AN OWNER'S GUIDE TO PRIVATE AIDS TO NAVIGATION

Canadian Coast Guard
2001 Edition

Established under the authority of the Canada Shipping Act

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The Canadian Aids to Navigation System

GENERAL

In Canada, it is permissible for private individuals, organizations, corporations or other groups to establish aids to navigation for their own use. Such aids to navigation are known as "private aids". More specifically, as defined by the ***Private Buoy Regulations*** a private aid includes any aid to navigation or mooring buoy which is not owned by a Federal or Provincial government or agency

The Canadian Coast Guard recognizes the value of these aids in contributing to the safety and well-being of the boating community, particularly in areas where Coast Guard policy or resource limitations do not allow for a public aids to navigation service. This guide has been created in an attempt to assist private owners in understanding the related legislation, requirements and responsibilities involved with the establishment of a private aid to navigation. In the end it is felt that the better the adherence to the basic rules of the Canadian aids to navigation system, the better the system will be for all boaters.

It is not necessary to obtain the Coast Guard's permission to place or operate a private aid to navigation; however, all who propose to do so must ensure that such aids conform to both the ***Private Buoy Regulations*** and, in cases where boating is restricted, the ***Boating Restriction Regulations***.

NOTE: A construction worksheet has been included at the end of the text. This worksheet may be referred to and filled in as you proceed through the guide.

THE CANADIAN AIDS TO NAVIGATION SYSTEM

The Canadian Coast Guard publication ***The Canadian Aids to Navigation System*** (TP 968) provides in depth information on standardized uses, colours, shapes, and identification of aids to navigation within the Canadian aids to navigation system. All those interested in establishing a private aid to navigation are therefore urged to consult this text. ***The Canadian Aids to Navigation System*** may be purchased from any authorized government distributor, or by writing to:

Canadian Government Publishing PWC/GSC
Ottawa, Ontario
K1A 0S9
tel. (819) 956-4800
fax (819) 994-1498

PRIVATE BUOY REGULATIONS

The ***Canada Shipping Act, Private Buoy Regulations*** apply to all private buoys placed for the purpose of navigation or mooring with the exception of those which are used to mark fishing apparatus. These Regulations have been enacted to ensure that Canadian private buoys conform to accepted International and Coast Guard standards. In situations in which a private buoy does not meet such standards, Coast Guard is authorized to affect its removal or repair in accordance with the Regulations.

Very generally, the main principles of this Regulation include:

1. No person shall place in any water a private buoy that interferes with or is likely to interfere with the navigation of any vessel, or that misleads or is likely to mislead any vessel.

2. No person shall place a private buoy in any water unless all size, shape and identification requirements are met (see section on Markings and Dimensions on Page 9). The owner of the private buoy must also ensure that any required information is accurate at all times.

3. All private buoys must conform to those standards and guidelines as set out in ***The Canadian Aids to Navigation System*** (TP 968), as amended from time to time.

4. The Minister may require any change to be made to a private buoy, including an increase in minimum dimensions or the addition of retroreflective material, in any case where there is a need for improved visibility or better identification.

5. The buoy's anchor shall be constructed and maintained in a manner and with materials that ensure that it remains in position.

6. Every lighted buoy shall exhibit those light characteristics as required by Coast Guard and as specified in ***The Canadian Aids to Navigation System*** (TP 968) during the hours of darkness.

7. The Minister may remove from any water a private buoy that does not comply with these Regulations.

Under the ***Canada Shipping Act***, persons failing to follow the legislated guidelines are liable on summary conviction to fines of up to $200. In the event of an accident, private owners may also be found liable for any damages resulting from negligent operation and/or maintenance of the aid to navigation.

NOTE: Consult the full text of the Regulations for further details.

BOATING RESTRICTION REGULATIONS

Regulations have also been enacted under the ***Canada Shipping Act***, which govern the marking of any private aid to navigation used for the purpose of restricting navigation (i.e. speed limits, keep-out areas). Under the ***Boating Restriction Regulations,*** requests for restrictions originate at the local level and are then transmitted for review by the designated provincial or federal authority before being forwarded to the Department of Fisheries and Oceans (Office of Boating Safety) for final review and subsequent publication in the Regulations. Once approved these restrictions are enforceable by law.

The main principles in terms of the establishment of private aids to navigation include:

1. No person shall place or remove a sign which restricts the operation of any vessel in Canadian waters without first receiving authorization from the Minister responsible. Any buoy or sign which is placed must comply with the requirements as set out in the Regulations.

2. No person shall alter, conceal, damage or destroy any authorized sign and shall not use such signs for mooring purposes.

3. No person shall operate a vessel in contravention of any restriction conveyed in an authorized sign unless exempt, as defined by the Regulations, or authorized by the Minister responsible.

4. No person shall engage in any unauthorized activity, such as the staging of a regatta, boat race or marine parade unless authorized by a permit issued pursuant to these Regulations.

5. No regatta, marine parade or boat race shall be held in a manner or at a place that would unnecessarily obstruct navigation.

6. The Minister may authorize any person or group to place a sign in an area for the purpose of indicating that a restriction on the operation of vessels established by the Regulations exists in respect of that area, but may also cancel such authorization and order removal if necessary.

7. Where a designated authority seeks the imposition of a restriction on navigation, the authority may submit its request to the office of Boating Safety, Canadian Coast Guard, together with any information regarding its implementation.

8. All authorized buoys and signs must conform to the size and markings specifications as defined by the Regulations.

9. Any person who places an authorized sign is liable for all costs of construction, placing, maintenance and removal thereof and shall cause the sign to be maintained in the form and construction required by the Regulations.

The restrictions may be enforced by any federal, provincial, or municipal peace officer, any harbour or river police force, or by any officer specially appointed by the Minister of Fisheries and Oceans. Provision is also made under the Regulations for a peace officer to direct or prohibit the movement of vessels in order to promote safety.

Any person found to be in contravention of these Regulations is liable on summary conviction to a fine of up to $500. In areas where the provisions of the Contraventions Act apply, offenders will normally be charged under this Act. A schedule of fines is shown in the Contraventions Regulations.

NOTE: A complete listing of Provincial and Federal contacts for boating restriction information is included on page 43. Consult the full text of the Regulations for further details.

Regional OBS (Office of Boating Safety) supervisors may be contacted for further clarification and may assist in the process.

NAVIGABLE WATERS PROTECTION ACT

Under the terms of the ***Navigable Waters Protection Act*** (NWPA), the owner of any project to erect a work in, on, over, under, through or across any navigable water must first have the project approved by the Canadian Coast Guard Navigation Protection Program as consistent with the Act. The primary purpose of the NWPA is to protect the public right of navigation in all Canadian waters.

Before approving a project, the Coast Guard may, among other things, require the installation of private buoys or other aids to navigation to mark works, such as wharves, marinas, aquaculture areas, water inlets and outlets, bridges, and so on, and their approaches. Where required by the Act, aids to navigation must be installed and maintained in accordance with the ***Private Buoy Regulations***, the Canadian Aids to Navigation System, ***the Boating Restriction Regulations*** and all other Canadian Coast Guard standards and requirements.

NOTE: Consult the full text of the Act for further details.

Responsibilities

Owners of private aids to navigation in Canada are responsible for ensuring that these aids meet all requirements of the ***Private Buoy*** and ***Boating Restriction Regulations*** and that the placement of these aids does not create a hazard or obstruction to normal navigation. In the event of an accident involving a private aid to navigation, the person(s) owning that aid may be held liable for any resulting damages.

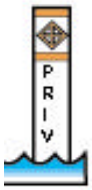
There are several ways to avoid or minimize liability. These include:

1. Take reasonable care in selecting the appropriate buoy type and construction material, and in the placement/positioning of buoys.
2. Establish a monitoring and repair schedule to ensure that the aids are on position and in good working order. Make records of such checks. (See the section on maintenance requirements, page 37)
3. Addition of lights and/or retroreflective material is encouraged in all cases.
4. The operation of private aids under the auspices of an organization, such as a boating club, ensures that all local users are aware of the purpose of the aids and increases the number of people available to monitor the position and condition of the aids.
5. Where a problem with a charted aid arises (i.e. out of position), where the aid is discontinued, or where changes are made to the buoy, owners must take the appropriate steps to initiate the issuance of ***Notices to Shipping*** and ***Notices to Mariners*** (if warranted). This includes contacting the nearest CCG office.
6. Liability insurance may be worth considering, over and above any other preventative action that is taken.

Above all, take the steps necessary to ensure that any private aid to navigation conforms to the requirements, standards and guidelines set forth in the Regulations and in ***The Canadian Aids to Navigation System*** (TP 968).

When buoys are placed in charted waters, it is desirable to provide Coast Guard with sufficient information to allow for publication of their characteristics and positions in marine notices (***Notices to Mariners; Notices to Shipping***) and for charting of the buoy(s) by the Canadian Hydrographic Service. Persons wishing to do so should contact their nearest Canadian Coast Guard office.

NOTE: Coast Guard Aids to Navigation personnel can provide advice to groups or individuals wishing to design a navigation system for a waterway.



Buoy Selection & Construction

SELECTION

When choosing buoys for navigational or mooring purposes every effort should be made to keep the system simple by using as few buoys and buoy types as possible. It should be recognized that some mariners possess limited knowledge with respect to the purposes and meanings of marine aids to navigation. Therefore, by limiting the number of different types (shapes, sizes) of buoys, and by sticking to the common types (i.e. lateral), the system is easier to understand and of greater value to the user.

Generally speaking, in small craft/low traffic areas, there is usually no need to use any private aids other than the port (green), starboard (red) and hazard (white with an orange diamond between two orange bands) buoys for navigational purposes. Other popular types that may be used include cautionary, swimming or information buoys and those buoys prescribed under the ***Boating Restriction Regulations*** (e.g. control, keep-out). In uncharted waters or in lakes where identification of “upstream direction” may be a problem, the use of cardinal buoys may be a better option.

CONSTRUCTION

Prior to establishing a buoy one must determine the appropriate construction material for each particular application. Ideally, a buoy should be rugged enough to withstand the elements, should possess and maintain a good visual signal, and yet be "soft" enough to absorb vessel impacts and reduce collision damage. Despite the fact that these criteria quite often conflict with one another, there are several types of commercially manufactured buoys which meet these needs.

Although manufactured products are the preferred choice for private usage, this does not imply that owners are required to "purchase" a buoy. In many cases "home-made" aids to navigation may be used in place of the manufactured devices. Some of the most commonly used materials for buoy construction and an outline of some of the more popular home-made devices, with the advantages and disadvantages of each, are included in Tables 1 and 2 on pages 7 and 8.

NOTE: In most cases manufactured buoys provide private owners with the safest, most reliable and standardized option available. A list of various North American suppliers and manufacturers is included on page 38.

NOTE: When purchasing a buoy, make certain that the mooring and lifting lugs offer a sufficient "safe working load" capacity in relation to the weight of the mooring being installed.

TABLE 1: Manufactured Aids to Navigation

ADVANTAGES	***DISADVANTAGES***
RIGID PLASTIC FOAM	
* low density, the softest and least likely to cause damage * inexpensive and readily available * lightweight, easy to position and handle * easily shaped * paint and ID markings adhere well * won't sink or waterlog	* the least rugged material * paint and markings require annual maintenance * larger sizes not widely available and expensive * will not withstand ice abrasion
RIGID MOULDED PLASTICS	
* rugged, unlikely to cause or sustain damage if struck * lightweight, easy to install and handle * readily available * maintenance free if manufactured in colour	* manufactured types are expensive * "waxy" finish makes paint adherence difficult or impossible * should be foam filled
STEEL	
* very rugged, even in moving ice conditions * inexpensive * easily fabricated * only material that provides radar return * easily painted * may be foam filled to provide buoyancy	* very hard and unyielding, capable of causing extensive damage to smaller vessels * heavy, larger sizes are difficult to handle * prone to corrosion in salt water
WOOD	
* readily available, easy to fabricate, inexpensive * easily painted * can be very rugged	* usually dense and heavy, can damage small vessels * depending on wood species, may waterlog
RUBBER	
* some inflatable forms may be made very soft	* may be prone to sun damage * must be inflated or foam filled * paint adhesion is difficult

TABLE 2: Home-Made Private Aids

BLEACH BOTTLES AND MILK JUGS
* generally, do not meet the 30.5 cm (12 inch) minimum above water height requirement * are too small to adequately display ID marking * NOT RECOMMENDED
PLASTIC DRUMS OR BARRELS
* should be 22 litre (5 imp.gal.) minimum * soft, large and conspicuous * paint adhesion difficult but is available from manufacturers in most colours * should be foam filled or have bung holes sealed tightly * if previously used, clean thoroughly to avoid pollution * require a ballast or heavy chain to float upright * if used as lateral buoys, starboard hand (red) must be equipped with a conical (pointed) top * RECOMMENDED FOR USE
STEEL DRUMS OR BARRELS
* large and conspicuous * good paint adhesion * hard, thus may cause damage to small vessels * NOT RECOMMENDED
PROPANE CYLINDERS
* for their size, very hard and unyielding * usually have sharp metallic edges * NOT RECOMMENDED

Markings & Dimensions

PRIVATE BUOY REGULATIONS - REQUIREMENTS

Under amendments to the ***Canada Shipping Act, Private Buoy Regulations***, all private buoys in Canada must conform to the requirements for buoy identification and marking. Those dealing with minimum size and letter identification as set out in the Canadian Coast Guard manual ***The Canadian Aids to Navigation System*** (TP 968) are exempt.

In terms of size, the ***Private Buoy Regulations*** require that all private buoys meet minimum above water dimensions of 15.25 cm (6 inches) in width and 30.5 cm (12 inches) in height. This should be regarded as the absolute minimum, suitable only for buoys placed in very sheltered, low traffic areas. In general, a buoy should be large enough to be seen at the distance for which its signal can be interpreted to allow for timely action by the mariner. Consideration should be given to both adverse weather conditions and varying sea states. The ***Private Buoy Regulations*** give Coast Guard the authority to require buoys to be larger than these minimum dimensions, be equipped with retroreflective material, or be altered in any other way (e.g. addition of lights, sound appliances, etc.) in the interest of marine safety and in accordance with site conditions.

The ***Private Buoy Regulations*** also require that all private buoys display, on two opposite sides, the capital letters "PRIV". These letters are to be as large as practical for the size of the buoy and contrasting in colour (white when the background colour is red, green or black, and black when the background colour is white or yellow). Additionally, the current name, address and telephone number of the owner of the buoy must be displayed in a permanent and legible manner. If the owner of a private buoy wishes to place additional numbers or letters on a buoy for identification purposes, the number or letter system must not correspond to the letter and number system used by the Coast Guard in that immediate area. This serves to ensure that there is no confusion between Government operated aids and private aids.

NOTE: Information with respect to the specific purpose of the aid to navigation, if present, may be located within the orange symbol (e.g. DANGER - RAPIDS).

BOATING RESTRICTION REGULATIONS - REQUIREMENTS

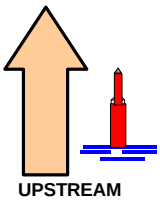
In addition to the above requirements, all private buoys which have been authorized under the ***Boating Restriction Regulations*** (e.g. keep-out, control) must also exhibit the markings and characteristics set out in the Schedules of the Regulations.

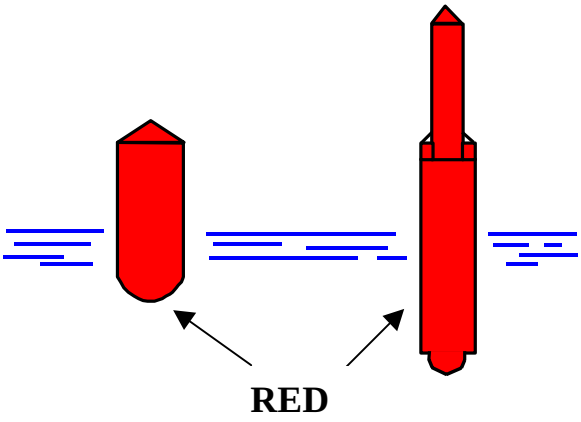
NOTE: Details of markings for each of the most commonly used private buoys are illustrated in Figures 1-8.

FIGURE 1: Lateral Buoys

STARBOARD

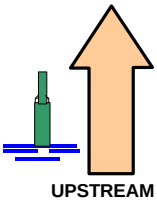
Description:
- used to mark the right side of a channel or the location of a danger which must be kept on the vessel's right side when proceeding in the upstream direction;
- if unlighted it must have a pointed (conical) top;
- red light (Fl) 4s or (Q)1s, if lighted;
- red retroreflective material, if equipped.





PORT

Description:
- marks the left side of a channel or the location of a danger which must be kept on the vessel's left side when proceeding in the upstream direction;
- if unlighted, it has a flat top;
- green light, (Fl) 4s or (Q)1s, if lighted;
- green retroreflective material, if equipped.



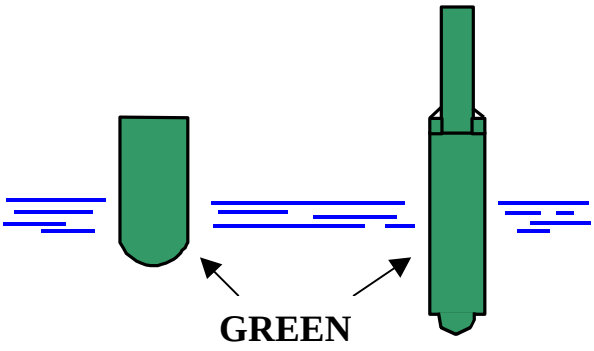


FIGURE 2: Cardinal Buoys

Description:
- indicate the positioning of the safest water in relation to the (e.g. north cardinal = safe water to the north);
- if it carries a light, the light is white and corresponds to CCG buoy light flash characters (see TP968);
- if it carries retroreflective material, such material is white;
- may be equipped with black topmarks which indicate the positioning of the black portion(s) of the buoy and hence its purpose.

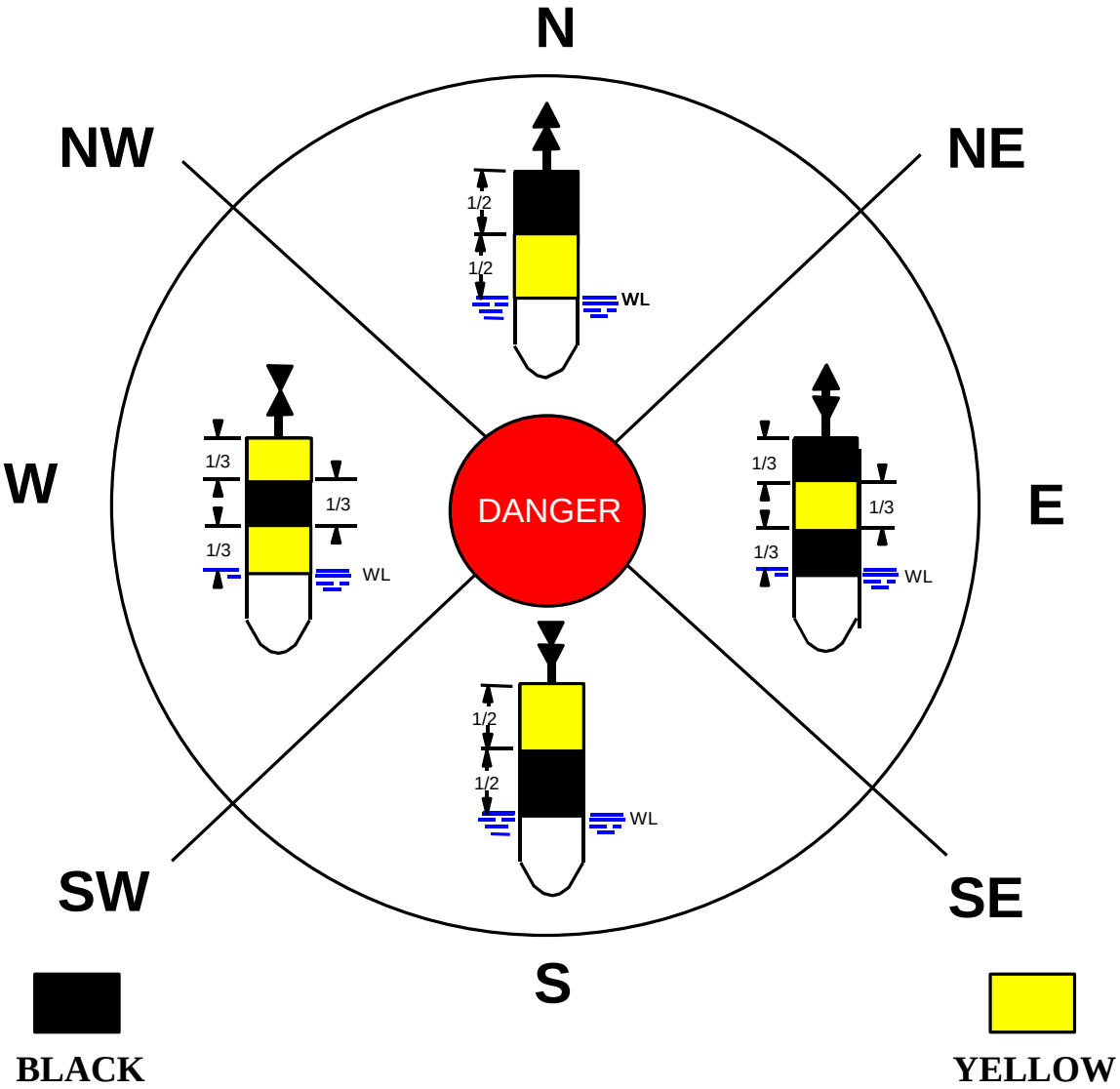
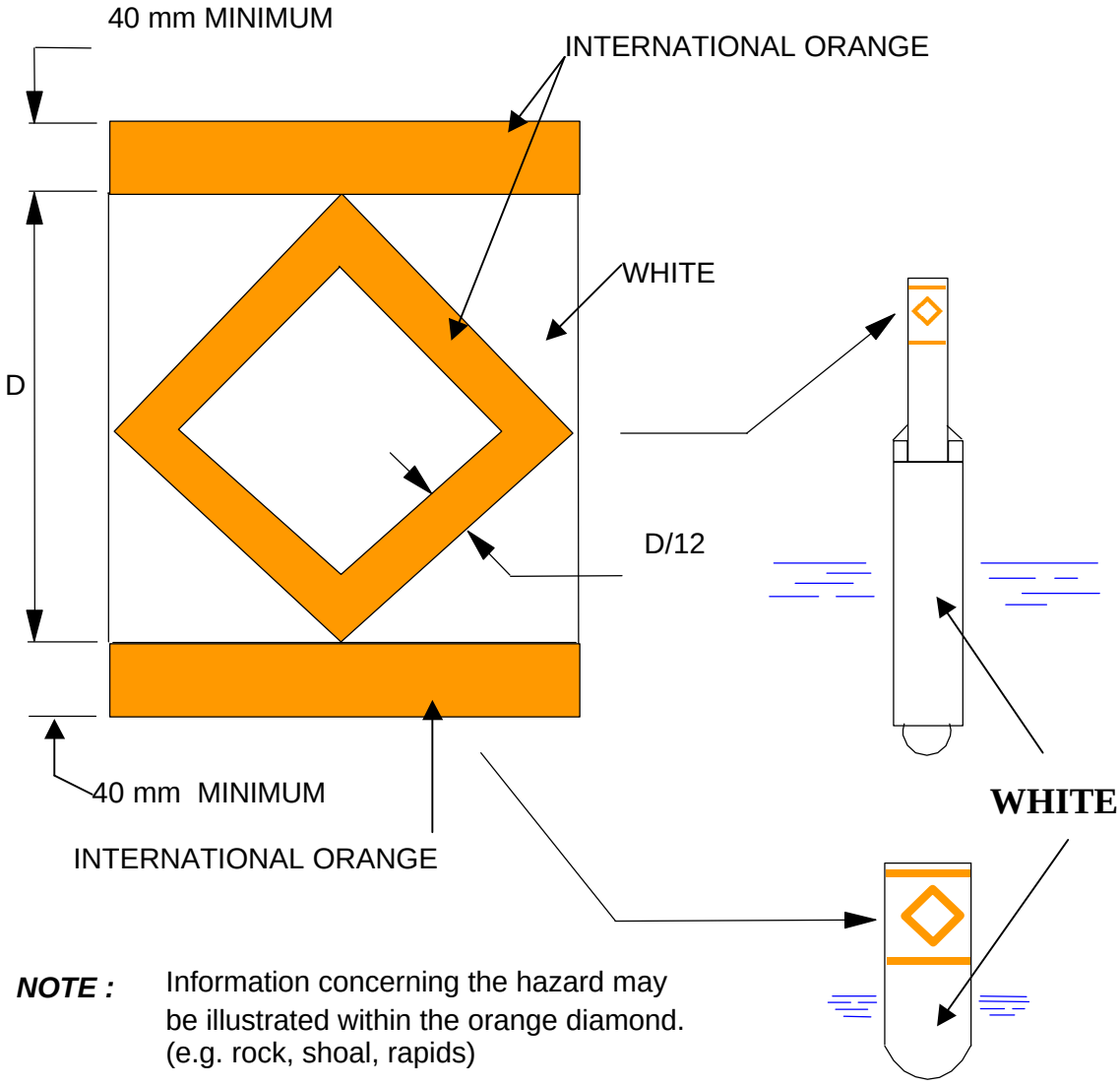


FIGURE 3: Hazard Buoys

Description:

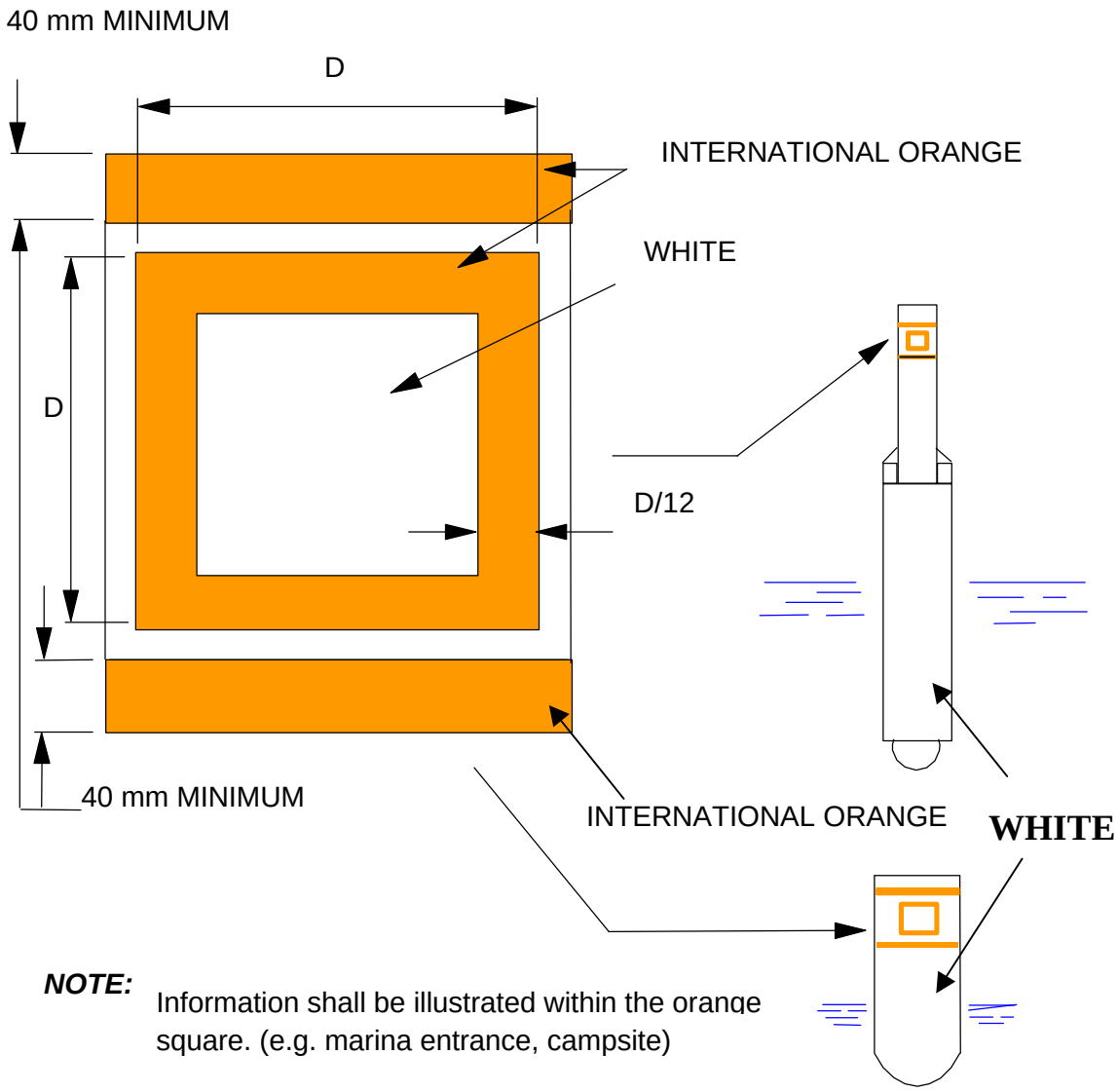
- marks random hazards such as rocks and shoals;
- if it carries a light, the light is yellow and flashing (Fl) 4s ;
- if it carries retroreflective material, such material is yellow;
- the international orange symbol may be retroreflective orange.



NOTE : Information concerning the hazard may be illustrated within the orange diamond. (e.g. rock, shoal, rapids)

FIGURE 4: Information Buoys

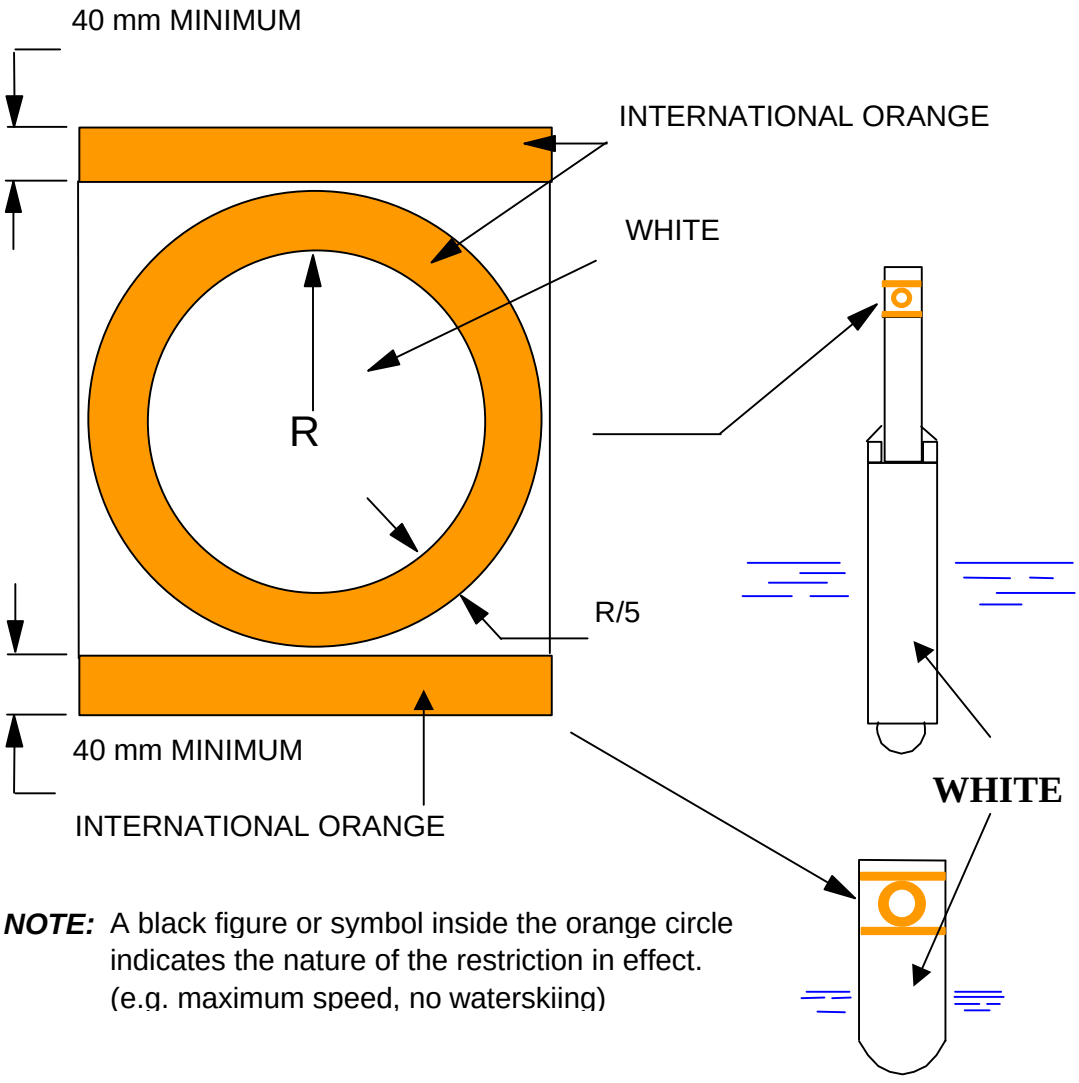
Description: - displays by means of words or symbols, information of interest to the mariner;
- if it carries a light, the light is yellow and flashing (Fl) 4s;
- if it carries retroreflective material, such material is yellow;
- the international orange symbol may be retroreflective orange.



NOTE: Information shall be illustrated within the orange square. (e.g. marina entrance, campsite)

FIGURE 5: Control Buoys

Description: - marks an area where boating is restricted in accordance with the ***Boating Restriction***
- if it carries a light, the light is yellow and flashing (Fl) 4s
- if it carries retroreflective material, such material is yellow
- the international orange symbol may be retroreflective orange



NOTE: A black figure or symbol inside the orange circle indicates the nature of the restriction in effect. (e.g. maximum speed, no waterskiing)

FIGURE 6: Keep-Out Buoys

Description: - marks an area where all vessels are prohibited as authorized under the ***Boating Restriction Regulations***
- if it carries a light, the light is yellow and flashing (Fl) 4s
- if it carries retroreflective material, such material is yellow
- the international orange symbol may be retroreflective orange

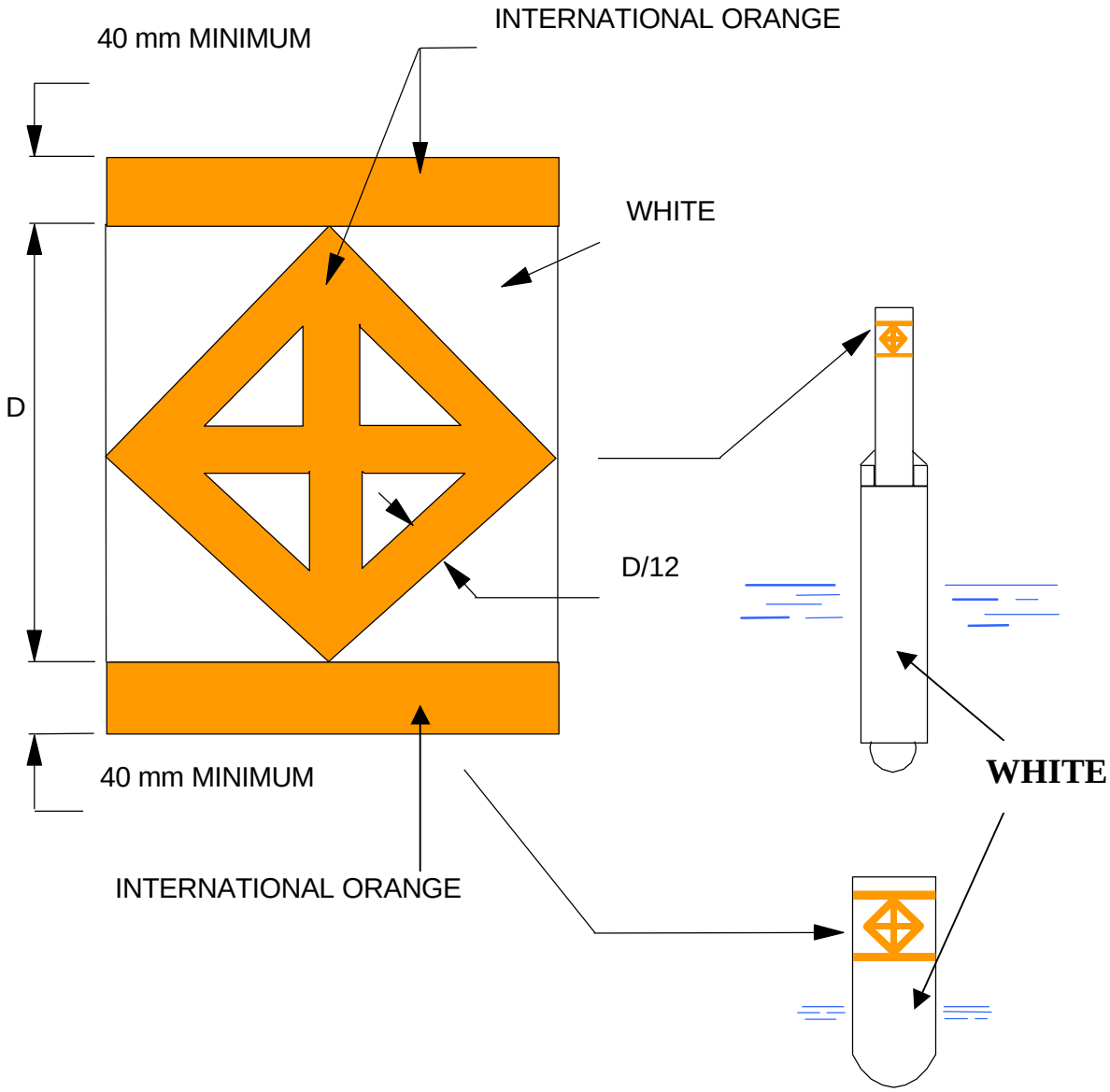
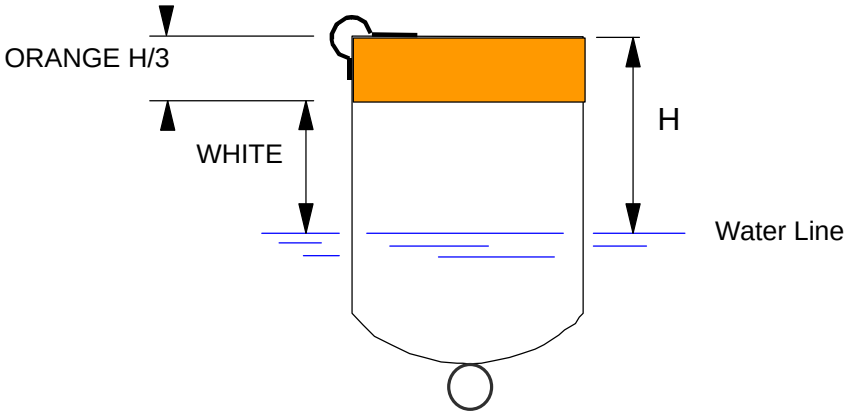


FIGURE 7: Other Special Buoys

MOORING

Description: - used for securing a vessel, seaplane, etc.
- if it carries a light, the light is yellow and flashing (Fl) 4s
- if it carries retroreflective material, such material is yellow



CAUTIONARY

Description: - marks an area where mariners are to be warned of:
a) dangers such as firing ranges, racing courses, seaplane bases, underwater structures;
b) areas where no safe through passage exists;
c) traffic separations;
d) aquaculture sites
- if it carries a light, the light is yellow and flashing (Fl) 4s
- if it carries retroreflective material, such material is yellow

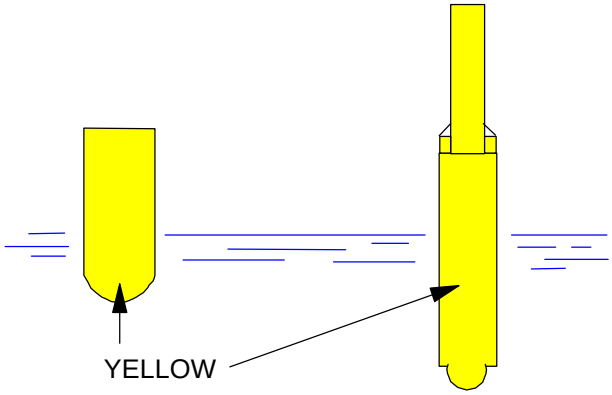
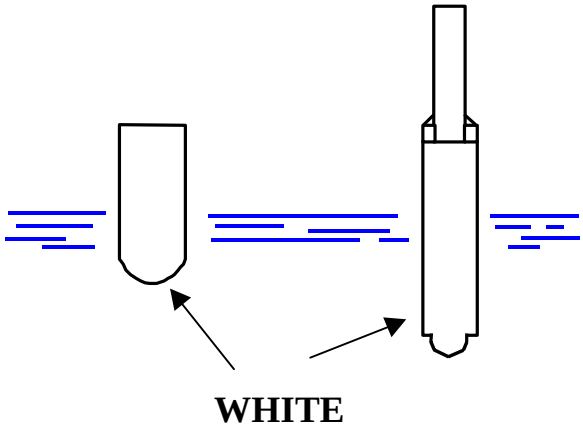


FIGURE 8: Swimming

Description:
- used to mark the perimeter of a swimming area;
- if it carries a light, the light shall be yellow and
- flashing (Fl)4s;
- if it carries reflecting material, the reflecting material shall be yellow.



Lights & Retroreflective Material

Although the related legislation does not require that buoys be equipped with retroreflective material or lights in every case, the addition of such safeguards is highly recommended.

As set out in the ***Private Buoy Regulations***, where private buoys are equipped with lights or retroreflective materials, the characteristics of such additions must conform to Coast Guard standards for colouring and flash character.

LIGHTS

At night, the colour and flash character of a buoy light indicate the buoy type and hence its function and interpretation. As such, it is important that these aids exhibit the appropriate characteristics.

Under the ***Private Buoy Regulations***, all private buoys which are equipped with lights are required to continuously display that light during the hours of darkness. A complete listing of appropriate light colours and flash characters is included in the Canadian Coast Guard publication, ***The Canadian Aids to Navigation System*** (TP 968).

RETROREFLECTIVE MATERIAL

An unlighted buoy equipped with retroreflective material is an economical alternative to a lighted buoy when justification for the latter is lacking, or where an aid is too small to practically carry a light. On a lighted aid, retroreflective material provides a back-up to the light in case of failure and increases detection and interpretation of the aid at night.

Colour

For all buoys other than special buoys the colour of the reflective material must be the same as that of the light which would be appropriate for that buoy (e.g. green - port; red - starboard). For special buoys the colour of material required will be yellow. Orange retroreflective material may be used to display the orange symbols on hazard, information, control and keep-out buoys. Swimming and diving buoys, which are white in colour, will exhibit yellow retroreflective material.

The Canadian Coast Guard is authorized to require the addition of retroreflective material in cases where there is a need for increased visibility or better identification of any buoy.

Applications

The primary method of displaying retroreflective material on buoys or signs is by the use of retroreflective numbers, letters, backgrounds or horizontal bands. Where a horizontal band is used, the band should be no less than 4 inches (10 cm) in width and should be placed around the circumference of the buoy.

Intensity Levels

The intensity or reflectivity of the material should also be considered. There are two levels or intensities of material available for use with marine aids with a number of adhesive options.

NOTE: A list of Canadian suppliers and manufacturers is included following the main text on page 38.

Degradation of Materials

Experience has shown that the retroreflective properties of some material may be adversely affected by bird droppings, even after thorough cleaning. Reflective properties may also deteriorate due to exposure to the sun. Because of the possibility of such degradation, which is not apparent during daytime, the retroreflective properties of the material should be verified with a light, after dark, to ensure the highest levels of performance. Any material which has degraded or the performance of which is in question should be replaced.

Moorings

GENERAL

Possibly the most difficult, yet most important, step in establishing a reliable and safe navigation buoy involves the design of an effective mooring system. Wind, current, waves and ice all exert forces on a buoy. The purpose of the mooring is to resist these forces and hold the buoy on station. If the buoy is to remain on station, the forces from wind and water must be balanced by the holding capacity of the mooring. Thus, the art of mooring design is in selecting a reliable mooring, with a tolerable watch circle radius, but without an exorbitant cost.

In accordance with the ***Private Buoy Regulations***, "No person shall place a private buoy in any water unless the buoy is constructed and maintained in a manner and with materials that ensure that it remains in position and retains its required characteristics". Further the Regulations state that "the buoy's anchor shall be constructed and maintained in a manner and with materials that ensure that it remains in position". In general this means that a mooring system should be designed to maintain a buoy on station during even the most severe environmental conditions. In many cases this can be accomplished through reference to other, similar buoys which have been found to operate satisfactorily under similar conditions. In this sense, experience has as much to do with determining mooring requirements as any other factor. Where no such reference exists, or where special circumstances prevail, the process of finding an adequate system may involve a considerable amount of trial and error.

To say that this process is easy would be to exaggerate; there are simply too many variables to consider. What can be said is that given some basic knowledge of the various mooring components, systems and associated installation concerns, much of the trial and error can be eliminated.

NOTE: Due to liability considerations, the Canadian Coast Guard will not advise on the design of private mooring buoys. Private owners wishing to establish mooring buoys are advised to consult a qualified professional engineer who is familiar with the specific application and local conditions.

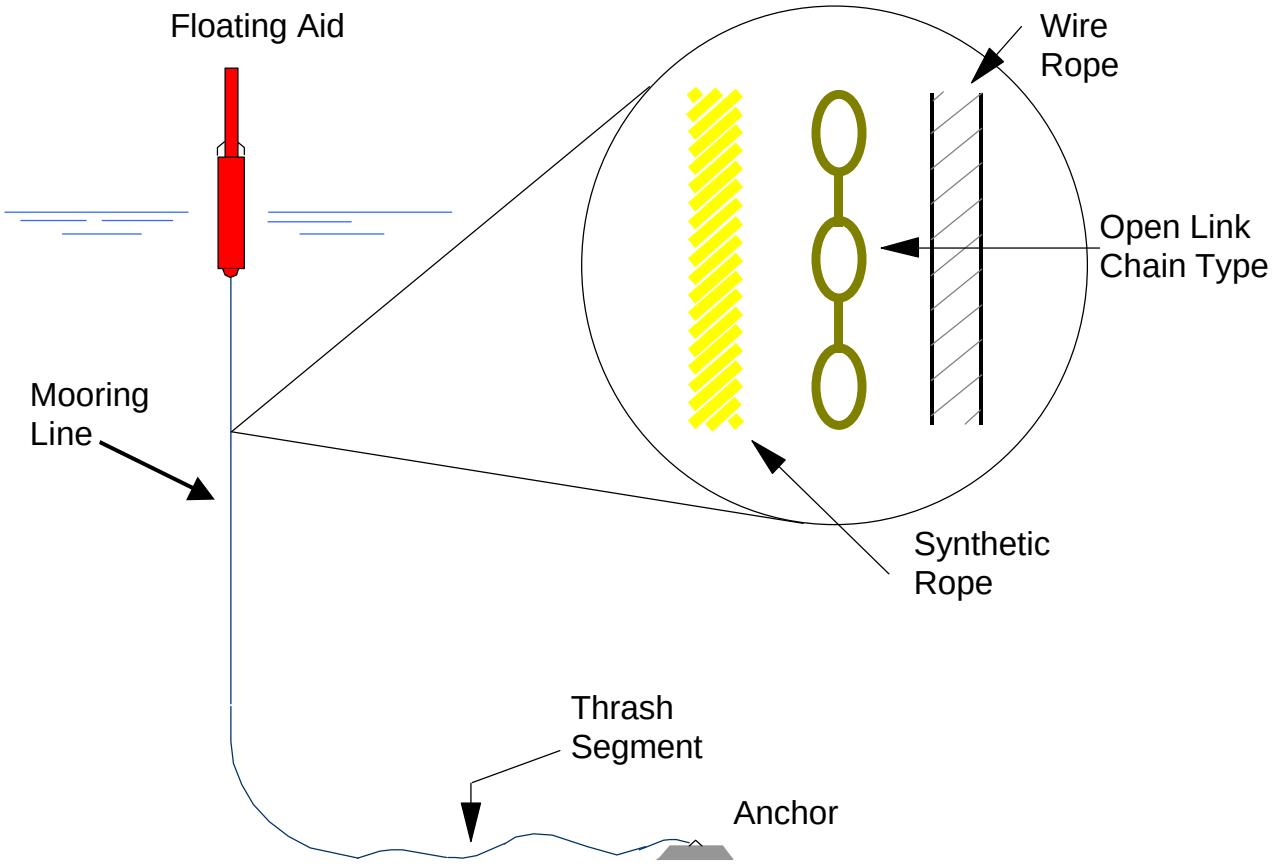
NOTE: Because of the difficulty associated with accurately determining mooring requirements, the following information should be used **as a guide only**.

NOTE: Coast Guard Regional offices will, upon request, provide advice on the design of appropriate aids to navigation systems for private use and should be contacted in any case where the reliability of a buoy is in question.

THE MOORING SYSTEM

Buoy mooring requirements should be determined in accordance with the following sections.

FIGURE 8: Simple Mooring System



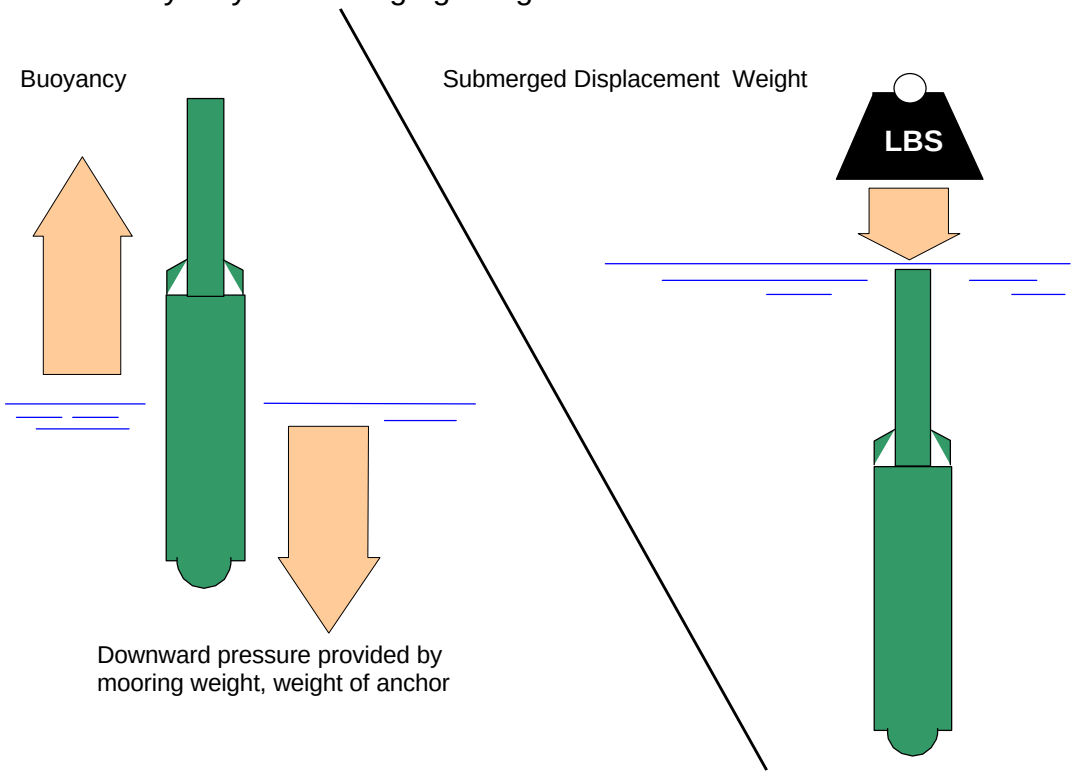
Generally, when choosing an appropriate buoy mooring, consideration should be given to the following:

1. **Buoyancy**
2. **System type**
3. **Mooring length (Scope)**
4. **Mooring material**
5. **Mooring anchor**

1. Buoyancy

Although the concept of buoyancy is one which may not be easily understood, it is one that is very important when it comes to the design of a reliable and properly performing mooring system. In very technical terms, buoyancy is the relationship between the volume of the object and the density of water which surrounds it. The point here is about the upthrust buoyancy which may come down to the following: "Any body plunged in a fluid is subjected to a vertical thrust, directed from the bottom to the top, equal to the weight of the displaced fluid". For our purposes though, buoyancy can be simply defined as the amount of upward force that water exerts on a submerged object.

FIGURE 9: Buoyancy - Submerging Weight



With respect to buoys and moorings, buoyancy is measured in terms of the buoy's carrying capacity or it's "submerging weight". Both of these terms refer to the amount of weight required to completely sink the buoy.

In terms of buoys, these concepts are significant when it comes to the appropriate selection of and sizing of mooring components. For example, a smaller buoy which has a lower submerging weight will most likely require the use of lighter mooring components (i.e. smaller chain diameter, shorter mooring length, etc.). The use of larger components with such small buoys, especially in deeper waters, may result in complete submersion of the buoy because the weight of the components is greater than that of the buoyancy or submerged displacement weight of the buoy. The opposite is true for larger buoys and for buoys with greater buoyancy.

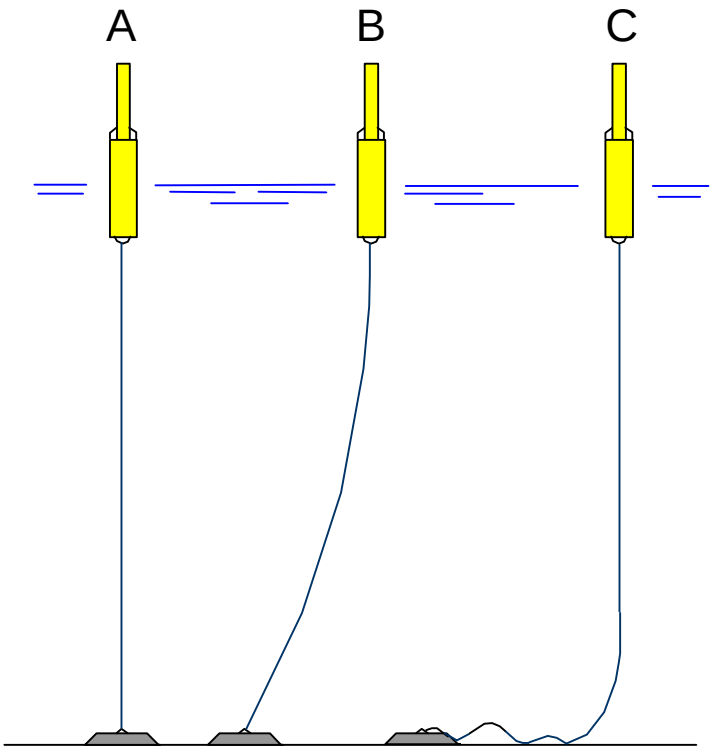
In this sense, larger components may be required in order to keep the buoy sufficiently above the water and on position.

In any case, when considering design requirements, it is important to remember that the higher the submerging weight or buoyancy of the buoy, the larger and stronger the mooring components should be. In addition, always ensure that the combined weight of the mooring line and any attachment does not exceed the submerging weight of the buoy.

2. System Type

As outlined in Figure 10, three main system types are used for the purpose of mooring buoys. These range from the simple taut mooring to the more sophisticated catenary mooring, and as with any other respect of mooring design, each has its own special purpose and component requirements.

FIGURE 10: Mooring System Types



A. TAUT

May be used in situations which necessitate a small watch circle radius (see Page 26). Requires a larger size of anchor, especially where rope is used for mooring. May be counterweighted to enhance upright stability. Recommended only in instances where there is no great variance in water levels, minimal current, very small waves and where high quality buoy components are used.

B. SEMI-TAUT

Used in the same way as the taut mooring system but leaves more room for buoy movement. Oversized components may still be required.

C. CATENARY

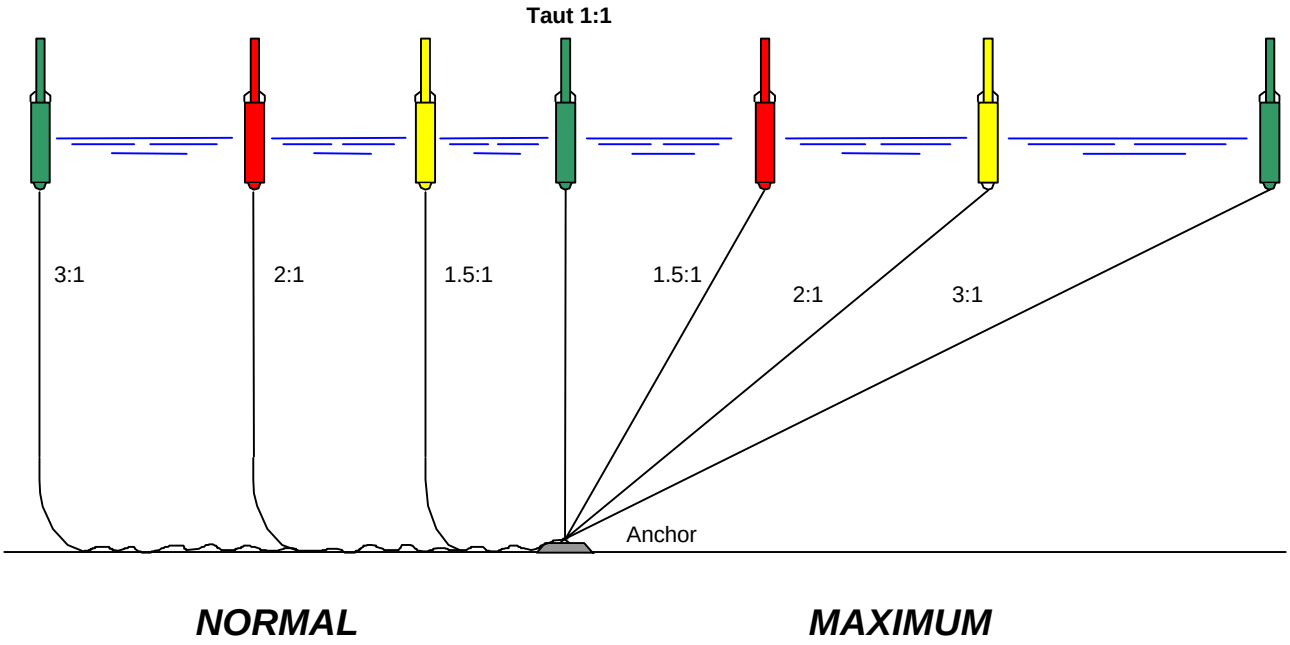
This system type provides the optimal shape in terms of holding power. It requires the use of longer lengths of mooring but may reduce the size of anchor needed. The greater length allows the line to absorb a large amount of energy and provides for upright stability, and provides for the absorption of lateral forces on the buoy (i.e. wind, waves, current) through the raising and lowering of the “thrash” segment of the mooring.

3. Mooring Length

As with all other mooring requirements, the length of the mooring line is highly dependent on the specific site conditions. The primary considerations for determining mooring length include water depth, buoy location and environmental conditions (tide, wave, wind and current). Above all, water depth is critical to the performance of the system and thus, measurements must be as accurate as possible.

From the standpoint of holding capacity a 3:1 ratio (e.g. if the water depth is 30 metres, the mooring length should be 90 metres) has proven to be effective with chain moorings. This ratio is also the widely accepted rule of thumb for chain moorings, supported by International Association of Lighthouse Authorities (IALA) recommendations. However, in many cases, such a ratio is neither warranted nor practical. For example, in shallow water, a greater ratio is often needed to prevent anchor movement, while in others the ratio must be reduced in order to prevent movement of the buoy into traffic areas or off a specific mark (e.g. a hazard). Additionally, when a heavier type of mooring line is selected, the length of chain required may be shorter and vice versa. In such cases there is no virtue in rigidly adhering to a length of chain three times the water depth; in actuality such adherence may be hazardous.

FIGURE 11: Watch Circle Radius



4. Mooring Material

The choice of mooring material is also an integral aspect of mooring design and, ultimately, mooring performance. Because the system depends so greatly on the mooring line for provision of shock absorbency and for the addition of weight, and because each individual mooring material possesses different qualities (i.e. elasticity, weight and strength), it is important to choose the most appropriate material type for each application. For example, heavy chain rather than light rope is required for large buoy applications which call for added weight to keep the buoy upright and higher load carrying capabilities. On the other hand, that same heavy chain may be too heavy for use with smaller buoys and a lighter rope mooring may be required.

A. Synthetic Rope

In some applications, synthetic rope is appropriate for use in the buoy mooring system. For example, as previously indicated in the explanation of buoyancy, the weight of a chain might be greater in deeper water than the carrying capacity of the buoy, and a lighter line is required. Because the elasticity of rope also serves to absorb the energy of the movements of a buoy under adverse environmental conditions (i.e. excessive wave and winds), consideration should be given to using it under such circumstances.

In all cases, synthetic rope should only be used in that part of the system that does not come into contact with the seabed or the buoy body. In moorings consisting exclusively of synthetic rope, special floats may be attached to the line to keep the mooring off the bottom and to enhance its energy absorbing properties.

B. Chain

Given its added strength, durability and weight, chain is the most common mooring material. As a result of these qualities, a chain can handle the forces created by large buoys. Smaller anchors may be used because of the chain's energy absorbing characteristics, and the periodic inspection of the system may be less frequent. The added weight of the chain gives resilience to the mooring line, therefore enabling it to absorb a significantly larger amount of energy than rope moorings. Additionally, the weight of a chain enhances the upright stability of the buoy.

In very deep water, or in situations where a smaller buoy is used, a chain mooring may be too heavy for a floating aid or mooring buoy. Where this possibility exists, a lighter weight chain or wire or rope mooring should be used.

Buoy moorings usually consist of open link type chain. Regardless of chain type, the chain material should be either mild steel alloy or a more expensive carbon steel type (where excessive wear is encountered).

TABLE 6: Mooring Materials (CCG recommended *)

MATERIAL		***TYPE***
*SYNTHETIC ROPE * *		
* has the advantage of being light * prone to wear in the thrash area (the length near the bottom that rubs the sea floor) and is easily vandalized or cut * recommended for small buoys in sheltered locations	***Nylon*** * high strength and elasticity * good abrasion resistance * can maintain heavy loads * relatively low cost ***Polyester*** * * high strength and elasticity * heavier weight ***Polypropylene*** * most popular material * good strength, elongation and seawater performance * may deteriorate if in direct sunlight ***Polyethylene*** * not as strong or as buoyant as polypropylene * recommended for non-critical applications only	***Twisted*** * offer good strength * easy handling * tend to "unravel" when placed under load; may cause failure ***Plaited*** * resists rotation and will not kink or twist * good strength, weight and elongation ***Braided*** * * higher in strength/durability and lower in elongation * very pliable and easy to handle * more difficult to splice * higher cost * single and solid-braided types are more reliable than double-braided
WIRE ROPE		
* stronger than synthetic rope and not as prone to wear * will rust and fray, therefore, most difficult to handle and maintain		
CHAIN *		
* Coast Guard's preferred choice for most buoys * not as prone to wear nor can it be cut or vandalized * due to its weight, chain enhances upright stability * allows for use of smaller sinkers * energy absorbing due to weight	***Steel Alloy **** * most common ***Carbon Steel*** * highest strength and durability ***Multiple or Chromium/Nickel Alloys*** * may fail due to stress, cracking, corrosion and fatigue	***Open Link Chain**** * most common type used for mooring ***Stud Link Chain*** * provides for extra strength * heavier than open link

5. Mooring Anchor

The final step taken prior to deployment of the buoy system involves the design, construction and sizing of the mooring anchor. In making determinations for this component, the important thing to remember is that the mooring anchor weight must be sufficient to withstand any vertical or horizontal force which may be placed on it, and consistently hold the buoy on station. Failure of the anchor in this respect can have very serious consequences. Thus, appropriate anchor sizing and placement is essential.

As a general rule, the ability of an anchor to hold position is dependent on the following factors:

i. Seabed Type

A mooring anchor needs to be carefully paired with the prevailing seabed type. Simply stated, much of the holding power of the mooring anchor is dependent on the level of friction which exists between the sinker and the seabed. As a general rule, the more cohesive the bottom type, the more horizontal friction there is between the two materials and the more the force required to move the anchor. It follows that the less cohesive a bottom, the more consideration should be put into providing a larger sinker or adding a second sinker to the mooring system.

Because several bottom conditions exist within the confines of each individual water body, those wishing to establish a private buoy should become familiar with the bottom types in order to properly determine mooring requirements. Overall, the deployment site should be relatively flat with no steep slopes or drop-offs. Where poor bottom conditions exist, mooring anchor weights should be increased to ensure positioning. If after all efforts, the bottom type cannot be determined, assume the worst bottom condition prevails.

NOTE: Soft bottoms will generally have more holding force than rocks, gravel or shells.

ii. Anchor Material

In choosing a mooring anchor, the density of the anchor material is critical due to the loss of weight which materials experience when fully submerged. This is known as the material's submerged weight and is expressed as a factor of the materials dry land weight.

As illustrated in Table 7, some materials perform better than others under water (e.g. a 100 lb / 45.5 kg concrete anchor weighs only 56 lb / 25.5 kg under water while the same sized steel anchor weighs 87 lb / 39.5 kg). Table 8 details some of the advantages and disadvantages of each anchor material.

TABLE 7: Submerged weight of anchor materials in water.

CONCRETE	-	56 % of dry land weight
GRANITE	-	64 % of dry land weight
IRON	-	86 % of dry land weight
STEEL	-	87 % of dry land weight

The low cost and ease of construction associated with concrete make it the most common material used in anchor construction. However, because of the reduced weight of concrete once submerged, larger sizes may be needed to achieve desired weights. This reduction in weight may be improved by reinforcing the concrete with steel or scrap chain.

More expensive anchors made from steel, iron or granite may also be used. With the exception of granite, these anchors are usually much smaller and easier to handle and stow in comparison to concrete. These materials are also superior to concrete in terms of durability. Granite, for example, has the longest lifespan of any anchor material.

TABLE 8: Anchor Materials

CONCRETE
* low submerged weight, therefore, a larger weight is needed * inexpensive and easily constructed * may lack some of the durability of other material * may be reinforced to add weight
GRANITE
* longest lifespan of any anchor material but priced high and difficult to obtain * average submerged weight
STEEL/IRON
* high submerged weight, therefore smaller sizes may be used * easiest to handle and stow * slightly more expensive than concrete * durable and readily available

NOTE: A detailed table of relative displacements for both concrete and metal anchors is given on page 35.

iii. Anchor Shape

There are also three rules of thumb about anchor shaping that will help to increase the holding power and overall performance of your anchor.

- First, to keep the anchor from rolling end over end, shape the anchor in such a way that its height is less than half its width.
- Second, provide room for a small cavity in the bottom of the anchor, or purchase only those manufactured anchors which offer this feature. Such cavities act as a suction chamber and can substantially increase holding power.
- And third, square anchors tend to sit flat while round anchors may be prone to roll if poor environmental conditions such as current and wave prevail. (See Table 9 on page 33)

iv. Anchor Weight

The most important factor in determining anchor weight is that of site conditions. It is important to remember that anchor-holding power is partially a measure of the weight of the anchor and thus of the friction between the anchor and the sea bed. Where conditions are calm, such as in sheltered coves or lakes, there is little reason to add additional weight to a mooring anchor. In contrast, in locations where poor conditions prevail, such as heavy current, strong winds, or rough waters, the need for a heavy anchor is a real possibility.

It is therefore recommended that all environmental conditions be taken into consideration before finalizing anchor design.

NOTE: For smaller mooring scopes (i.e. ratio of mooring length to water depth), a heavier sinker may be required to hold the buoy in position because there will be more tendency for the buoy to lift the anchor under rough sea conditions.

WEIGHT CALCULATION

The following procedure may be used to determine a **minimum** anchor weight for the application in question. This procedure takes the most fundamental and measurable factors into account, including buoyancy of the buoy, weight already present in the form of the initial dry land weight of the mooring line and any buoy, and the expected displacement factor of the sinker material itself. A small safety factor should then be added in consideration of any unseen problems.

NOTE: The next edition of this publication will contain a table showing anchor weights for various buoy types, mooring scope, bottom type and environmental factors.

CALCULATION:

Calculation of the minimum anchor weight required may be estimated by using the following equation:

[(SW - OW) x Material Displacement Factor] x Safety Factor = Minimum Anchor Weight

The term "SW" in the equation refers to the weight required to completely sink the buoy. The term "OW" can be defined as the offsetting weight of any attachment, and is calculated by adding together the dry land weight of the buoy, the mooring line, and any other addition to the system (i.e. floating devices or righting weights).

The Material Displacement Factor is calculated by dividing the weight of the anchor material on dry land by the weight of the anchor material in water.

The idea of material displacement factor has been discussed on pages 29-30. For safety purposes, the Coast Guard recommends that a safety factor of **2.5** then be worked in to achieve the final result.

EXAMPLE:

For the purposes of this example, the weight calculations will be made for a concrete anchor, although factors for other types have been included.

A	Sinking Weight	=	100 lb/ 46 kg
	TOTAL SW =	100 lb/ 46 kg	
B	Dry Land Weight Buoy	=	20 lb/ 9 kg
	Mooring Line Weight	=	25 lb/ 11 kg
	TOTAL OW =	45 lb/ 20 kg	
C	Material Displacement Factor (concrete at 56% = 1.79) * (granite/rock at 67% = 1.56) (iron/steel at 86% = 1.16)	=	1.79
D	Safety Factor	=	2.5

Minimum Acceptable Sinker Weight

= [(SW - OW) x MDF] x S
= [(100 - 45) x 1.79] x 2.5
= (55 x 1.79) x 2.5
= 98.45 x 2.5

= 246.125 lb or 111.875 kg

Following designation of the minimum sinker weight, all other relevant factors must be considered. As stated above, the sinker calculation gives only a nominal minimum weight and does not factor in the effects which current, wind, waves, mooring system type, and sea bottom have on the weight. For example, if the sinker was to be positioned in an area where heavy current existed, weight may have to be added to the system to retain precise positioning. In most cases, best judgment must be used to determine whether or not a heavier sinker, over and above that of the minimum, should be used. The more negative characteristics there are for your location and the system type, the more likely it is that a heavier sinker is required; the more positive they are, the more you can be confident that the minimum weight is acceptable.

The following table gives some indication of the approximate anchor dimensions that will be necessary to achieve a specific weight. The table is to be used for concrete anchor applications only. As suggested, reinforcement of the concrete with steel mesh or scrap chain will add weight to the anchor.

***TABLE 9*:** Approximate concrete Anchor Dimension Requirements

DIMENSIONS IN mm		**WEIGHT IN lb** *	**WEIGHT IN kg** *
A	**B**		
1 500	520	4 500	2 060
940	360	1 200	560
820	320	800	380
700	280	550	250
580	240	375	170
460	200	200	100

***** Weights are approximate.

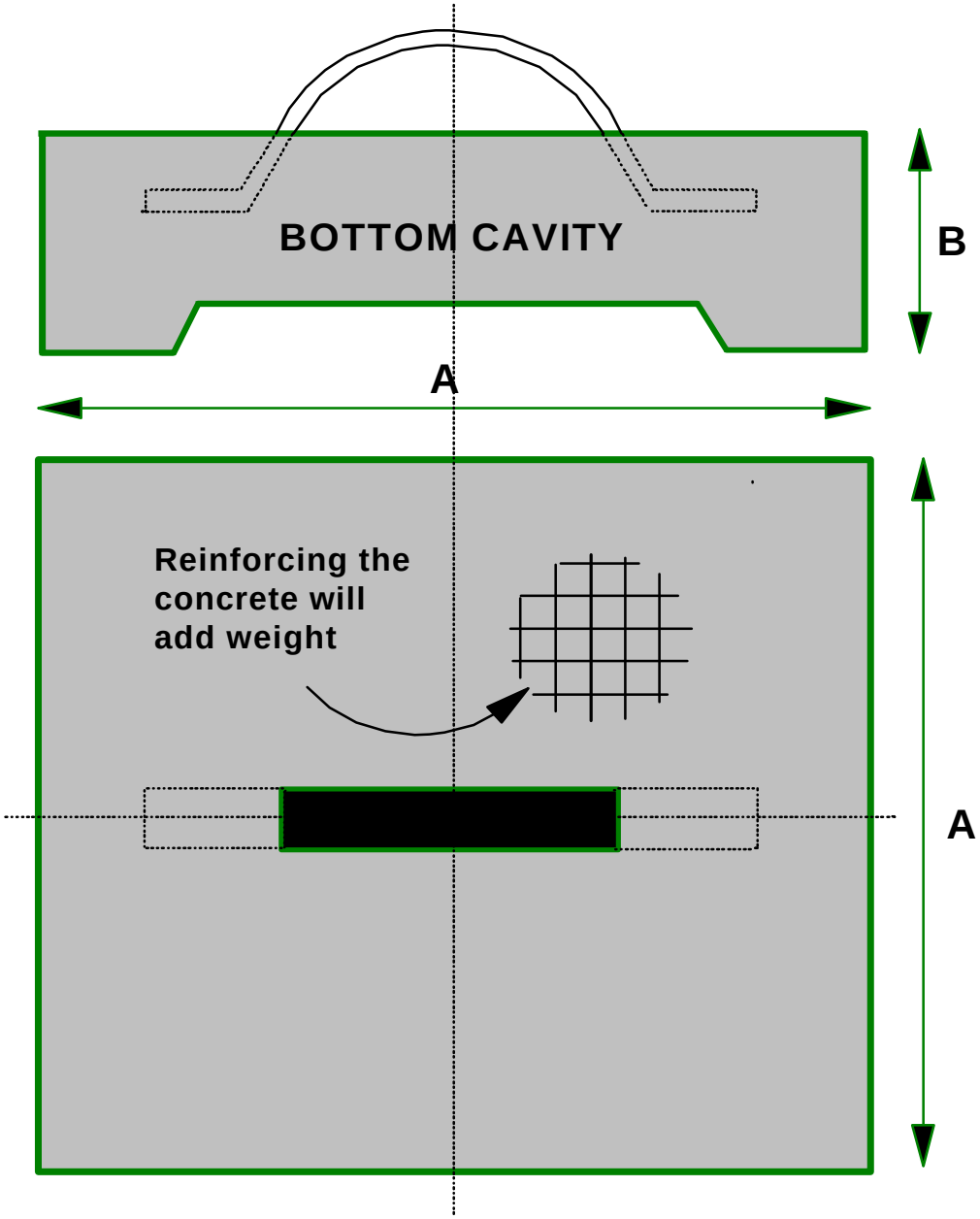

BOTTOM CAVITY
B
A
Reinforcing the concrete will add weight
A

TABLE 10: Submerged Weight of Anchor Materials

SALTWATER

Anchor Weight on Dry Land		***Concrete Anchor Weight*** Submerged		***Steel/Iron Anchor Weight*** Submerged	
(lb)	**(kg)**	**(lb)**	**(kg)**	**(lb)**	**(kg)**
5 000	2 300	2 780	1 261	4 280	1 941
3 000	1 380	1 668	756	2 568	1 165
2 000	920	1 112	504	1 712	776
1 000	460	556	252	856	388
500	230	278	126	428	194
300	138	167	76	257	116
200	92	111	50	171	78
100	46	56	25	86	39

FRESHWATER

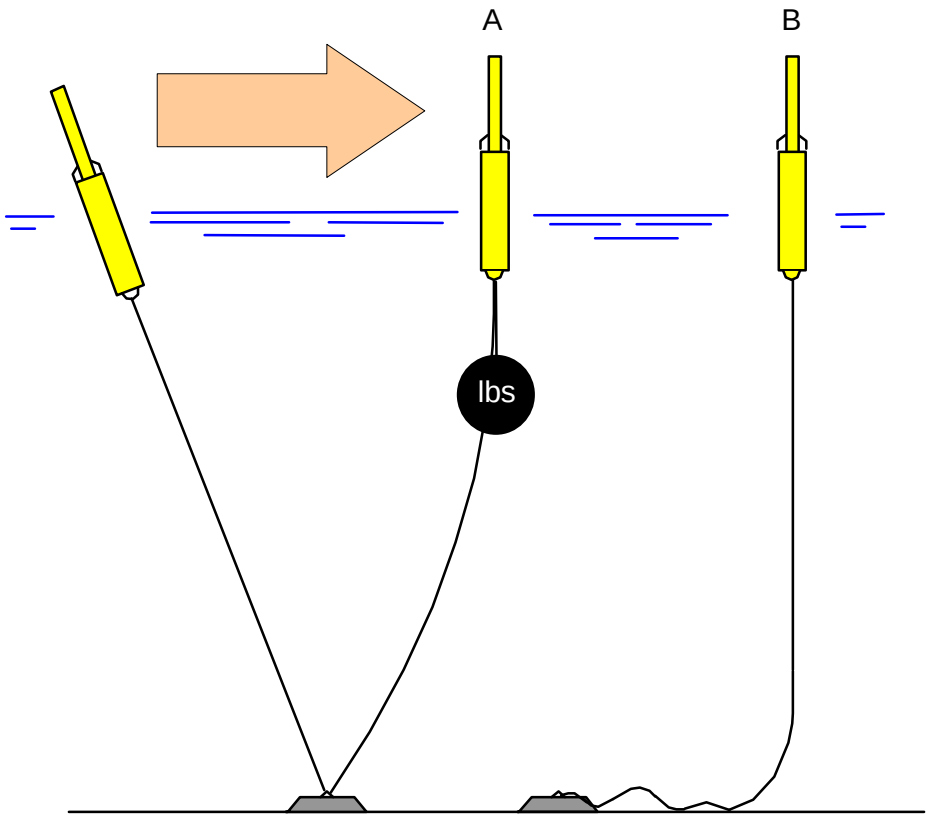
Anchor Weight on Dry Land		***Concrete Anchor Weight*** Submerged		***Steel/Iron Anchor Weight*** Submerged	
(lb)	**(kg)**	**(lb)**	**(kg)**	**(lb)**	**(kg)**
5 000	2 300	2 835	1 286	4 300	1 950
3 000	1 380	1 701	771	2 580	1 170
2 000	920	1 134	514	1 720	780
1 000	460	557	257	860	390
500	230	284	129	430	195
300	138	170	77	258	117
200	92	113	51	172	78
100	46	56	25	86	39

Righting Action

A factor that should not be overlooked in buoy design is the righting "action" which is needed to keep the buoy in an upright position. In many cases, where strong winds, waves or current exist, a buoy will begin to lean, sometime to the point where it becomes difficult to see and identify in the water. This is especially prevalent in cases where a lighter material such as synthetic rope or wire is used for mooring or where the mooring length is too short.

Much of this "lean" is the result of insufficient counterweight on the buoy. In this sense, there is not enough vertically oriented weight under the buoy to counteract the horizontal pressure that the sea or environmental conditions place on it.

FIGURE 12: Righting Action



If encountered, there are two ways to correct this problem. As illustrated in Figure 12, the first method involves the attachment of additional weight to the buoy hull. This can be accomplished by simply suspending a piece of heavy chain from the buoy bottom (See "A"). If weight is still required, attach an additional weight (e.g. a rock) from the bottom. The second way to accommodate the righting action is to increase the length of chain used (See "B").

Maintenance

The service life of a buoy system is somewhat limited due to the effects of wear and corrosion on its components and on the effects of marine fouling and weathering on markings. As a result, periodic inspection and maintenance is required to avoid the possibility of system failure. In areas where winter conditions such as ice movement or spraying are severe, buoys should be removed at the end of the navigation season and replaced in the spring.

Generally, moored buoys should be inspected at least once a year. More frequent checks are required in situations where local conditions are harsh and the risk of wear is high (i.e. high sand transport, open waters, poor weather or ice will intensify wear and corrosion). It also makes good practice to check a private buoy for damage and positioning accuracy immediately following large storms.

Although the buoy itself may require only occasional repair to counteract the effects of weathering or marine fouling, the mooring system must be watched very carefully. It is recommended that the following maintenance be done according to an appropriate maintenance schedule:

a) reassess buoy positioning to ensure its accuracy
b) ensure that all buoy markings, including colours, are in good condition
c) clear any chain or other line of shells and algae which may cause kinks
d) check the wear of any hardware component, ensuring that there is free movement between all parts
e) check every link of chain or length of line in the thrash area where the mooring comes into contact with the sea bottom (see diagram on page 22).
f) change the chain or line or any component when any part shows excessive wear

The sinker, which is not exposed to wear, needs less frequent examination (i.e. every 2 to 3 years).

The International Association of Lighthouse Authorities (IALA) recommends that buoy mooring chain be replaced when the bar diameter of the links has been reduced by wear to a minimum of 60 % of its original thickness. In some cases, such as those in which the chain is exposed to severe wear (e.g. the thrash area), this percentage should be increased. For safety purposes, a reduction of 25% in exposed areas and 40% in sheltered areas are reasonable limits. Acceptable wear for rope, wire and other mooring types has yet to be determined and thus, good judgment must be exercised with respect to maintenance.

Manufacturers & Suppliers

The following is a list of suppliers of aids to navigation known to the Canadian Coast Guard. The Coast Guard does not provide aids to navigation equipment, but keep in mind that the equipment must be in accordance with the Canadian Aids to Navigation System booklet (TP968) when used as an aid to navigation.

For information on drawings and/or specs for steel buoys please contact:

Director
Navigation Systems Branch
Canadian Coast Guard
200 Kent Street
Ottawa, Ontario
K1A 0E6

Eastern Canada

DOWNEAST PLASTICS LTD.
P.O. Box 509
2598 Arcadia Road
Cap-Pele, New Brunswick
E0A 1J0
Tel: (506)577-4351
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Dartmouth, Nova Scotia
B3B 1W2
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Fax: (902)468-6434

TIDELAND SIGNAL CANADA LTD.
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c/o Mcloughlan Supplies Limited
P.O. Box 877
22-24 Blackmarsh Road
St. John's, Newfoundland
A1E 1S3
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Fax: (709)576-0904

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Fax: (902)566-4929

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Fredericton, New Brunswick
E3B 4Z9
Tel: (506)454-5341
Fax: (506)462-9883

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243 Airport Heights Drive
St. John's, Newfoundland
A1A 4X3
Tel: (709)685-6826
Fax: (709)754-7023

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17 Maitland St.
Dartmouth, Nova Scotia
B2Y 3L8
Tel: (902)466-2151
Fax: (902)466-2264

Central Canada

POL-E-MAR INC.
(Ontario, Alberta, Manitoba, NWT & Arctic)
Unit 2-203 Colonnade Rd. South
Nepean, Ontario
K2E 7K3
Tel: (613)723-1541
Fax: (613)723-8692

KINGSTON ANCHORS LTD.
143 Hickson Avenue
Kingston, Ontario
K7K 2N8
Tel: (613)549-2718

3M CANADA LIMITED
(Head Office)
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Nepean, Ontario
K2E 7V5
Tel: (613)225-1175
Fax: (613)225-7514

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M3N 1V7
Tel: (416)663-6416

POL-E-MAR INC. (Quebec)
8389 Av. Sous le vent
Charny, Québec
G6X 1K7
Tel: (418)832-0013

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Brockville, Ontario
K6V 1N4
Tel: (613)342-0618
Fax: (613)342-6417

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Fax: (250)920-9800

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North Vancouver, B.C
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Fax: (604)986-6246

SIGMA
7-2062 Henry Avenue West
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V8L 5Y1
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Fax: (250)655-4383

International Sources

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Gloversville, New York 10278
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Churchill Industrial Estate
Marlborough Road
Lancing, West Sussex B15 8UF
England
Tel: (0)903 752535
Fax: (0)903 87232

BALMORAL GROUP LIMITED
Balmoral Park
Loirston
Aberdeen
AB12 3GY
United Kingdom
Tel: (0) 1224 859037
Fax: (0) 1224 859059

PROTONNA BV
Sint-Jobsweg 30
3024 EJ Rotterdam
Tel: (010) 2441441
Fax: (010) 2441444

SEAWARD INTERNATIONAL INC.
C3470 Martinsburg Pike
P.O. Box 98
Clearbrook VA. 22624-0098
USA
Tel: 1(703)667-5191
Fax: 1(703)667-7987

Boating Restriction Regulations

Provincial Contacts

ALBERTA

Department of Environmental Protection
Fish and Wildlife Services
Enforcement Program
Main Floor, South Tower
Petroleum Plaza
9915-108th Street
Edmonton, Alberta
T5K 2G8
Tel: (780) 427-3887
Fax: (780) 422-9560

BRITISH COLUMBIA

Canadian Coast Guard
Office of Boating Safety
25 Huron Street
Victoria, British Columbia
V8V 4V9
Tel: (250) 480-2792
Fax: (250) 480-2793

MANITOBA

Department of Natural Resources
Policy Coordination Branch
Box 38, 200 Salteaux Crescent
Winnipeg, Manitoba
R3J 3W3
Tel: (204) 945-7462
Fax: (204) 945-7782

NEWFOUNDLAND

(Northwest Atlantic Fisheries Centre)
Canadian Coast Guard
Office of Boating Safety
P.O. Box 5667
St-John's, Newfoundland
A1C 5X1
Tel: (709) 772-6915

NOVA SCOTIA, NEW BRUNSWICK and PRINCE EDWARD ISLAND

Canadian Coast Guard
Office of Boating Safety
P.O Box 1000
Dartmouth, Nova Scotia
B2Y 3Z8
Tel: (902) 426-7525
Fax: (902) 426-4828

ONTARIO

Ministry of Natural Resources
Natural Heritage Section, S5
300 Water Street
Peterborough, Ontario
K9J 8M5
Tel: (705) 755-1230

QUEBEC

Services Juridiques
Ministère des affaires municipales
20 Chauveau Avenue
Québec, Québec
G1R 4J3
Tel: (418) 691-2022
Fax: (418) 644-5772

SASKATCHEWAN

Saskatchewan Department of Environment
and Resource Management
Provincial Enforcement Section
P.O. Box 3003
Prince Albert, Saskatchewan
S6V 6G1
Tel: (306) 953-2977
Fax: (306) 953-2999

CCG Aids to Navigation Offices

(B) Bilingual Service
(E) English Only Service

(TF) Toll Free
(H/N) Holidays & Nights

Newfoundland Region:

ST. JOHN'S, NFLD.

SUPERINTENDENT,
AIDS TO NAVIGATION
NAFC, White Hills
P.O. Box 5667
St. John's, Newfoundland
A1C 5X1
Tel: 1(709)772-5195 (E)
Regional Operation Centre: 1-800-563-9089 (B)(H/N)(TF)

Maritimes Region:

REGIONAL OPERATIONS CENTRE: 1(902)426-6030 (B)(H/N)

DARTMOUTH, N.S.

REGIONAL DIRECTOR
P.O. Box 1035
176 Portland St.
Dartmouth, Nova Scotia
B2Y 1J3
Tel: 1(902)426-3907

CHARLOTTETOWN, P.E.I.

AIDS TO NAVIGATION OFFICER
P.O. Box 1236
Charlottetown, P.E.I.
C1A 7M8
Tel: 1(902)566-7936 (B)
1(800)565-1633 (B)(TF)

DARTMOUTH, N.S.

SUPERINTENDENT,
AIDS TO NAVIGATION
P.O. Box 1000
Dartmouth, Nova Scotia
B2Y 3Z8
Tel: 1(902)426-3151 (E)
1(800)565-1633 (B)(TF)

SAINT JOHN, N.B.

AIDS TO NAVIGATION OFFICER
P.O. Box 700
Saint John, New Brunswick
E2L 4B3
Tel: 1(506)636-4703 (E)
1(800)565-1633 (B)(TF)

Laurentian Region:

QUEBEC CITY, QUEBEC

SUPERINTENDENT
101 Champlain Blvd.
Québec, Québec
G1K 7Y7
Tel: 1(418)648-3574 (B)
Montreal Office: 1(800)363-4735 (B)(TF)
Internet: aidesnavquebec@dfo-mpo.gc.ca

Central and Arctic Region:

SARNIA, ONTARIO

REGIONAL DIRECTOR GENERAL
201 North Front Street, Suite 703
Sarnia, Ontario
N7T 8B1
Tel: 1(519)383-1800 (E)
Operations Centre: 1(519)383-1841 (B)(H/N)
Regional Superintendent Aids to Navigation: 1(519)383-1859 (E)

PARRY SOUND, ONTARIO

SUPERVISOR, AIDS TO NAVIGATION
P.O. Box 310
Parry Sound, Ontario
P2A 2X4
Tel: 1(705)746-2196 (E)

PRESCOTT, ONTARIO

SUPERVISOR, AIDS TO NAVIGATION
P.O. Box 1000
Prescott, Ontario
K0E 1T0
Tel: 1(613)925-2865 (E)

HAY RIVER, N.W.T.

SUPERVISOR, AIDS TO NAVIGATION
P.O. Box 5002
Hay River, N.W.T.
X0E 0R0
Tel: 1(403)874-5501 (E)

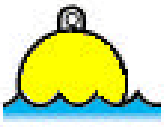
Pacific Region:

VANCOUVER, B.C

DIRECTOR, MARINE AIDS PROGRAM
300-555 West Hastings Street
Vancouver, B.C.
V6B 5G3
Tel: 1(604)775-8852 (E)

VICTORIA. B.C.

SUPERINTENDENT,
AIDS TO NAVIGATION
25 Huron Street
Victoria, B.C.
V8V 4V9
Tel: 1(250)480-2600 (B)



Standardized Marking of Fish Nets

For information outlining the standardized marking of Commercial Fishing Nets, please communicate with the following regional contacts:

Newfoundland Region:

Superintendent of Navigation Protection Program (NPP)
Tel: (709)772-2284

Maritimes Region:

Scotia Fundy – Fisheries Management
Director, Conservation and Protection
P.O. Box 1035
176 Portland St.
Dartmouth, N.S.
B2Y 1J3
Tel: (902)426-2392

and / or

Gulf – Fisheries Management
Director, Conservation and Protection
P.O. Box 5030
343 Archibald St.
Moncton, N.B.
E1C 9B6
Tel: (506)851-7795

Laurentian Region:

Central & Arctic Region:

Ontario Fish Producers' Association
45 James Street, Box 2129
Blenheim, Ontario
N0P 1A0
Tel: (519)676-0488
Fax: (519)676-0944

Pacific Region:

Fisheries Management Branch
Regulation Unit
Suite 470-555 West Hastings
Vancouver, BC
V6B 5G3
Tel: (604)666-6408

CONSTRUCTION WORKSHEET

Location: _____

Buoy Usage: _____

Buoy Construction: _____

Date: _____

Requirements as per Private Buoy and /or Boating Restriction Regulations

Markings	
Colours	
Shape	
Dimensions	
Lights or Reflective Material	
Additional Requirements	

Mooring Specifications

Mooring Type		
Buoyancy or D.W. of Buoy		
Buoy Dry Land Weight		
Water Depth		
Mooring Line Material		**Weight Per ft / m:**
Anchor Materials		**Displacement Value:**

Anchor Weight Calculation:

MINIMUM = [(DW - OW) x Material Displacement Factor] x Safety Factor

=

=

Resulting Anchor Dimensions (*Concrete Only*): _____

Environmental Considerations

Wind Maximum	
Wave Maximum	
Current Maximum	

Maintenance

Component	Maintenance Cycle	Complete
Buoy		
Mooring		
Anchor		