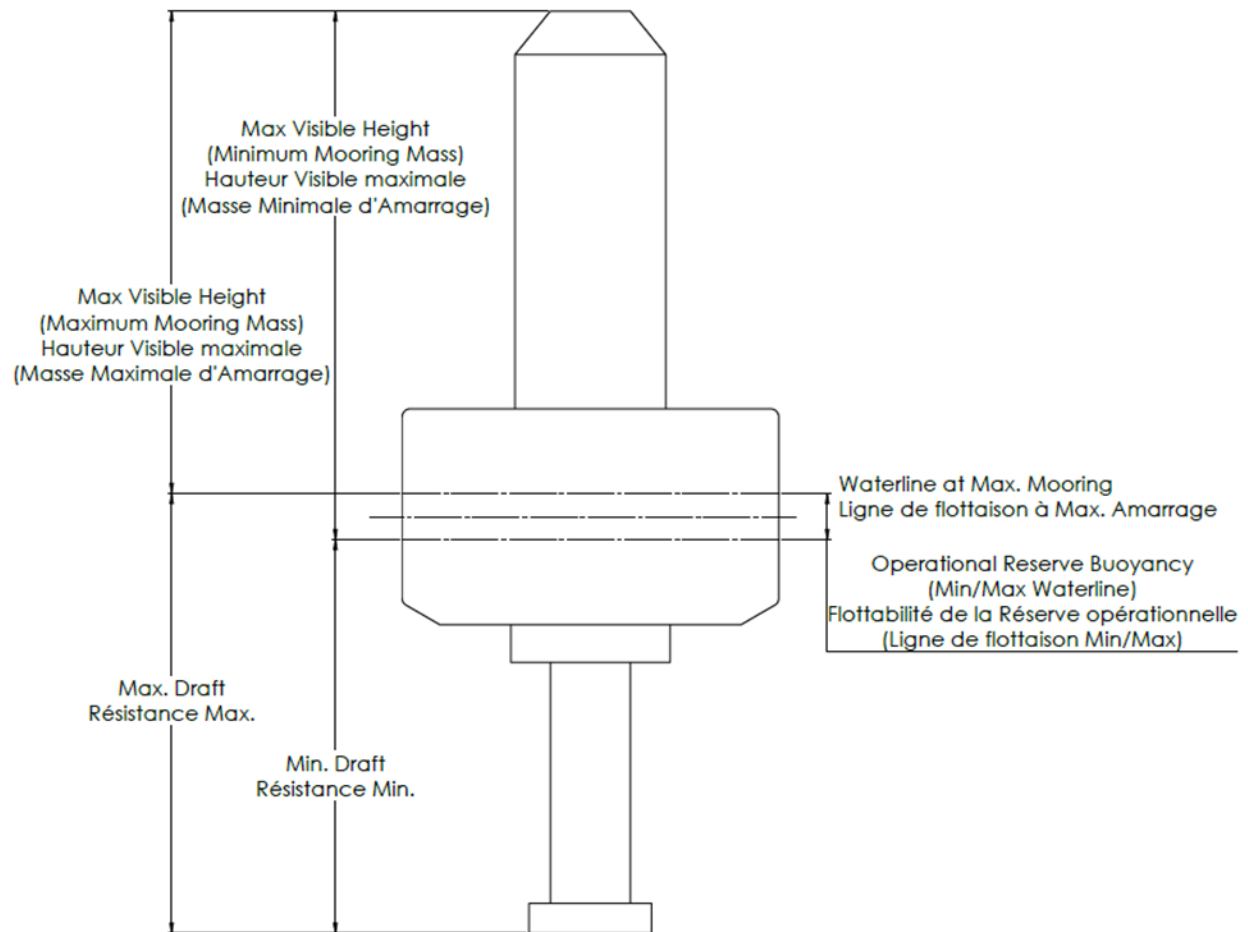


Figure A-2.7: Buoy Terminology

Solicitation No. - N° de l'invitation
F7047-231212/B

Client Ref. No. - N° de réf. du client
F7047-231212-008ERD

Amd. No. - N° de la modif.

File No. - N° du dossier
F7047-231212-008ERD

Buyer ID - Id de l'acheteur
008ERD

CCC No./N° CCC - FMS No./N° VME

ANNEX "C"

BASIS OF PAYMENT

There are ten configurations of the Plastic Buoys

The Offeror must provide firm unit prices for each configuration within each category they are submitting an offer for;

- a.

All prices must be in Canadian currency;
- b.

All prices must include customs duties;
- c.

All prices must not include Applicable Taxes;
- d.

Offerors must submit firm unit prices for each item per category(Total 10 Categories) that they are offering on listed below to be given further consideration.
A financial offer addressing only a portion of the offered requirement will be declared non-responsive
- e.

The Offeror is requested to insert "\$0.00" for any cost of the cost elements for which it does not intend to charge - If any cost element is left blank, Canada will insert "\$0.00" for that element; and

Note 1: all Quantities contained in the tables below represent estimates and will be used for Evaluation purposes ONLY

Note 2: These italicized Instructions to Offerors will not be included in any resulting offer.

Solicitation No. - N° de l'invitation
F7047-231212/B
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F7047-231212-008ERD

Amd. No. - N° de la modif.
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F7047-231212-008ERD

Buyer ID - Id de l'acheteur
008ERD
CCC No./N° CCC - FMS No./N° VME

Buyer ID - Id de l'acheteur
008ERD
CCC No./N° CCC - FMS N

Table 2-Category 2: Small Marker with hull diameters of 0.35 to 0.55 metres (estimated quantities are for evaluation purposes only and will be deleted when the standing offer is issued)

			With the delivery to CCG St. John's Base, Newfoundland	With the delivery to CCG Dartmouth, Nova Scotia	With the delivery to CCG Charlottetown, Prince Edward Island	With the delivery to CCG Québec City, Québec	With the delivery to CCG Sorel Base, Quebec	With the delivery to CCG Parry Sound, Ontario	With the delivery to CCG Prescott Base, Ontario	With the delivery to CCG Hay River Base, Northwest Territories	With the delivery to CCG Victoria Base, British Columbia	With the delivery to CCG Seal Cove Base, Prince Rupert, British Columbia	With the delivery to CCG Selkirk Base, Manitoba												
			QTY A	Price B	QTY C	Price D	QTY E	Price F	QTY G	Price H	QTY I	Price J	QTY K	Price L	QTY M	Price N	QTY O	Price P	QTY Q	Price R	QTY S	Price T	QTY U	Price V	Extended Price W
Year 1	Description	Colour	1		55		55		10		10		10		10		1		1		1		1		W1 \$
			1		1		1		1		1		1		1		1		1		1		1		W2 \$
Year 2	Description	Colour	1		55		55		10		10		10		10		1		1		1		1		W3 \$
			1		1		1		1		1		1		1		1		1		1		1		W4 \$
Option Year 1	Description	Colour	1		55		55		10		10		10		10		1		1		1		1		W5 \$
			1		1		1		1		1		1		1		1		1		1		1		W6 \$
			Category 2 Evaluated Price =The sum of Extended Price W of Year 1 , Year 2 and Option Year 1 (W1 to W6)																					W7 \$	

Solicitation No. - N° de l'invitation
F7047-231212/B
Client Ref. No. - N° de réf. du client
F7047-231212-008ERD

Amd. No. - N° de la modif.
File No. - N° du dossier
F7047-231212-008ERD

Buyer ID - Id de l'acheteur
008ERD
CCC No./N° CCC - FMS No./N° VME

Table 4-Category 4: Medium Marker with hull diameters of 0.70 to 0.80 metres (estimated quantities are for evaluation purposes only and will be deleted when the standing offer is issued)

			With the delivery to CCG St. John's Base, Newfoundland	With the delivery to CCG Dartmouth, Nova Scotia	With the delivery to CCG Charlottetown, Prince Edward Island	With the delivery to CCG Québec City, Québec	With the delivery to CCG Sorel Base, Quebec	With the delivery to CCG Parry Sound, Ontario	With the delivery to CCG Prescott Base, Ontario	With the delivery to CCG Hay River Base, Northwest Territories	With the delivery to CCG Victoria Base, British Columbia	With the delivery to CCG Seal Cove Base, Prince Rupert, British Columbia	With the delivery to CCG Selkirk Base, Manitoba												
			QTY A	Price B	QTY C	Price D	QTY E	Price F	QTY G	Price H	QTY I	Price J	QTY K	Price L	QTY M	Price N	QTY O	Price P	QTY Q	Price R	QTY S	Price T	QTY U	Price V	Extended Price W
Year 1	Medium Marker with hull diameters of 0.70 to 0.80 metres	One Colour	1		1		1		10		2		1		10		5		5		W1 \$				
		Multicolour	1		1		1		1		1		1		1		1		1		W2 \$				
Year 2	Medium Marker with hull diameters of 0.70 to 0.80 metres	One Colour	1		1		1		10		2		1		10		5		5		W3 \$				
		Multicolour	1		1		1		1		1		1		1		1		1		W4 \$				
Option Year 1	Medium Marker with hull diameters of 0.70 to 0.80 metres	One Colour	1		1		1		10		2		1		10		5		5		W5 \$				
		Multicolour	1		1		1		1		1		1		1		1		1		W6 \$				
			Category 4 Evaluated Price =The sum of Extended Price W of Year 1 , Year 2 and Option Year 1 (W1 to W6)																					W7 \$	

