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Boating Safety Circular 76

PREVENTING PROPELLER AND BOAT STRIKE ACCIDENTS

There are nearly 12 million registered boats in the United States, 95 percent of which are less than 26 feet in length. These same boats account for as many as 80 percent of the underwater impact injuries in which people in the water are struck by a boat or its propeller. The majority of these accidents are the result of operator error, making them one of the most preventable of all types of boating accidents. While boat or propeller strike accidents are relatively few in number, as compared to other types of boating accidents, some of them are severe and have tragic consequences . . .

Operator inexperience, incompetence, negligence and intoxication are significant contributing factors in reported boat and propeller strikes, as well as in all other types of boating accidents. In almost all cases, the victim is in the water -- a swimmer, scuba diver, fallen water skier or the operator or a passenger.

Passengers moving about a boat, or who are improperly seated on the bow, a gunwale or a seatback, are ejected from the boat or fall overboard when boat operators are wake jumping, are in sharp turns, or are performing other maneuvers at speeds which are dangerously fast for prevailing conditions. Some victims are ejected from boats by collisions with another boat or a submerged or fixed object. Ejections from a boat are also caused by sudden acceleration or deceleration. While some victims have been struck by the propeller when a boat was airborne, such as when one vessel collides with and passes over another, such incidents are rare.

Negligent or Grossly Negligent Operation of a Vessel which endangers lives and/or property is prohibited by law. The Coast Guard may impose a civil penalty for negligent operation; violations involving boating while intoxicated could result in criminal penalties. State and Federal marine law enforcement officers are trained to define negligent operation as failure to exercise that degree of care which a reasonable person under like circumstances would demonstrate in order to prevent the endangering of life, limb or property of any person. Grossly negligent operation involves situations in which the boat operator knows a certain act can create an unreasonable risk of harm. Some examples of actions that may constitute negligent or grossly negligent boat operation are:

- Operating a boat in a swimming area;
- Operating a boat while under the influence of alcohol or drugs;
- Excessive speed in the vicinity of other boats or in dangerous waters;
- Hazardous water skiing practices; or
- Bowriding or riding on the seatback, gunwale or transom.

Most boat or propeller impact accidents can be prevented by boat operators who follow basic safe boating practices:

- Always maintain a proper lookout. The greatest single cause of accidents in which people in the water are struck by a boat or its propeller is operator inattention or carelessness.

- Make sure the engine is off so the propeller is not rotating when passengers are boarding or disembarking a boat.

- Never start a boat with the engine in gear.

Inside:

• Slow down when approaching congested areas and anchorages. In congested areas, always be alert for swimmers and divers.

• Become familiar with the warning buoys signifying swimming areas and other hazardous areas.

• Keep the boat well clear of marked swimming and diving areas. Become familar with the red and white or blue and white diagonally striped flags signalling that divers are down.

• Before getting underway, make sure passengers are properly seated. Some operators of larger boats with several passengers have started their boats and put the engine in gear while their friends were still swimming or diving from the boat.

• Never ride on a seatback, a gunwale, the transom or on the bow.

• When someone falls overboard:

(1) turn the bow of the boat towards the person in the water. For example, if a person falls overboard on the starboard (right) side, turn the boat to starboard so as to move the propeller away from the person in the water.
(2) Slow down.
(3) Circle around, keeping the individual in sight.
(4) Take the engine out of gear or turn off the engine at least a boat length from the victim.
(5) Throw the individual a line or something which floats with a line attached to it and pull the person to the boat.

• When water skiing, designate a passenger who will keep the skier(s) in sight at all times. Communicate with a skier using standard water skiing hand signals.

The best approach to preventing boat and propeller strikes is to educate boaters, especially boat operators. They must learn the abilities and limitations of their equipment. They must learn and understand the hazards their boats can cause to people in the water. Above all, they must understand the consequences of careless or negligent operation, and how they, as boat operators, can act to prevent accidents.

OPENINGS AND DUCTS IN NATURAL VENTILATION SYSTEMS

According to a letter from the Commanding Officer, U.S. Coast Guard Martine Safety Office Puget Sound:

"Over the past year or two several boat builders in this District have begun to build larger boats. These larger boats naturally have larger engine compartments. I have noted that on some of these boats the builder continues to use the same size and number of ventilation ducts for the larger compartments (i.e., one three inch exhaust and intake duct for a 100 cubic foot net compartment volume).
I don't believe builders are purposely thwarting the regulations in order to save a few dollars; they just don't realize that with increased engine compartment volume they need to increase the ventilation capacity."

According to Sections 183.630(d) and (e) of the Ventilation System Standard:

"(d) Except as provided in paragraph (e) of this section, supply openings or supply ducts and exhaust openings and exhaust ducts must each have a minimum aggregate internal cross-sectional area calculated as follows:

A= 5 ln (V/5)

Where:
(1) **A** is the minimum aggregate internal cross-sectional area of the openings or ducts in square inches;
(2) **V** is the net compartment volume in cubic feet, including the net volume of other compartments connected by openings that exceed 2 percent of the area between the compartments; and
(3) **ln** is the natural logarithm of the quantity (V/5).
(e) The minimum internal cross-sectional area of each supply opening or duct and each exhaust opening or duct must exceed 3.0 square inches."

For example, let's assume that we are trying to determine the minimum size openings and ducts which would be required for a 19-foot fiberglass inboard powered by a six cylinder, in-line engine. The engine compartment measures five feet by three feet by four feet. This means the total engine

compartment volume is 60 cubic feet.

Net compartment volume is determined by subtracting the volume of permanently installed items of equipment and accessories from the total compartment volume.

Examples of items which would probably be permanently installed in the engine compartment of a 19-foot inboard are:

- the engine
- the fuel tank
- the battery

Examples of items which would not be considered permanently installed are:

- stowed fenders
- coolers
- tool boxes
- other items that may or may not be in a compartment requiring ventilation at any given time.

For the sake of this example, let's assume the engine and the battery are the only permanently installed items of equipment installed in the engine room of the 19-foot inboard. The typical volume of a six cylinder, in-line engine is 3.5 cubic feet. The volume of a battery is .5 cubic feet.

60.0 ft^3	(engine compartment volume)
- 3.5 ft^3	(volume of 6 cyl engine)
56.50 ft^3	
-.50 ft^3	(volume of 1 battery)
56.00 ft^3	**net compartment volume**

Using the table at right, the 19-foot inboard would require supply ducts and openings with a minimum total cross-sectional area of 12.07 square inches. Any opening used to achieve the minimum 12.07 square inch total cross-sectional area cannot be smaller than three square inches.

The minimum total cross-sectional area of all the exhaust ducts and openings in our example is also a minimum of 12.07 square inches with a minimum of three square inches per opening.

Construction of a boat with a larger net compartment volume would require progressively larger supply openings and ducts and exhaust openings and ducts.

Net compartment volume in cu.ft.		**Aggregate internal cross-sectional area in sq. in.**
V	**ln (V/5)**	**5 ln(V/5)***
6	.1823	.91
7	.3365	1.68
8	.4700	2.35
9	.5878	2.93
10	.6931	3.46
11	.7885	3.94
12	.8755	4.37
13	.9555	4.77
14	1.0296	5.14
15	1.0986	5.49
16	1.1632	5.81
17	1.2238	6.11
18	1.2809	6.40
19	1.3350	6.67
20	1.3863	6.93
21	1.4351	7.17
22	1.4816	7.40
23	1.5261	7.63
24	1.5686	7.84
25	1.6094	8.04
26	1.6487	8.24
27	1.6864	8.43
28	1.7228	8.61
29	1.7579	8.78
30	1.7918	8.95
31	1.8245	9.12
32	1.8563	9.28
33	1.8871	9.43
34	1.9169	9.58
35	1.9459	9.72
36	1.9741	9.87
37	2.0015	10.00
38	2.0281	10.14
39	2.0541	10.27
40	2.0794	10.39
41	2.1041	10.52
42	2.1282	10.64
43	2.1518	10.75
44	2.1748	10.87
45	2.1972	10.98
46	2.2192	11.09
47	2.2407	11.20
48	2.2618	11.30
49	2.2824	11.41
50	2.3026	11.51
51	2.3223	11.61
52	2.3418	11.70
53	2.3608	11.80
54	2.3795	11.89
55	2.3978	11.98
56	**2.4159**	**12.07**
57	2.4336	12.16
58	2.4510	12.25
59	2.4680	12.34
60	2.4849	12.42

*The minimum internal cross-sectional area of each supply opening or duct and each exhaust opening or duct must exceed 3.0 square inches. The shaded area in the table indicates values of "A" which do not meet the minimum size requirements specified in 183.630(e).

HULL IDENTIFICATION NUMBERS AND SALES OF REPLACEMENT HULLS FOR PERSONAL WATERCRAFT

The largest number of vessels reported stolen annually are Personal Watercraft (PWC). In addition, both PWC manufacturers and independent aftermarket manufacturers routinely sell replacement hulls for PWC.

The sale of replacement PWC hulls without Hull Identification Number (HINs) represents a serious problem for State vessel registration, numbering and titling authorities and marine theft investigators, because thieves can "launder" the engine and other components from a stolen PWC. The sale of replacement PWC hulls with an HIN which differs from the HIN originally assigned to the vessel may also mislead retail purchasers about the age of a used PWC and might be considered evidence of fraud.

Because of these problems involving HINs and the sale of replacement hulls for personal watercraft, the Coast Guard urges manufacturers to require any purchaser seeking a replacement hull to:

(1) return the damaged hull to your company or the dealer for destruction and disposal; and
(2) affix the same HIN originally assigned to the PWC, preferably with OEM rivets and epoxy.

Both PWC manufacturers and manufacturers of aftermarket PWC hulls are reminded to be very careful to ensure that the methods used for affixing HINs to PWC hulls make the HINs difficult to remove, without leaving obvious evidence of tampering. If the HIN is on a separate label which is riveted to the hull, the label should also be bonded with epoxy or some other adhesive.

These procedures will ensure that PWC with replacement hulls are traceable through manufacturer warranty and State vessel registration and numbering systems, and makes it virtually impossible for a “damaged” PWC hull to be recycled as a usable vessel.