9 SEAMANSHIP UNDER POWER

What boater does not envy the skipper of a well-kept yacht as it pulls up to a crowded dock, eases into reverse and magically settles into the berth?

In reality, there is no magic involved in maneuvering a boat; it responds to the laws of physics. However, discovering the relationship between the physical laws and boat behavior can be an exasperating experience.

In this chapter the handling characteristics of single-screw, twin-screw and outboard or stern-drive boats are explained in principle. With practice, you will be ready to meet the real test—maneuvering in and around docks and busy harbors.

BASIC PRINCIPLES OF BOAT HANDLING

The ability to steer well—called helmsmanship, when referring to either men or women—is a quality that cannot be learned from a book or in a classroom. However, understanding the basic principles of boat handling will make it easier for you to practice in a variety of situations.

The art of helmsmanship

It is important to realize that boats are nearly as individualistic as people, particularly in their steering characteristics. Deep-draft and shallow-draft vessels handle differently. Boats that steer by changing their thrust direction—outboards and stern drives—respond differently than boats steered by rudders; the response of heavy displacement hulls to helm changes is quite unlike that of light planing hulls.

The secret of good helmsmanship is to know your boat. If you skipper your own craft, this comes quickly as you gain experience with it. If you take the wheel or tiller of a friend's boat, however, take it easy at first with helm changes, until you get the "feel" of the craft's response.

Steering is often done by compass. The helmsman must keep the compass lubber's line on the mark of the card that indicates the course to be steered. If the course to be steered is 100 degrees, and the lubber's line is momentarily at 95 degrees, the helmsman must "swing the boat's head" with right rudder, 5 degrees to the right, to bring the lubber's line around to 100. Remember, the card stands still while the lubber's line swings around it. Any attempt to bring the desired course on the card up to the lubber's line will produce exactly the *opposite* result.

As a vessel swings with a change in course, the inexperienced helmsman tends to allow it to swing too far, from the momentum of the turn and the lag between the turn of the wheel and response of the craft. The experienced helmsman knows how to steady on the new course without over-swinging. In almost all power cruisers, this requires that the helmsman return the rudder to the neutral, midships, position *before* the craft reaches the intended new heading. The helmsman will often need to use a slight amount of opposite rudder to check the boat's swing.

A zigzag course also brands the helmsman as inexperienced. The goal is a straight course, which can be achieved, after the boat has steadied, by only slight movements of the wheel. The experienced boater at the helm anticipates the vessel's swing and, turning the wheel slowly and deliberately, makes corrections with little rudder instead of going well off course before correcting.

When holding a course it helps to pick out a distant landmark. But you must also drop your eye periodically to the compass to check your course, and look back periodically at the aids or landmarks you have passed, making sure that you remain on your proper track. Even though you may be steering quite precisely toward your objective, the wind or a cross-current may be setting you to one side. If in a narrow channel, you could soon be out of it and aground.

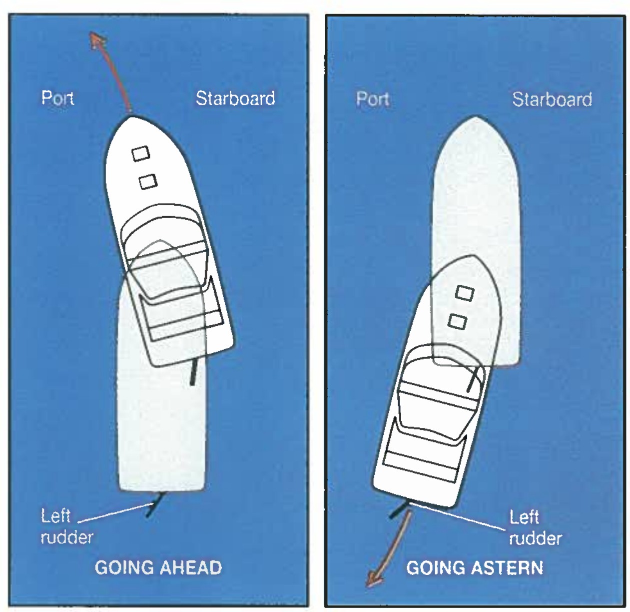
Basic boat terms

Certain basic boating terms apply specifically to boats equipped with one or more engines—whether inboard (mounted within the hull), outboard (mounted on the transom and detachable), or the combination inboard-outboard (I/O) type. Thrust for the movement of the boat through the water is achieved by the rotation of a propeller (or "screw"), which draws in water from ahead and pushes it out astern. A boat with one propeller is termed a single-screw type. Boats with two propellers are referred to as twin-screw craft. Sailboats fitted with an engine are called auxiliaries. The handling characteristics are similar to those of the single-screw powerboat.

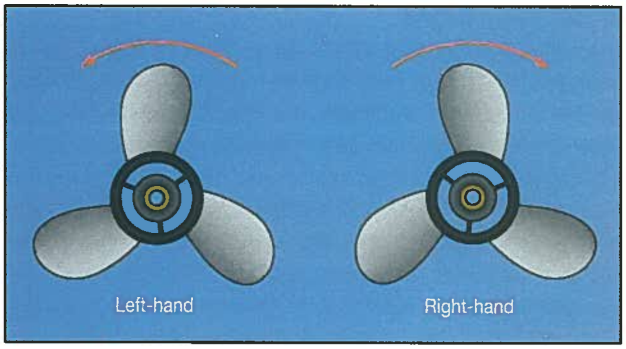
Steering is accomplished in one of two ways. An inboard engine operates according to a "fixed screw": Turning a rudder or rudders diverts the thrust developed by the propeller(s), which in turn turns the boat. An outboard or I/O powered boat operates without a rudder. Moving the motor and propeller, or outdrive unit, directly turns the propeller thrust, changing the boat's direction.

Just as a person has a left and right side, a boat has a left or port side or a right or starboard side as you stand and look forward on it. Turning around while on board and looking aft will not change the boat's port and starboard sides.

A boat is said to be making headway when it is going forward in the water and sternway when it is backing up. A boat is turning to port when its bow is moving to the left when making headway. A boat is said to be going to port when making sternway if its stern is moving to port. Right and left rudder refer to the direction the rudder must be turned to cause the bow to turn to the right or left as the boat makes headway. The same is true when making sternway. A boat with left rud-



With left rudder in a boat going ahead *(above, left)*, the stern is thrown to starboard, bow to port. With left rudder when going astern *(above, right)*, the stern is thrown to port.



If you stand at the stern of a boat that is out of the water, and look at its propeller, you will be looking at the driving face of the propeller blades. If the propeller must turn to the right (clockwise) to push water toward you, the propeller is right-handed; if it turns in the opposite direction it is left-handed.

der applied will turn its bow to port while making headway and swing its stern to port when making sternway.

Propellers are said to be right-handed or left-handed depending on the direction they turn (looking forward from aft of the propeller). The difference is important because propeller rotation has a great bearing on how a boat maneuvers, especially when reversing. A propeller that turns clockwise when driving the boat ahead is right-handed, one that turns counterclockwise is considered left-handed. Most single propeller boats have right-handed propellers; dual propeller boats are likely to have a right-handed propeller on the starboard side and a left-handed propeller on their port.

It is not always easy to determine the hand of a propeller by looking at the rotation of the engine alone. The engine is connected to a transmission that may change engine rotation depending on its reduction gearing. The rotation of the coupling connecting the transmission to the propeller shaft is, however, a true indication of the propeller shaft rotation. If, looking forward toward the transmission from aft of it, the shaft and coupling rotate clockwise when the transmission is in forward, then the shaft has a right-hand propeller.

This sport-fishing boat with its planing-type hull has only part of the hull in contact with the water when on a plane.

Hull shape

In addition to propeller and rudder configuration, the hull shape of a boat has a strong influence on how it handles. Given the same wind and sea conditions, a trawler with its heavy displacement hull and deeper draft will behave differently than a lighter sport-fishing boat with its shallower draft, planing hull, flying bridge and, possibly, tuna tower.

Displacement-type hulls are heavily built and have a large load-carrying capacity, but are limited in the speed at which they can be driven through the water. Sailboats, trawlers and most large yachts fall into this category. Planing-type hulls are sometimes lighter in weight. They have less draft, and can be driven through the water fast enough to cause the hull to rise up out of the water and plane on top of it, keeping only a part of the hull in contact with the water. As a planing hull eventually slows down, it reaches a point where it reverts to the displacement mode.

Wind and current

A boat's handling characteristics are affected by wind and current, no matter what type of hull and power combination it has. Keeping a course or maneuvering in close quarters may be straightforward on a calm day during a slack tidal current, but the boat may become quite ill-mannered when coping with a stiff crosswind or crosscurrent. Since bows on many powerboats are higher than the sterns, they tend to fall off the wind when backing, despite anything that is done with the helm.

Hull type has the most effect on how a boat reacts to the current. Displacement-type hulls with considerable draft are affected by current to a greater extent than shallower-draft, lighter, planing-type hulls. Water is much denser than air, so a half-knot crosscurrent may have more effect on a displacement cruiser than a stiff 15- to 20-knot wind. On the other hand, given the same conditions, a planing-type hull with a high tuna tower could be more affected by wind than by current. Neither a displacement nor planing boat can ignore the wind or current. Skippers of both will find one of them a major factor affecting the boat's maneuverability. This becomes most apparent while running at low speed in close quarters.

Two boats of roughly the same size, one with a considerable hull draft forward but little aft, and another with relatively greater draft aft but more superstructure forward, have radical differences in their handling qualities. The governing factor is the relative area presented above the water to the wind, compared with the areas in the water, both fore and aft.

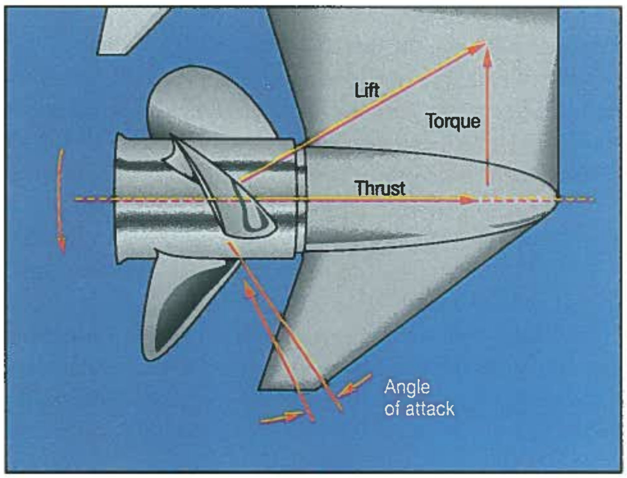
Finally, skippers sometimes refer to propellers as "wheels," especially when describing right- or left-handedness. Since most of the discussion in this chapter is about steering, we will use "propeller" exclusively.

UNDERSTANDING PROPELLERS AND RUDDERS

Powerboats are driven through the water by the action of their propellers, which act like pumps—drawing in a stream of water from forward (when going ahead), and throwing it out astern. Moving these streams of water aft creates an opposite forward thrust at the propellers, which is transmitted to the boat through the propeller shaft and its supporting structure. This drives the boat forward.

How propellers create thrust

The curved blades of the propeller are similar to other curved foils found on boats, for example a sailboat's sail or a fin keel. When such a foil passes through a fluid, the flow is divided into two streams, one on either side of the foil. When a rudder is in a straight position, the water flows evenly on both sides. Turning the rudder causes an uneven flow, building pressure on one side and reducing it on the other. The rudder will then tend to move toward the low pressure, creating lift, and turning the boat in that direction.



This illustration shows the relationship between lift, thrust and propeller torque.

A propeller blade creates force in a very similar way to the rudder. If the propeller were designed with blades that were flat rather than curved, and if the blades were simply spun around without any angle to their direction of travel, the propeller would turn through the water like a disk with equal flow on each side. However, this is not the case. The blades of the propeller are both curved and angled; as they pass through the water, they create lift. There is a low pressure area on the side of the blade facing forward and a high pressure area on the side facing aft.

Although the water drawn into the propeller does not actually flow from directly ahead like a thin column of water, for our purposes here it can be considered as coming in generally parallel to the keel. As the propeller ejects the water, it imparts a twist or spiral motion to that water. (The direction of rotation is dependent on the way the propeller turns.) This flow of water is called "screw current."

Regardless of whether the propeller is rotating to move the boat ahead or astern, the part of the current which flows into the propeller is called the "suction screw current." The part of the current ejected from the propeller is called the "discharge current." Discharge current, spiral in motion, is a compact stream of water that exerts greater pressure than the broader suction current.

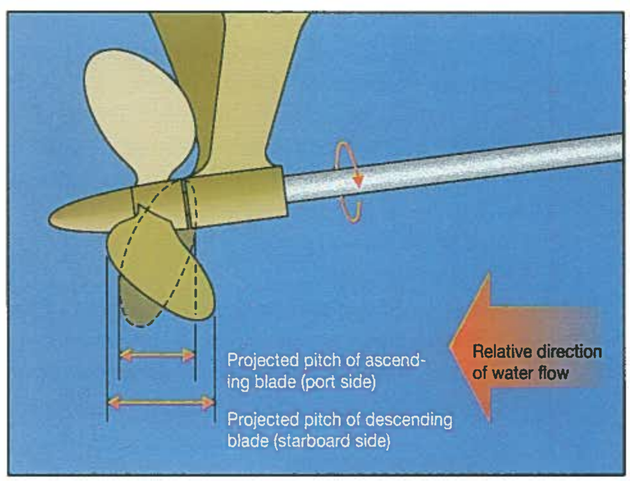
Placing the rudder behind the propeller in the discharge current increases the steering effect because the rudder is acting in an accelerated flow. (Of course, there is a small rudder action from any flow of water past it even if the propeller is not turning.) A twin-screw cruiser has twin rudders, one behind each propeller, keeping the rudder blades directly in the propellers' discharge currents.

The pressure difference created by the propeller blade is called lift, and its force is roughly perpendicular to the blade itself. Lift can be divided into two components—a thrust component in the direction of travel and a torque component in the opposite direction of propeller rotation. You can easily see the effect of propeller torque when a runabout with a large engine accelerates; as the propeller begins to accelerate, the boat tends to dip on one side (generally on the port side with a right-hand propeller).

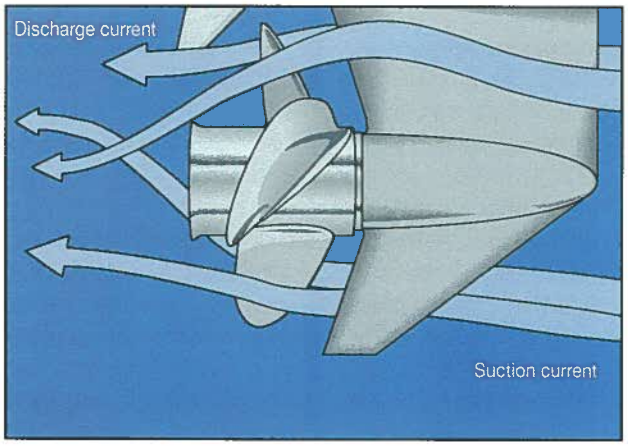
Unequal blade thrust

Turning propellers not only create forward or reverse thrust with their discharge current, they also produce forces that tend to push the propeller to one side or the other, depending on the direction of rotation. The effect of this unequal blade thrust is commonly referred to as propwalk.

This effect is most noticeable on inboard boats that have a propeller shaft set through the hull at an angle to the horizontal. Since the propeller is attached to the end of this shaft, it is positioned at the same angle and the water that flows into



A propeller shaft at an angle to the horizontal has the effect of increasing the pitch of the descending blade relative to that of the ascending blade, producing greater thrust to starboard. A left-hand wheel would produce greater thrust to port.



With the propeller turning ahead, suction screw current is drawn toward the propeller; the discharge current is driven out astern.

it meets the blades at different angles depending whether they are on the downward or upward part of their circle. The effective pitch of one blade is increased, the other reduced. For example, a forward-turning right-hand propeller would have the pitch of its starboard (descending) blade increased, while the pitch of the port (ascending) blade would be decreased. The relatively greater blade pitch on the starboard side creates a stronger thrust on that side. The stern of a single-screw boat with a right-hand propeller tends to go to starboard when the propeller is going ahead, with the bow turning to port; with reverse thrust, the effect that is created is just the opposite.

The importance of this factor is reduced as the shaft angle is decreased, so the effect of unequal blade thrust varies with each design. However, when the shaft angle is parallel to the flow of water into the propeller, the paddle wheel, or prop-walk, effect may come into play: As an outboard is progressively raised, the propeller will eventually break the surface of the water. As this occurrence increases, a blade sweeping across the top, fanning through aerated water, will not pull as hard in a sideways or propeller torque direction as the fully submerged blade sweeping across the bottom of the propeller arc. This will cause a right-hand rotation propeller to "walk" to the right, much as a paddle wheel would do. This action in turn tries to pull the aft end of an outboard or stern drive to the right, causing the boat to go into a left-hand turn, if not resisted at the steering wheel.

Unequal blade thrust becomes more of a concern to lighter single-engine craft at higher speeds when the propeller is elevated closer to the water surface; the paddle wheel (prop-walk) effect will eventually dominate any steering torque cause.

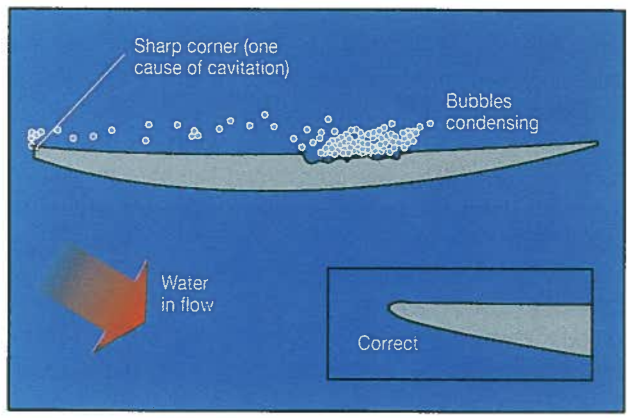
Ventilation and cavitation

Since all but a few high-speed, surface-piercing propellers rely on the smooth flow of water over their blades to create lift, a slight disturbance to this flow limits the overall efficiency of the propeller.

Ventilation occurs when air from the water's surface or exhaust gases from the exhaust are sucked into the screw current. The propeller then loses its grip on the water and over-revs, losing much of its thrust. Trying to turn an outboard too tightly at too high a speed often results in propeller ventilation.

Cavitation usually occurs at the tip of a propeller that is turning too fast. A spot on the tip of a propeller blade travels farther and faster during each revolution than does one near the hub. As the propeller rpms increase, the tip reaches a point where water simply can't flow past the tip without breaking down and forming small bubbles, much like boiling water. As these water vapor bubbles move along the surface of the metal, they eventually find an area of higher pressure where they collapse and cause damage. When collapsing, the bubbles release their stored energy onto the metal, acting like tiny jackhammers; the result is known as "cavitation burn."

Cavitation may result from a number of causes, including nicks in the leading edge, sharp leading edge corners (as shown below), improper polishing or poor blade design, severely bent propeller or broken blade tips, or ventilation.



Cavitation results from a partial vacuum being formed by the blades of a propeller, with a consequent loss of thrust.

How a rudder acts

Most inboard boats have a vertical rudder blade located at the stern, attached to a rudder post that extends through a water-tight stuffing box into the boat. Movement of the steering wheel turns the rudder to port or starboard. The position of the rudder creates a higher pressure on one side of the rudder and a lower pressure on the other. As the rudder is pushed and pulled into its own lower pressure area, it takes the stern of the boat with it.

Steering wheels on boats are rigged in such a way that they turn with the rudder—turning the helm to port accordingly turns the rudder to port. Turning the helm to port therefore gives left rudder; this then kicks the stern to starboard, so that the bow in effect moves to port, starting a turn to the left. Conversely, turning the helm to starboard gives right rudder, throwing the stern to port so that the boat then turns to starboard (to the right).

The Arneson Drive is a high-performance system designed to reduce drag while enhancing positive-thrust steering. It uses surface-piercing propellers.

Small rudders are effective when there is considerable propeller current; but they develop little turning force at slow speeds or when the propeller is not turning. Sailboats and most single-prop heavy displacement powerboats have larger rudders and respond to the helm adequately at slow speeds.

At very slow propeller speeds, the boat's headway may not be sufficient to give control over the boat if wind or current are acting upon it. Take, for example, a strong wind on the port beam. Even with the rudder hard over to port, it may not be possible to make a turn into the wind until the propeller is speeded up—enough to exert a more powerful thrust against the rudder blade. As a vessel travels through the water, the minimum speed at which it can be controlled is called steerageway.

Turning circles

When any boat has headway and the rudder is put over to make a turn (to starboard, for example), the stern is first kicked to the opposite side (in this example, to port). The boat then tends to slide off obliquely, in a crablike fashion. Its momentum will carry it some distance along the original course before settling into a turn, in which the bow describes a smaller circle than the stern. The pivoting point may be aft from the bow between one-fourth and one-third of the boat's length, varying with different boats and changing for any given boat with its trim.While there is always a loss of speed in making a turn, the size of a boat's turning circle varies little with changes in speed, assuming a given rudder angle.

However, the size of the turning circle is much larger for single-screw inboard boats as compared with outboards (or stern-drive boats) because the shaft and propeller of the inboard are fixed on the centerline and cannot be rotated. The twin-screw inboard, on the other hand, provides excellent maneuverability, as will be seen later.

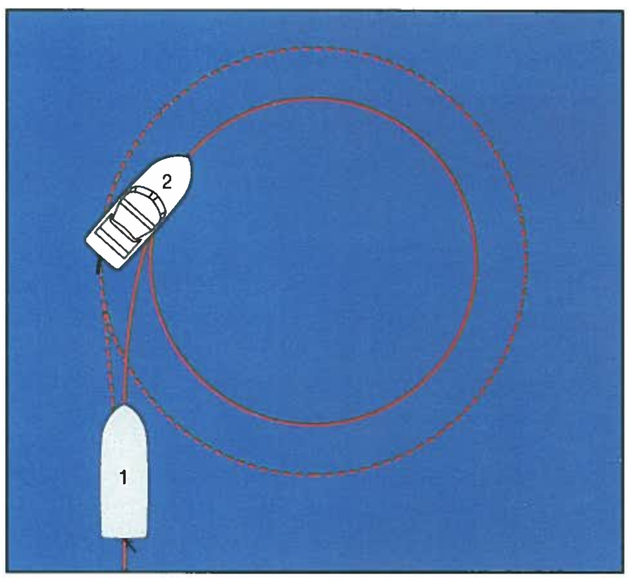
It is important to consider the position of the rudder with respect to the pivot point of the hull when the boat is reversing. In this case, the pivot may be at one-fourth of the hull length from the transom. Therefore, the rudder is acting on a much shorter lever arm as it tries, sometimes in vain, to swing the hull off course.

When the boat has sternway (reversing) there is no powerful discharge current past the rudder, only the weaker, more diffuse suction screw current. The rudder normally would be turned to port (left rudder) to turn the stern of the boat to port; right rudder should normally turn the stern to starboard in backing. Under certain circumstances, the effect of the reversing propeller "walking" itself the other way may more than offset the steering effect of the rudder. The boat may actually continue to turn to the right, for example, despite left rudder angle.

Water depth also has an effect on a boat's steering. Even though the keel may be several inches above bottom, a boat's response to rudder action in shallow water is almost always very sluggish.

Steering with propeller thrust

In close quarters, a motorboat can often be turned within its own boat length by applying brief bursts of engine power. Take, for example, a boat that has no headway: The throttle can be quickly opened and then closed, with the helm hard over to starboard. The stern then can be kicked around to port before the boat has a chance to gather headway. The exact technique of turning in limited space will be described in detail later in this chapter.



When a boat's rudder is put over to make a turn, the stern is kicked away from the direction in which the rudder moves. Then, after sliding obliquely along the course from 1 to 2, it settles into a turn in which the bow follows a smaller circle (red solid line) than the stern (red dotted line).

MANEUVERING WITH DIRECTED THRUST

Outboard and inboard/outboard (I/O) boats do not have rudders. The boat is steered by directing the propeller thrust, by turning the outboard motor or stern-drive unit on which the propeller is mounted. Maneuvering an outboard or stern-drive boat is usually easier than a single-propeller inboard boat of the same type.

Directed propeller thrust makes slow speed maneuvering easier. The propeller discharge current is turned from side to side to create turning forces, unlike a boat with a rudder that must have water flowing by it to be effective. Outboard and stern-drive units are also designed to have very little or no shaft angle, so the propeller does not produce as much unequal blade thrust as does the propeller on an inboard boat. Larger, more powerful outboard motors and high-power stern-drive boats do, however, produce considerable propeller torque.

How an outboard or stern-drive boat reacts to the helm is difficult to predict exactly, but there are some general principles which apply in most typical situations. Some of these situations—basic maneuvers that any boater will likely have to complete during regular daily operation—are described below. This discussion assumes a typical boat with single outboard or stern-drive power.

Gathering headway

When an outboard or stern-drive boat is "dead in the water," that is, not moving forward or sternward, and the propeller is not turning, the boat will not respond to the helm. Since the propeller is not turning, it is not creating any discharge current, so no turning forces are created. Even though the boat may be moving over the bottom with a current, no water is passing by the lower unit of the outboard or stern-drive; therefore, it cannot act as a rudder.

As soon as the outboard or stern drive is shifted into forward gear, the propeller's action creates a discharge current and generates thrust. If the engine or stern drive is centered, the discharge current is directed straight back causing the boat to begin to move forward.

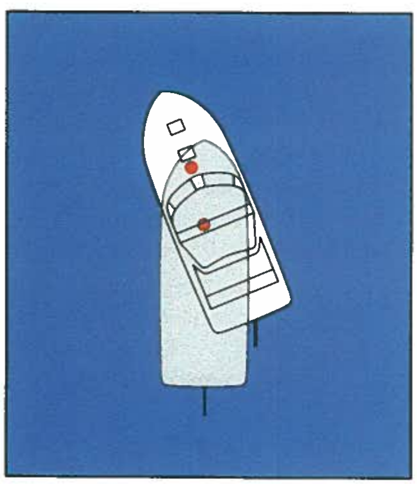
If you open the throttle quite quickly on a boat with a large outboard or stern drive, as you would when pulling a water-skier, for instance, the propeller will pull the stern of the boat to starboard like a single-screw inboard. Large outboards and some stern drives have small trim tabs located behind the propeller that help compensate for these forces, but a firm grip on the helm, before the throttle is opened, is also necessary.

As the boat gathers headway and the propeller begins to operate in the faster water flow for which it was designed, this unbalance usually lessens. If your boat wants to turn to port or starboard as soon as you let go of the helm, then the steering trim tab needs adjustment.

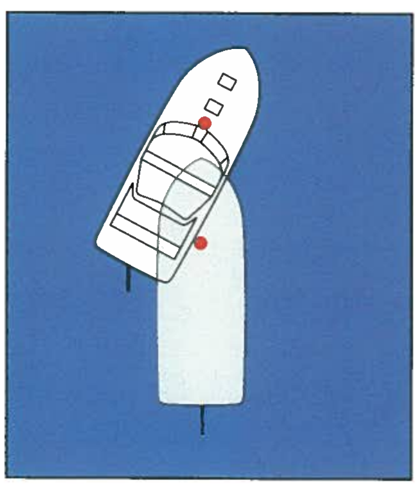
Turning

After the boat has gathered headway, with the helm amidships and the drive leg so that the boat is planing at a slight bow-up angle, the average boat tends to hold its course in a straight line fairly well. Once underway, the outboard or stern-drive boat is not affected to any significant degree by propwalk unless the drive leg is trimmed too far out or in.

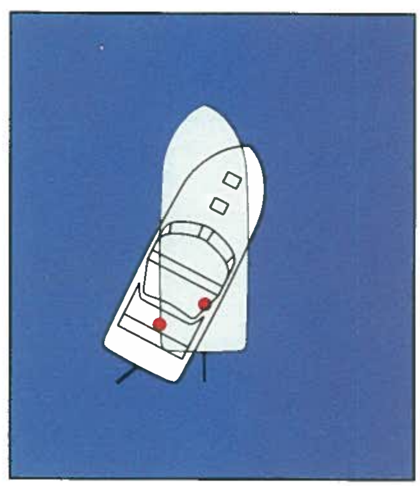
If the helm is turned to the right or starboard, the outboard motor or stern drive is also turned in the same direction. The propeller's discharge current is directed to starboard, forcing the stern to port. Water flowing past the hull hits the lower unit on its starboard side, creating additional turning forces. The stern begins to move to port, causing the bow to turn to starboard.



The boat in its gray position is dead in the water. When the forward gear is engaged, the stern is kicked to starboard; the amount of kick depends on the boat form and the amount of throttle given.



With forward motion when the helm is put over, the boat pivots around a point about one-third its length abaft the stem. Note that the stern swings through a wider arc than the bow.



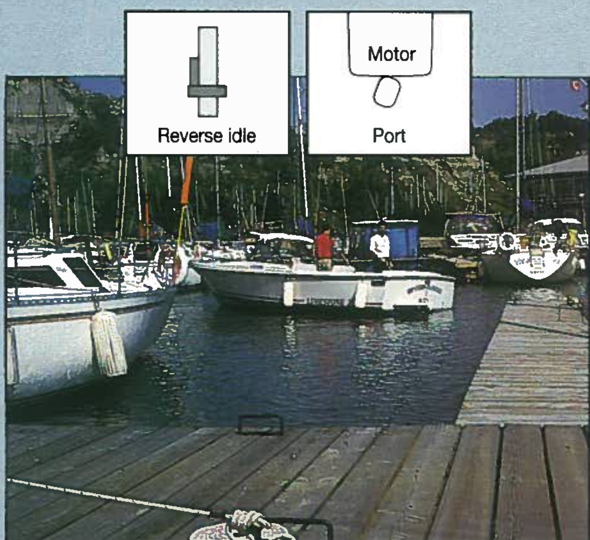
When backing down with the rudder to port, the pivot point is about one-quarter of the boat length forward of the stern. The bow, therefore, describes a wider arc than the stern.

STEP-BY-STEP DOCKING WITH AN OUTDRIVE

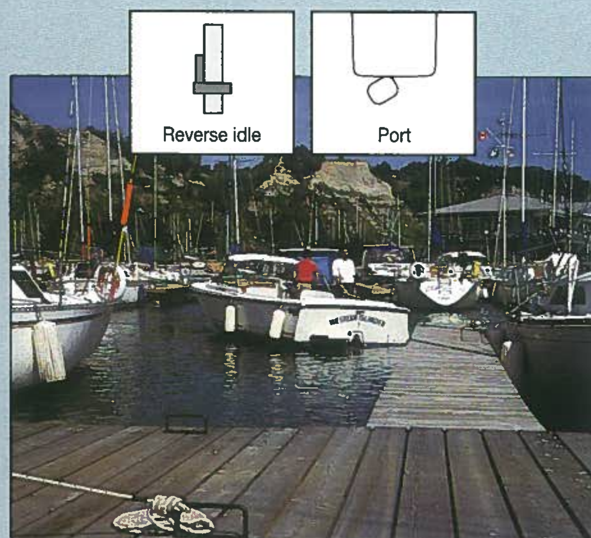
Outboard or inboard/outdrive powered boats are relatively easy to back up, but that may be scant comfort to the novice in a busy marina. The reversing propeller is turned in the direction you want to go, by using the wheel or motor handle or tiller. On some light displacement boats with shallow draft, the bow tends to be influenced by the wind (coming from left in photos below).

When backing down in a crosswind, allow maneuvering room (to port in this example) and watch the bow carefully. If it begins to swing downwind you may have to stop backing, leave the helm over to port (toward the wind) and go in forward to straighten the boat. A quick burst of power is all that is usually needed, but be careful that you don't knock your crew down with a sudden maneuver.

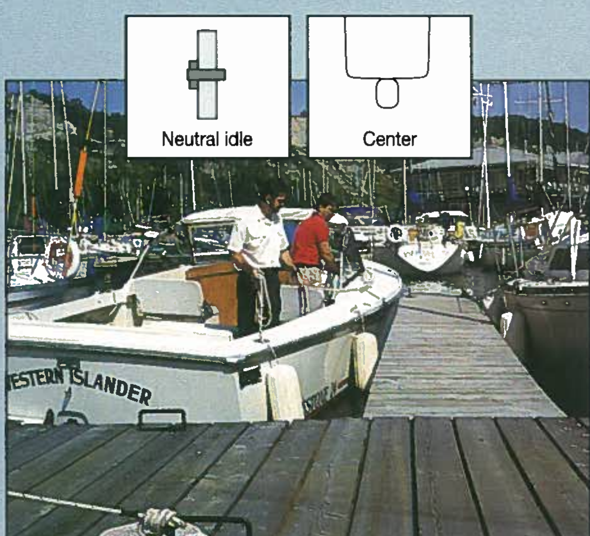
Set your speed to just overcome the effect of a crosswind. If it's not working, abort the maneuver early, reposition and wait for a lull in the wind.



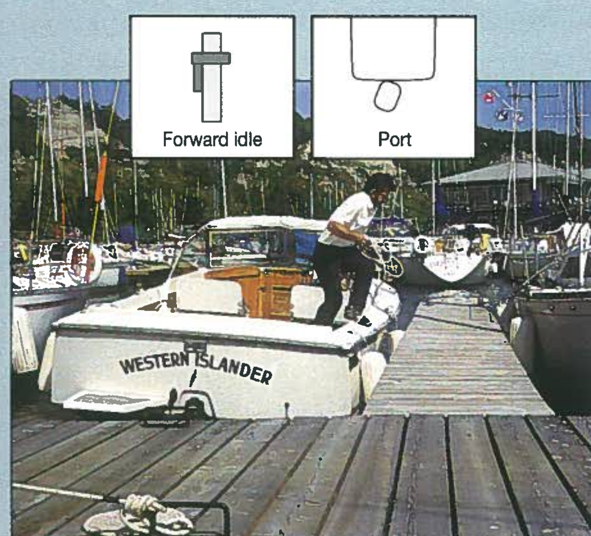
1 **Bring the boat to a stop by shifting into reverse. Put the helm over to port and begin backing in. Slow your speed by momentarily shifting into neutral.**



2 **Continue backing, with the helm over hard to port. Watch the bow, and begin to straighten the helm as the boat enters the slip.**



3 **Center the helm to align the boat parallel to the pier. If the stern is too far from the pier, shift to neutral, then put the helm over to port and go forward for a second or two.**



4 **When fully into the slip, stop sternway by shifting into forward. Put the helm to port to kick the stern over close to the pier if necessary. Shift into neutral and secure the boat.**

In order for the boat to begin its turn, the stern must be free to move to port. For example, the force of a water-skier tow line secured to the stern can make steering difficult, since it may prevent the stern from swinging to port. That is why competition ski boats secure the line to a towing post located well up into the boat, forward of the transom.

If the helm is turned to the left, the motor or stern drive turns to port; the stern of the boat moves starboard as the bow begins to turn to port.

At low speeds, there can be a time lag between when the helm is put over and when the boat actually begins to turn. At high speeds, there is little lag in helm response. Small movements of the helm result in immediate action by the boat. The faster the boat moves through the water, the greater the forces generated by the water hitting the lower unit of the outboard or stern drive, which provides a small amount of "rudder action." Also, the discharge current increases in strength as the throttle is advanced and propeller rpm increases.

It is important to remember that the response of each boat depends on the maneuver and the speed at which it is undertaken. Actual experience at the helm at different speeds is the only way to become familiar with the handling characteristics of any boat.

Having the tow line well forward of the transom will permit good maneuverability when towing a skier.

Stopping

Unlike a car with brakes, your boat depends on reverse thrust in order to stop. Assume that the boat has headway, with the helm amidships and the propeller turning in reverse. Now the propeller discharge current is directed backward, past the lower unit of the stern drive or outboard.

Depending on the throttle setting, the discharge current may not be strong enough to reverse the water flowing past the lower unit. As power is increased, the propeller discharge current becomes strong enough to stop the flow of water past the lower unit and, as the throttle is opened, more completely reverses its flow.

While water is flowing past the lower unit, there is some steering force generated, but when the discharge current stops the water flow, the boat will not respond to the helm. When the strong propeller discharge current is again flowing past the lower unit, steering is again restored. In addition to the force of the water hitting the lower unit, the propeller discharge current is directed by turning the outboard or stern drive, adding to the steering forces.

The propwalk of the reversing propeller tends to throw the stern to port, but to a lesser extent than a comparable inboard. This is why most experienced skippers make a port-side landing when wind and current permit. They allow propwalk to walk the stern to port toward the wharf.

Backing down

If your boat is dead in the water with the motor or stern drive amidships, and you put it into reverse gear, the stern will be pushed slightly to port by the reversing propeller. The tendency to back to port can easily be overcome by turning the engine or stern drive slightly to starboard.

Since outboards and stern-drive boats have the advantage of directing the propeller discharge current, and not relying on a rudder for steerage, you can also steer your boat by the judicious use of the throttle. The technique is to position the drive unit with the steering wheel while in gear or while at very low speed, then to give a short, sharp burst of throttle. The overall effect will be to push the stern in the desired direction while not adding an appreciable forward or sternward way to the boat.

As the boat begins to gather sternway, the water passing by the lower unit will begin to contribute to the steering force. Unlike most single-screw inboard boats, outboard and stern-drive boats back predictably. If the helm is put over to starboard, the motor or stern drive will turn to starboard, and will direct the propeller discharge current to port, moving the stern to starboard.

However, wind and current will affect how the boat backs. Outboard and stern-drive powered boats tend to be light displacement, shallow draft craft and, when backing down in a strong crosswind, the bow will tend to fall off downwind. This can cause steering difficulties. Remember that, in addition to the force of the wind on the forward topsides, the hull's pivot point has also moved aft, much closer to the drive unit. The steering forces are now acting on a much shorter lever as a result.

Usually, once sufficient headway is gathered in reverse, the force of the keel moving through the water is enough to keep the boat on track. Also remember that, when backing, the stern will lead as it moves to port or starboard, before the boat begins to turn.

SINGLE-SCREW INBOARD MANEUVERING

A single-screw inboard boat relies on water flowing past the rudder for maneuvering power. This is provided by the movement of the boat through the water and by the discharge current from the propeller. How well your boat responds to the helm in any given situation will depend largely on constant factors such as unequal blade thrust, propwalk and hull type. The variable factors are wind, current and the amount of rudder angle being used.

Every time you leave your slip or pier, certain basic maneuvers are necessary—getting underway, turning, stopping and backing down. Next is a description of how to perform these maneuvers in a single-engine inboard boat with a right-hand propeller—the most popular type. In addition, you will read about why your boat sometimes seems to have a mind of its own.

Gathering headway

Getting underway should be straightforward, but when you put the boat into forward gear with the rudder amidships it may not behave as you would expect. When you engage the forward gear and the propeller starts to turn ahead, the unequal blade thrust tends to move the stern to starboard. This can be frustrating when pulling away from a starboard-side berth. If you don't get your boat far enough away from the pier or wharf, the stern may swing in and hit it. Compensating by using right rudder may help, but it could also hamper the maneuver of getting away from the structure. The truly proper way to depart a wharf or pier is to back out—here the natural tendency of a boat will pull the stern out, and when the boat is clear of the structure, it can go forward, parallel to the wharf or pier face, at an adequate distance from it. If there is any tendency for wind or current to pin the boat against the wharf or pier face, go ahead on an after bow spring to get the stern out *(page 207)*.

As the boat gathers headway, wake current (from the movement of the boat through the water) enters the picture, increasing pressure against the rudder. This tends to offset the effect of unequal blade thrust, and the average boat tends to hold course in a straight line fairly well.

From a purely theoretical standpoint, the unequal blade thrust, with a right-hand propeller, should tend to move the stern to starboard, and the bow to port. Once underway, the effect of unequal blade thrust is quite slight. Only in comparatively few cases will unequal blade thrust have a pronounced effect on steering, and in these it can be corrected by a small rudder tab.

Turning

Now that your boat has headway, assume the rudder is put to starboard. The water flowing past the hull hits the rudder on its starboard side, forcing the stern to port. The propeller's discharge current intensifies this effect by acting on the same side, and the boat's bow turns to starboard, the same side on which the rudder is set.

How fast a boat will react to the helm is dependent on the size of the rudder and hull shape, but the most influential factor is how fast the boat is moving through the water. At slow speeds, with the engine idling or turning slowly, a heavy boat will have a considerable lag between the time its helm is put over and the time the boat actually begins to turn. At idle speeds, there is less water flowing past the rudder, and the propeller discharge current is weak; so it may take a boat several seconds to begin a turn. You may also have to give the boat considerably more rudder to get the same response you achieved at higher speeds.

Of course, the opposite is also true. A boat traveling fast has a very powerful flow of water past the rudder; with a very strong propeller discharge current, it responds much more quickly to helm movement. At speed, a light fast-planing type inboard has a very positive feel to the helm, with no noticeable lag between helm movement and turning.

The boat's turning radius is determined by how much the helm is turned at both high and slow speeds. How quickly the boat responds to helm movement is basically a factor of how fast it is moving.

Stopping

Stopping a boat is achieved by reversing the propeller. Assume that your boat has headway, with the rudder amidships, and the propeller is turning in reverse. The rudder has decreasing steering effect as the boat slows, and unequal blade thrust of the reversed propeller tends to throw the stern to port. At the same time, on some boats the propeller blades on the starboard side are throwing their discharge current in a powerful column forward against the starboard side of the keel and bottom of the boat, with little on the port side to offset this pressure. This also adds to the forces moving the stern to port.

If wind and current permit, an experienced boater will make a port-side approach to a pier with a single-engine boat that has a right-hand propeller. By reversing the propeller, the stern then is moved in toward the pier, instead of away from it.

Backing down

If the boat is lying dead in the water with no headway, rudder amidships, and the propeller is turning in reverse, we again have the strong tendency of the stern to go to port as the discharge current strikes the starboard side of the hull. In each case where the discharge current of the reversing propeller is a factor, the strong current on the starboard side is directed generally toward the boat's bow but upward and inward in a spiral movement. The descending blade on the port side, on the other hand, tends to throw its stream downward at such an angle that its lesser force is largely spent below the keel. Therefore, the two forces are never of equal effect.

Until the boat gathers sternway from its backing propeller (right-hand), it would not matter if the rudder were over to port or starboard. The discharge current against the starboard side is still the strong controlling factor and thus the stern will be moved to port.

Now visualize the boat gathering sternway as the propeller continues to turn in reverse. Here arises one of the seemingly mystifying conditions that baffle many a new helmsman. The novice assumes that in order to back in a straight line the rudder must be amidships, just as it must be when going ahead on a straight course. But under certain conditions the boat may even respond to *right* rudder as the boater reverses by going to *port*, which is totally unexpected.

If the boater is learning by trial-and-error it is easy to come to the conclusion that it depends on the boat's fancy, while rudder position has nothing to do with control. Fortunately, something can be done about it.

■ **Backing with left rudder.** Consider a boat in reverse with left rudder. Here there are four factors all working together to throw the stern to port. Unequal blade thrust is pushing the stern to port; the discharge current of the propeller is adding its powerful effect; and now we add the steering effect of the rudder acting on the after side of the rudder blade, against which the suction current of the propeller is also working.

Remember this condition well, for it is the answer to why *practically every single-screw vessel with right-hand propeller easily backs to port,* although it may be obstinate about going to starboard when reversing.

■ **Backing with rudder amidships.** If, while backing to port, you bring the rudder amidships, you eliminate the effects of suction current and steering from the rudder. This leaves unequal blade thrust and the discharge current to continue forcing the stern to port.

■ **Backing with right rudder.** Assuming further that you have not yet gathered much sternway, you might expect that putting the rudder to starboard should make the boat back to starboard. The forces of unequal blade thrust and discharge current still tend to drive the stern to port, but the suction current of the propeller wants to offset this.

The effect of the discharge current is stronger than the suction so the overall tendency is still to port. With sternway, the steering effect of the right rudder is to starboard, but as yet you haven't way enough to make this offset the stronger factors.

■ **Steering while backing.** Opening the throttle to gain more sternway finally has the desired effect; with full right rudder you will find that the steering effect at considerable backing speed is enough (probably) to turn the stern to starboard against all the opposing forces. How well the boat will back to starboard—in fact, whether it will or not—depends on the design of the craft.

All of this means that if the boat will back to starboard with full right rudder, it may also be made to go in a straight line—but not with the rudder amidships. There's no use trying. The boat will need a certain amount of right rudder depending both on its design and on speed. While some boats always back to port much better than to starboard, a boater can learn to control a particular boat with a reasonable degree of precision.

In some cases, boats may even be steered backwards out of crooked slips or channels—not, however, without a lot of backing and filling if there is much wind to complicate the situation. Generally, the trick is to keep the boat under control, making the turns no greater than necessary to keep the boat from swinging too much.

In backing situations, set the rudder first and *then* add maneuvering power by speeding up the propeller.

■ **Killing sternway.** There is one other situation to be considered, where you want to kill sternway by engaging the propeller to turn ahead. Regardless of the rudder position, unequal blade thrust with the propeller going ahead now tends to throw the stern to starboard, while the suction current is of little or no consequence. In this situation, unequal blade thrust may or may not be offset by the steering effect and the discharge current.

With rudder amidships, there is no steering effect and the discharge current does not enter into calculations. Therefore the stern will go to starboard. Now if you throw the rudder to port the discharge current of the propeller hits the rudder and drives the stern to starboard—even though the normal steering effect of left rudder sends the stern to port, with sternway. The powerful discharge current from the propeller going ahead is the determining factor.

If the rudder is put to starboard, the steering effect works with the unequal blade thrust, tending to move the stern to starboard, but the discharge current strikes the starboard side of the rudder and acts to kick the stern to port. Be sure to apply enough power so that the force of the discharge current outweighs the other factors, and the stern will indeed go to port.

Propeller action governs

From the above analysis it is clear that in a single-screw inboard boat you must be constantly aware of what the propeller is doing, in order to know how best to use the rudder. What the propeller is doing is even more important than whether the boat has headway or sternway.

Left-hand propellers

Maine lobstermen prefer a left-hand propeller because it allows them to back down quickly on a lobster pot while standing at the starboard helm station, near the gunnerhole, ready to lift the lobster pot aboard. Many commercial boats also operate with a left-hand propeller, but for a different reason: It helps them leave a starboard pier and back up against it with more control.

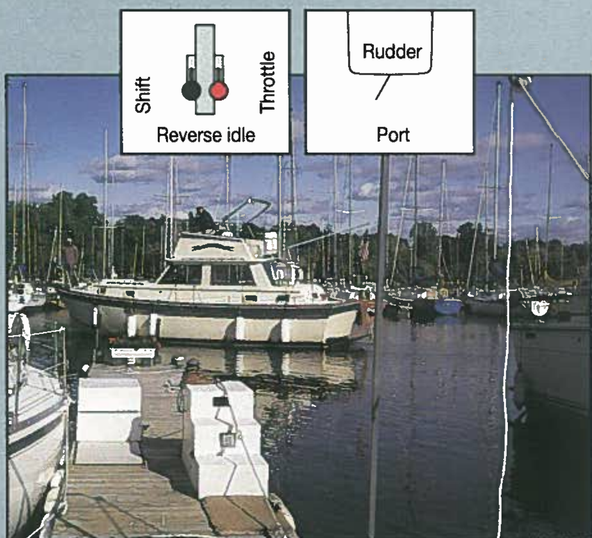
If your boat is equipped with a left-hand propeller, you can generally reverse "port" and "starboard" in the foregoing discussions. But to be absolutely sure, make tests for all possible situations.

STEP-BY-STEP DOCKING WITH A SINGLE-SCREW BOAT

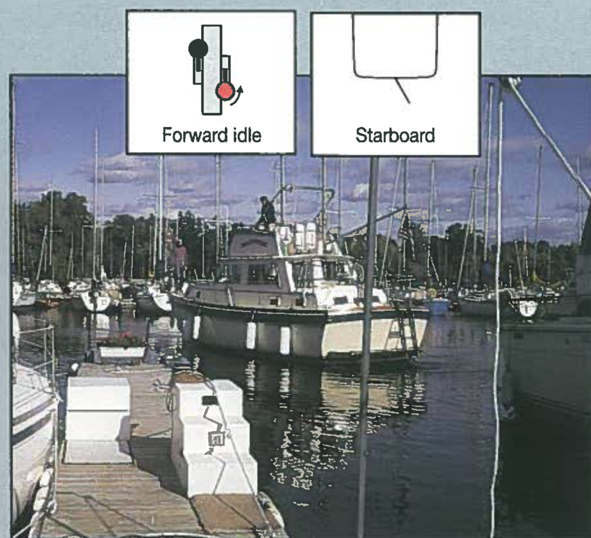
With a right-hand propeller, back to port when entering a slip. How fast you can turn your boat determines when to stop and when you should begin backing. A high freeboard and flybridge may respond to crosswind, so choose your moment so as to avoid sudden gusts.

Propeller action will help most single-screw boats turn to port when backing. With the helm hard to port, the boat should begin a turn into the slip.

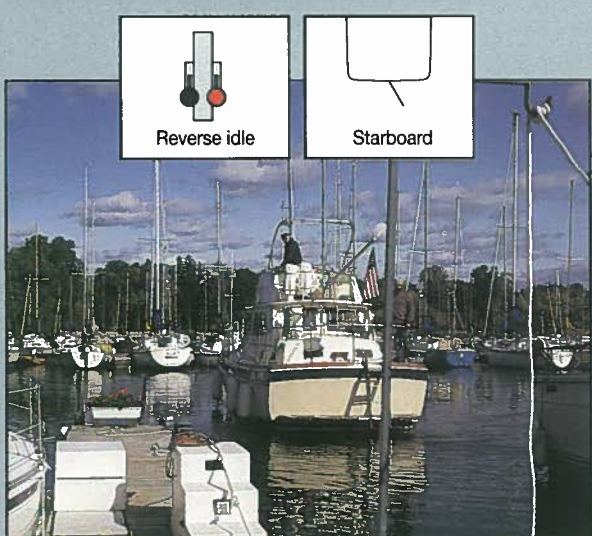
Usually the boat will need some help kicking its stern farther to port to align itself with the slip. Going ahead with a short burst of power, with helm over to starboard, will accomplish this. Some right rudder will probably be needed to make the boat back in a straight line into the slip, but remember that the torque of the propeller to port (in reverse) often has more influence than the position of the rudder. If a short burst of power is needed, position the rudder first, then apply the power.



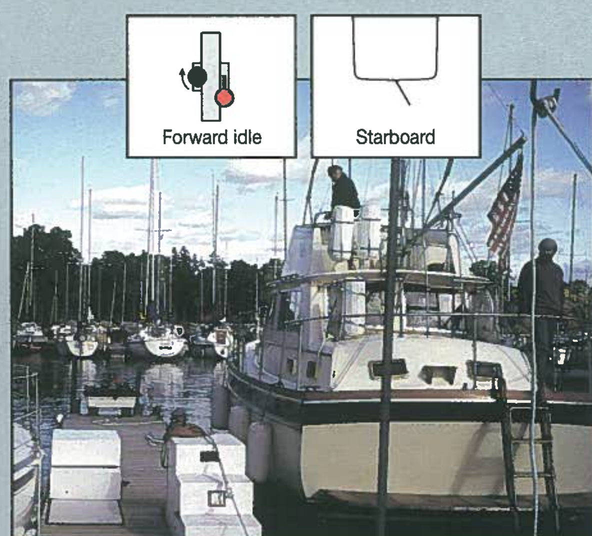
1 **Shift into reverse to stop the boat, then put the helm over hard to port to start the turn into the slip. A slight increase in power will cause the boat to turn a bit quicker.**



2 **Shift into forward as you enter, put the helm over to starboard and open the throttle for a short burst of power. This kicks the stern to port, aligning the boat with the slip.**



3 **Shift into reverse and keep the helm to starboard in order to overcome the propeller walk to port and back straight into the slip.**



4 **When fully in the slip, put the gear in forward to stop sternway. Keep the helm to starboard in order to kick the stern closer to the dock—or to port if it is too close.**

TWIN-SCREW MANEUVERING

Twin-screw craft have two rudders, one directly behind each propeller. The propellers are counter-rotating, which balances any steering pull, and will generally rotate "out"—the right-hand rotation on the right side and the left-hand rotation on the left side.

Going ahead with the starboard engine for a turn to port, the offset of the propeller from the centerline adds greatly its effect of throwing the stern to starboard. Similarly, offset of the port wheel going ahead helps the steering effect when the port propeller is going ahead for a turn to starboard.

When reversing, the starboard propeller throws its discharge current against the starboard side of the hull to help the turn of the stern to port. Likewise, the port propeller reversing throws its stream against the port side of the hull to help the swing of the stern to starboard.

The important factors in turning and steering are thus combined by the outward-turning propellers. The steering effect is exerted in the same direction as the turning movement caused by the off-center location of the propellers.

Gathering headway

Unlike a boat with a single propeller, if the transmission gears of a twin-screw boat are put in forward together, the boat will begin to make headway without any tendency to pull to starboard or to port.

Turning

Clearly, having two propellers gives you the means of shifting one propeller or the other ahead or astern, independent of rudder control. In fact, much of a twin-screw boat's slow-speed maneuvering is done without touching the steering wheel; working the clutches and throttles is the key to controlling the boat's movements.

A boat's stern may be put to one side or the other by going ahead or backing down one propeller, without turning the other. Some headway or sternway in these cases accompanies the turn. The maximum turning effect is, of course, obtained when one propeller is turning ahead and the other is in reverse—the two effects are additive.

With practice, you can easily turn a twin-screw boat in a circle only a little larger than the boat's length. For example, to turn to starboard, the rudders can be set amidships while the port engine goes ahead and the starboard engine reverses; on most boats, turning the rudder will tighten the turn.

Start this type of turn with the engines at idle or turning slowly at the same speed. To turn to starboard, put the port gear in forward and the starboard gear in reverse. As the boat begins to turn, it may start to make some headway. (This is not surprising, since the boat drives forward more easily than it goes astern, and the propeller develops more thrust at a given rpm while turning ahead than astern because the propeller blades are curved so as to produce lift on the forward side.) To compensate, you will probably have to open the starboard throttle slightly to increase the rpm of the reversing starboard propeller. For both engines, a rate of rpm can be found that will turn the boat in its own length.

When the port engine is speeded up a little, the circle is larger and the boat makes some headway. If the port engine is slowed down, the circle is also larger, but the boat makes some sternway as the reversing starboard wheel pulls it around, stern to port.

Steering with the throttles

If your boat happens to sustain some damage to the steering gear, it can still make port by steering with the throttles (provided that the rudders are not jammed hard over to one side). One engine can be allowed to turn at a constant speed—the starboard one, for example. Then open the throttle of the port engine to speed up the port propeller and cause a turn to starboard. Closing the throttle of the port engine slows down the port propeller and allows the starboard propeller to push ahead, causing a turn to port; keep your speed moderate when doing this, as steering is not as positive as with rudders. Since most slow-speed maneuvering is done with the propellers, when you get back to port you will be able to maneuver into your berth.

Stopping

A twin-screw boat is stopped by reversing its propellers, but unlike a single-screw vessel, this will usually not throw the stern to one side.

When docking, the experienced helmsman of a single-screw boat usually tries to make a port-side approach so that, when the vessel is stopped, the reversing propeller will swing the stern toward the pier. The skipper of a twin-screw boat can use this technique on both port and starboard approaches. By reversing the outboard engine to check headway when coming up parallel to the pier, the stern will move in. On a port-side approach the reversing starboard right-hand propeller will move the stern to port. When approaching to put the craft's starboard side to the pier, the reversing port propeller will conveniently move the stern to starboard.

Backing down

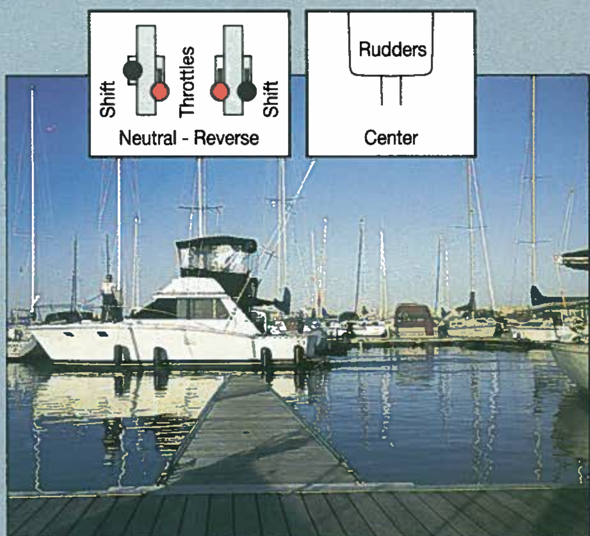
The helmsman of a twin-screw vessel has a great advantage over the operator of a single-screw type because the boat will most likely answer the helm as expected. Not considering wind and current, most twin-screw boats can be steered with the rudders when backing down. Rudder action, however, will be less than when going ahead, since the propellers' discharge currents are directed away from the rudders rather than onto them.

In addition to rudders, the twin-screw vessel offers the possibility of using its throttles to slow down one engine or the other as an aid to steering while maintaining sternway. Alternatively, you can stop one propeller or go ahead on it for maximum control in reverse.

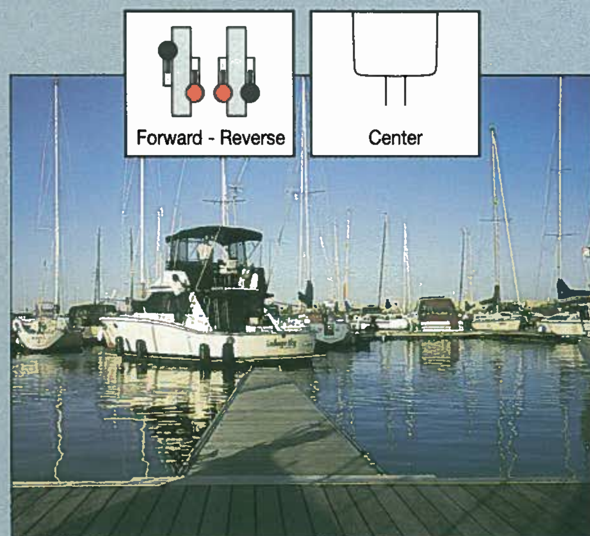
STEP-BY-STEP DOCKING WITH A TWIN-SCREW BOAT

Most twin-screw boats are maneuvered in close quarters by using the propellers. Depending on wind or current conditions, stop the boat in front of the slip, or slightly to windward or up current. (The rudder may be used if needed.)

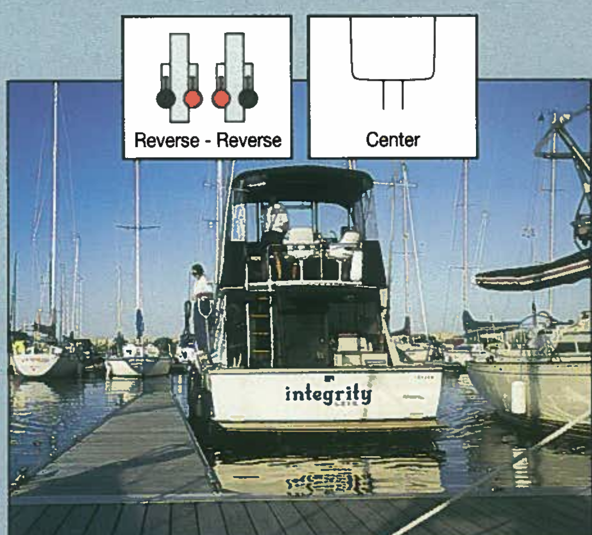
The sequence below is intended as an example. Depending on the circumstances, this will sometimes be done in the opposite manner, swapping "starboard" for "port," and vice versa. In this example, both throttles are in idle and you begin backing. As the boat gathers way, it will begin to back to port. By going forward with the port engine, the boat can be made to pivot and to align with the slip. When alignment is satisfactory, the port engine is also put in reverse to continue backing into the slip. Slight adjustment in direction can be made by putting either gear momentarily in neutral or forward. Going forward on the port engine kicks the stern to port; the starboard engine going forward kicks the stern to starboard.



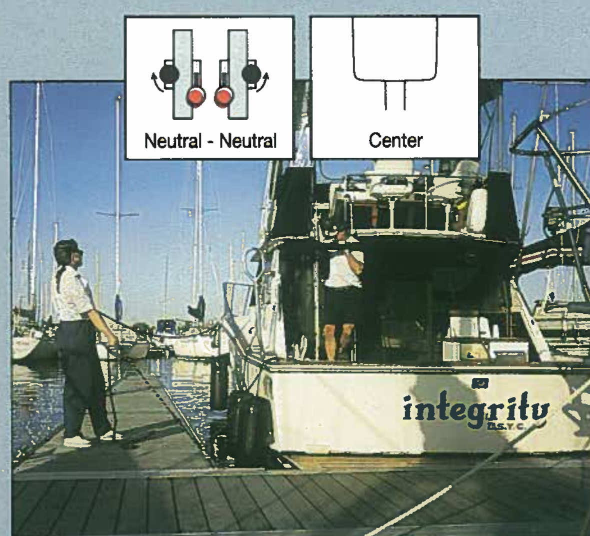
1 **Stop headway with the starboard engine in reverse; the stern will begin to move to port. Then continue backing, with the starboard and port engines at idle.**



2 **As sternway builds and you enter the slip, go ahead with the port engine to align the boat with the slip.**



3 **With the boat aligned with the slip, put both engines in reverse; continue backing into the slip. If either engine is put in forward, the stern will move in the same direction.**



4 **When fully into the slip put both engines in forward momentarily to kill all sternway. Secure the boat.**

MANEUVERING IN TIGHT QUARTERS

Since most marinas and anchorages are congested places, handling a boat in these confined spaces can be a real test of your skills. In fact, in some harbors, leaving and returning to your berth can be the most harrowing part of a cruise. Most of the basic maneuvers that you will need to get underway from, and return to, your slip or mooring safely are covered below.

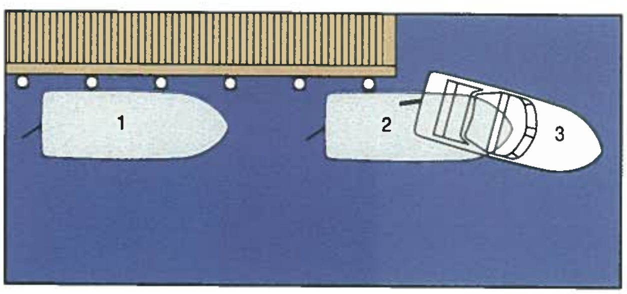
Getting underway

As skipper, you are responsible for the safe operation of your boat. Before you leave the slip, be sure that all your getting-underway procedures are completed. Make sure that all electrical cords and hoses are disconnected before taking off last-minute dock lines. Avoid spending too much time at the pier or mooring warming up the motor; long periods of idling are not good for the motor or the transmission. The engine will warm up faster under a light load.

Checking headway

Stopping a boat's headway can require reversing the propeller. Experiment with stopping the boat from different speeds. This will give you an idea about the propeller's ability to check the boat's headway. Consider the following:

- Generally speaking, a larger diameter propeller, acting on a large volume of water, will exert a greater effect. Small propellers, especially those on outboards, may do a lot of churning before they can overcome the boat's momentum.
- You can stop a fast boat in a short distance by cutting the throttles. Then, as the boat comes off of plane, shift into reverse and apply power.
- When practicing these maneuvers, take the following precaution: When you need to go from forward into reverse or vice versa, slow the engine down before going through neutral. Warn crew members and passengers of your intentions so that they will not be unexpectedly thrown off balance, possibly injuring themselves. Never make a practice of shifting from full ahead into full astern. You will tear up the gears.
- Always remember to approach piers as well as other craft at a very slow speed. Failure of the transmission, or an unexpected stopping of the engine, can result in embarrassment or damage, or both.

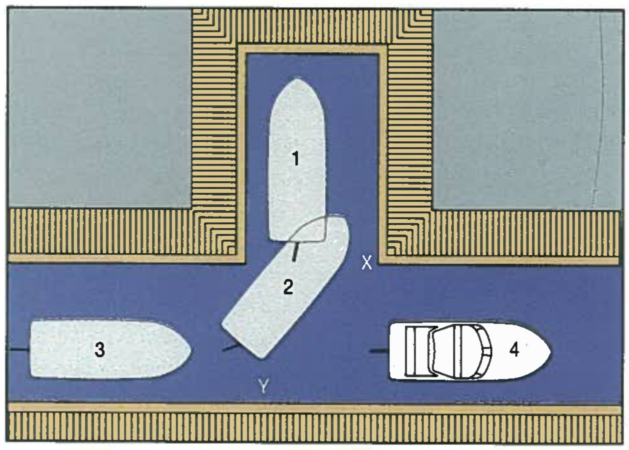


With right rudder, as the boat moves from 1 to 2 to 3, the stern is driven against the piles, with risk of damage. The rudder should be amidships until the boat is clear (or the craft should first be backed away from the face of the pier).

Turning in close quarters

Although turning a boat in a narrow channel or other confined waterway not much wider than the boat itself may seem impossible to the novice, it is really no more difficult than turning a car around on a narrow road.

Suppose, for example, that you have reached the head of a dead-end canal and must turn around. Assuming you have a single-screw boat with a right-hand propeller, steer to the left side of the channel and make all forward maneuvers to starboard and backing maneuvers to port, to take advantage of the boat's natural tendencies. Now, running at slow speed, put the rudder hard over to starboard and, as the boat begins to turn, check headway by reversing. Leave the wheel hard over to starboard (right rudder). Very little is gained by applying right rudder while going ahead and left rudder while going astern, since the boat will make little way through the water. As the reversing propeller stops the boat, open the throttle for an instant; the stern will be kicked farther to port. Then put the gear in forward and open the throttle for a short burst

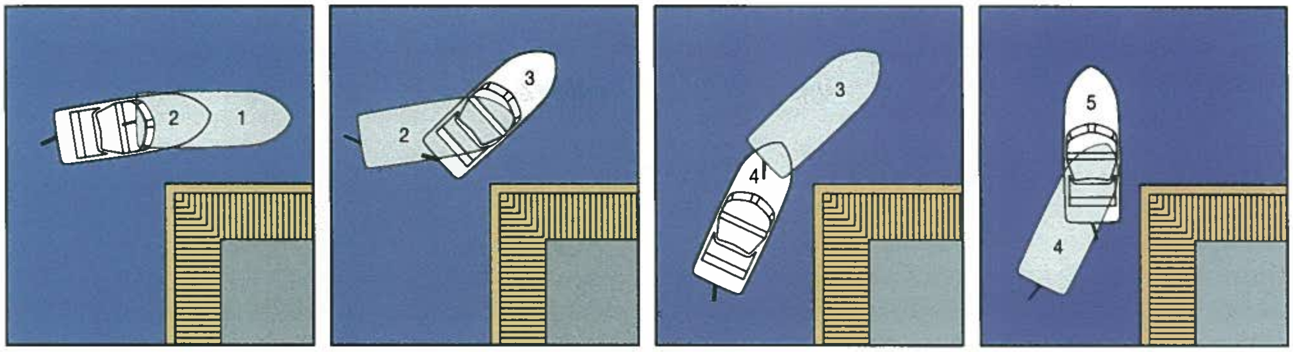


To back out from a slip, the boat should be able to make a short turn to port from 1 to 2, when reversing with left rudder, but if the bow swings wide it may hit at X and Y.

of power, to check any sternway and keep the stern swinging to port. As soon as the boat gathers headway, shift into reverse and back down to kick the stern to port; then shift into forward again.

Most single-screw inboard boats can be maneuvered in very tight quarters by using this technique. Unequal propeller thrust in combination with rudder action turns the boat. Remember, however, that this applies only for a right-handed propeller; reverse the technique for a left-handed propeller.

A twin-screw boat can reverse one engine and run ahead on the other in order to make the same turn. Although outboards and stern-drive boats can use this technique, they are usually able to make a turn like this with a single forward-reverse cycle. It will be necessary to turn the wheel from one side to the other when going from forward to reverse and vice versa.



To back around to starboard, where space is limited, the boat starts *(left)* at 1 with right rudder and backs to 2, as it cannot turn short to starboard. At 2, the rudder is shifted to port, and the stern is kicked to starboard to position 3 by going ahead strong for a few seconds. From 3, the boat is backed to 4 with full right rudder. Here the rudder is put to port, and the boat moves ahead to 5. Backing down from 5, it will need a certain amount of right rudder to maintain straight course.

Backing to port from a slip

When leaving a slip, an experienced skipper will back a single-screw boat with a right-hand propeller to port. Suppose the boat is lying in a slip and you intend to back out into the channel. With left rudder, it will likely turn fast enough as it gathers sternway, aligning with the channel in one maneuver.

Before putting the boat in reverse, pull the boat to the port side of the slip, ensuring as much clearance as possible on the starboard side. Although some room is necessary on the port side because the stern immediately starts to move to port, more room is required on the starboard side because the bow will swing this way as the boat backs.

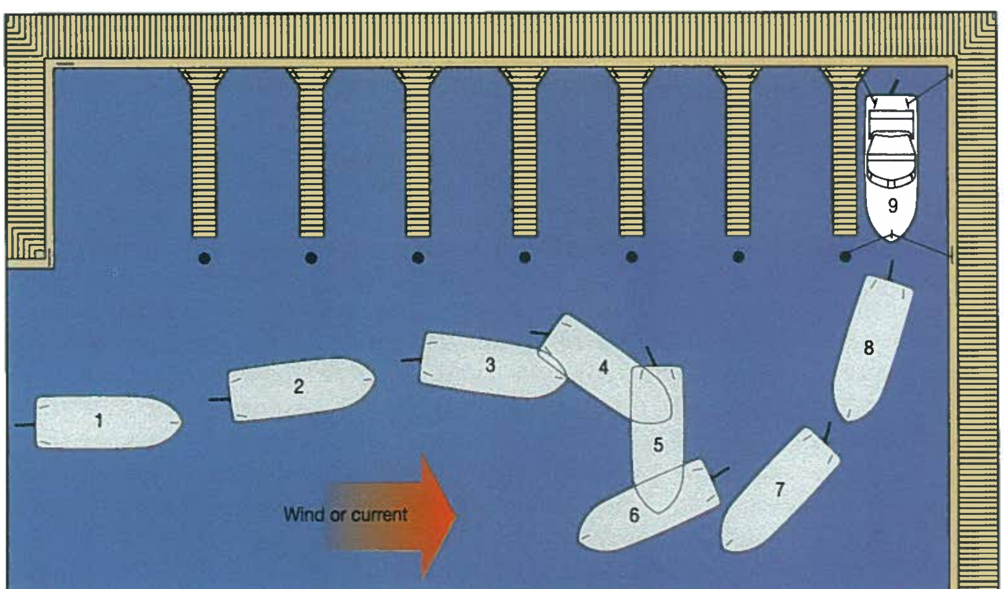
The starboard bow and port stern are the places to watch in executing this maneuver. If the boat turns sharper than expected, the starboard bow is in danger of touching the adjacent pier *(page 196, right)* or a boat in the adjacent slip. This could be corrected by going ahead with the propeller a few revolutions while backing out of the slip. Once the bow is clear of the slip, right rudder followed by a short burst of power in forward will help kick the stern over to port if it is not turning fast enough while making sternway.

Backing to starboard from a slip

In a different scenario, suppose you want to back out of the same situation outlined above or from a slip into a narrow canal that would require a sharp turn to starboard.

Reversing with full right rudder, you will not be able to turn short enough to steer around the 90-degree angle before you would come up on the opposite canal bank. Most likely, you will back to a position somewhere in the middle of the canal with the stern slightly to starboard. Now, by going ahead with left rudder, the stern is kicked further over to starboard.

Reversing once more, with full right rudder, the boat backs to starboard and, just as it begins to make sternway, you go ahead once more with left rudder. This checks the sternway and kicks the stern to starboard in alignment with the channel.



Backing into a berth between piles in a basin, where space allows a turn ahead under power to maneuver the bow partly into the wind before backing down: Note the right rudder from 5 through 8 keeps the stern from swinging to port.

Backing into a berth between piles

Many marinas and yacht clubs provide slips in which boats are berthed at right angles to a pier or wharf and made fast to piles. Normally, a short secondary pier, often called a finger pier or catwalk, extends out between each pair of slips. In this situation, it is much easier to board the boat if it is moored with the stern toward the pier. This arrangement makes for an easy departure, but requires backing into the slip upon return. There are many variables that come into play as you back into the slip: Wind, current and the location of other boats are just a few. At times some of these factors may be so disconcerting that you may decide not to back into the slip, but instead to dock bow first until conditions improve. A wise man who said "Discretion is the better part of valor" must have been thinking of this situation.

Now let's consider a typical situation: You have spent a nice day on the water, and are returning to your slip—one of hundreds located on a pier in a large marina; you want to back in. As you turn into the channel, the slip is to port and you are moving with a light wind and current. The channel is only a couple of boat lengths wide, so there is not much room for maneuvering. In this situation, the port side of the channel should be favored to allow for wind and current. Begin your turn before the slip, in order to position the boat upwind and/or up-current of it.

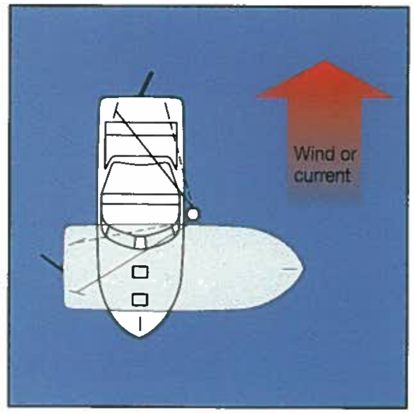
Depending on how quickly the boat can be turned, put the helm over to starboard well before you reach the slip. Because the channel is narrow, the boat will not be able to turn more than 90 degrees, almost into the wind, in a single maneuver *(page 197, bottom)*. As the bow approaches the other side of the channel, shift into reverse and open the throttle to stop headway and kick the stern to port. As soon as the boat gathers sternway, reduce throttle, then shift to forward and open the throttle again to kick the stern farther to port; position the boat at about a 45-degree angle to the slip.

The turn should be timed so that the final position of the boat is slightly upwind from the slip, with the wind and current off the starboard quarter. If you are not upwind of the slip, complete the turn and run upwind until you are. If you are too far upwind, wait for the current to push you down closer to the slip.

Begin backing with right rudder. As soon as you start backing, the current and wind will push the bow to port so that, by the time the stern is entering the slip, the boat will be nearly parallel with the slip. Remember, when backing a boat with a right-hand propeller, use left rudder in combination with a short burst of forward power to move the stern to starboard. Left rudder with the propeller reversing should move the stern to port.

Getting clear of a pile

In maneuvering around slips and piles, you may be caught in a position where the wind and/or current hold the boat against the pile, preventing any maneuver. The solution is to rig a forward spring line from the pile to an aft cleat, preferably on the side of the boat away from the pile. Then, by reversing with left rudder, pivot the boat around the pile and bring the bow into the wind or against the current. You can then clear the pile by going ahead with power as the spring is cast off.



If pinned against a piling, use a forward spring line from a stern cleat to swing the boat into the wind or current.

In getting clear from this point, you may need a little left rudder to keep the stern clear of the pile, but don't use enough to throw the stern so far over that the starboard quarter is in danger of hitting an adjacent pile.

Plan maneuvers in advance

Obviously the number of possible situations—considering the differences in boats and the strength, direction and effect of wind and current—is almost infinite. Usually, however, applying one of the principles above, modified as needed, will permit a seamanlike handling of the problem.

Even though you know the principles, however, it pays to think ahead about the steps you will take. With a clear plan of action, you can take each step slowly and easily, and have time to keep the boat under perfect control. To avoid confusion, tell your crew the steps you plan to follow, the actions that each crew member will have to take, and the orders you will give when these actions are required. Even on occasions that call for swift and decisive action, you'll need calm, ordered judgment.

If your plan of action requires total abandonment because of unforeseen conditions, don't hesitate to act accordingly. For example, if your plan for a clean approach to a pier or wharf has been upset by a freak current you couldn't calculate, or by a passing boat's wake, back off and square away for another attempt. That in itself is good seamanship, regardless of how some may judge your apparent "miss" on the first try. Common sense, if you act with deliberation, will enable you to work out a solution for any combination of conditions.

When you are at the helm and you have people on deck handling lines, give orders to each so that all action is under your control, instead of having two or three acting independently to cross purposes. This is especially imperative when your crew is not familiar with boats or with your method of boat handling.

Leaving a mooring

Yacht club and marina anchorages often have mooring buoys chained to mushroom anchors or heavy concrete blocks on the bottom. Boats are secured by a pennant or mooring line to a forward cleat or bitt. These boats are accessible from shore by dinghy or by club launch.

Getting away from the mooring is among the simplest of maneuvers, yet there is a right and a wrong way to go about it. When done incorrectly, the greatest dangers are getting the mooring line or dinghy painter fouled in the propeller, or colliding with a boat moored nearby.

After running through your departure checklist, make sure that the boarding ladders and fenders are brought on board. Then send someone forward to let the pennant go; there is usually a small buoy to float the pennant, making it easy to pick up again when you return.

If your mooring is in a bay or the day is calm, there may be neither wind nor current to move the boat when the mooring line is let go. To go ahead under such conditions would almost certainly foul the mooring line in the propeller. To avoid this, back away a few boat lengths, far enough so you can have the buoy in sight and give it ample room when you go ahead. You can decide to back away straight or turn as you reverse—depending on the position of neighboring boats.

When your mooring is in a stream, or if a tidal current flows past it, the boat will be set back when the mooring line has been let go. This usually simplifies the problem of getting away, so reversing may not be necessary.

In a wind (assuming the current is not stronger), the boat will be lying head to the wind. As the boat drops back from the mooring—whether or not the reverse gear is used—the bow will pay off to one side and allow getting away without additional maneuvering.

Boats with considerable freeboard have a strong tendency to "tack" back and forth as they lie at anchor in a wind; the same is true to an extent at permanent moorings. If the bow is tacking in this manner, and you want to leave the mooring buoy on one particular side, wait until the boat reaches the limit of its swing in the desired direction, then let the pennant go.

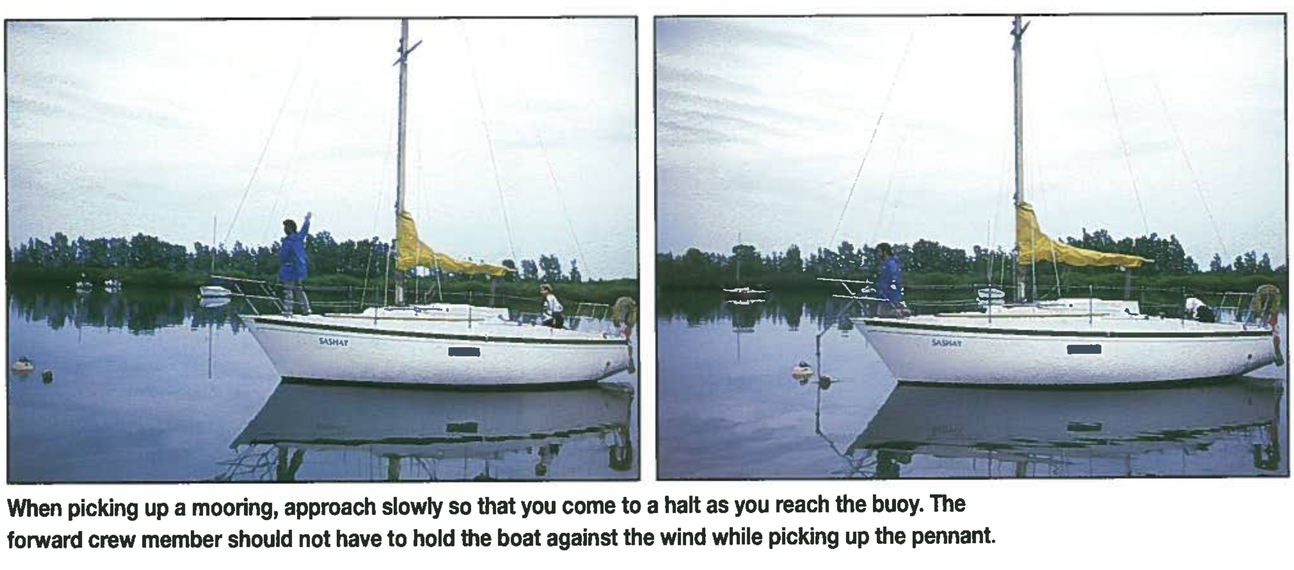
Picking up a mooring

Returning to the anchorage, approach your mooring at a slow speed. Note how other boats are lying at their buoys. They are heading into the wind or current (whichever is stronger), and your course in approaching your mooring should be roughly parallel to their heading. Stay clear of other moorings, or you may cut or foul them.

If your mooring is the only mooring in the anchorage, you will have to gauge the effect of wind and current on your boat as best you can. Pass by the mooring so you can judge the current and then approach—upwind, or against the current, or directly against any combination of these factors.

Shift into neutral when you estimate that you have enough headway to carry you up to the buoy. Station a crew member well forward on the bow, with a boat hook to pick up the pennant float. If you see that you are about to overshoot the mark, reverse enough to check the headway as the bow comes up to the buoy. If you fall short, a few slight kicks ahead with the propeller will help. The helmsman will not be able to see the mooring buoy, so good communication is essential. The person on the bow must indicate the buoy's position and maneuvering required to bring the boat close enough to reach the pennant with the boat hook; previously agreed-upon hand signals are preferable to shouting.

Do not expect the person forward to do the engine's work in holding the boat in position. Until the signal is given that the pennant eye has been secured on the bitt, keep the engine ready in case the boat tends to drop astern. Also, take care that the buoy does not chafe against the hull. If you do overshoot or fall off and your crew forward cannot reach the pennant, get clear and try again calmly.



When picking up a mooring, approach slowly so that you come to a halt as you reach the buoy. The forward crew member should not have to hold the boat against the wind while picking up the pennant.

DOCK LINES AND THEIR USES

Dock or mooring lines play an important part in the handling of vessels at a pier. Obviously, as boat size increases, more and heavier lines are needed. A small, light outboard craft requires fewer lines for secure mooring than does a heavy 50-foot trawler. But both skippers should know and understand how lines are used, so that they can decide which lines are appropriate. In addition to securing a boat in its berth, the proper use of lines can aid maneuvering close to moorings.

Dock line terminology

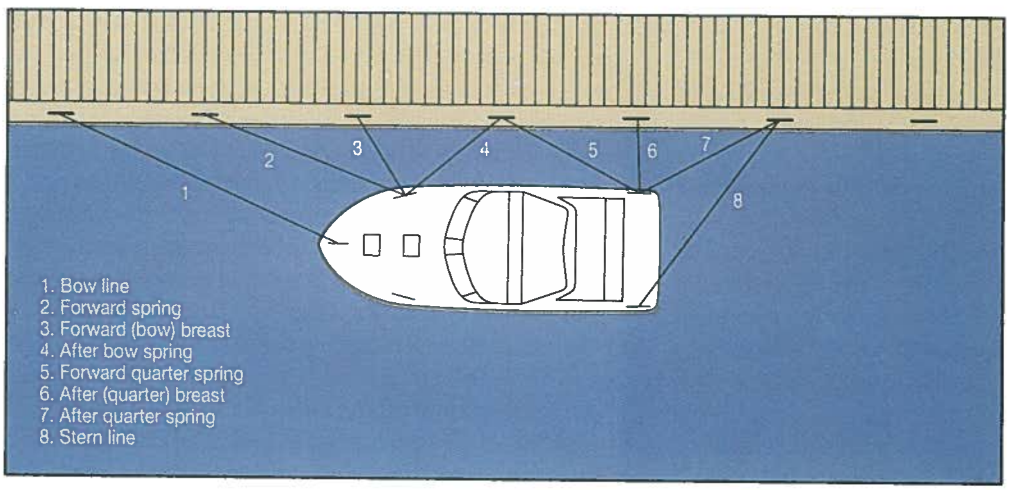
Although most skippers speak quite loosely of bow and stern lines, it generally matters little as long as the line is made fast forward or aft. However, there are several lines that can be secured to the bow or stern and, depending on their direction and use, these are given other names. (Note that "forward" and "after" relate to the direction in which a spring line runs from the vessel, and not to where it is made fast on board.)

■ **Bow and stern lines.** According to correct nautical terminology, there is only one bow line. This is made fast to the forward cleat and run forward along the pier to prevent the boat from moving astern. The stern line leads from an after cleat to a pile or cleat on the pier astern of the boat; this line checks the boat from going ahead. For securing a small craft, these lines are often the only ones that are required. If they are given the proper slack, they can allow for considerable rise and fall of the tide.

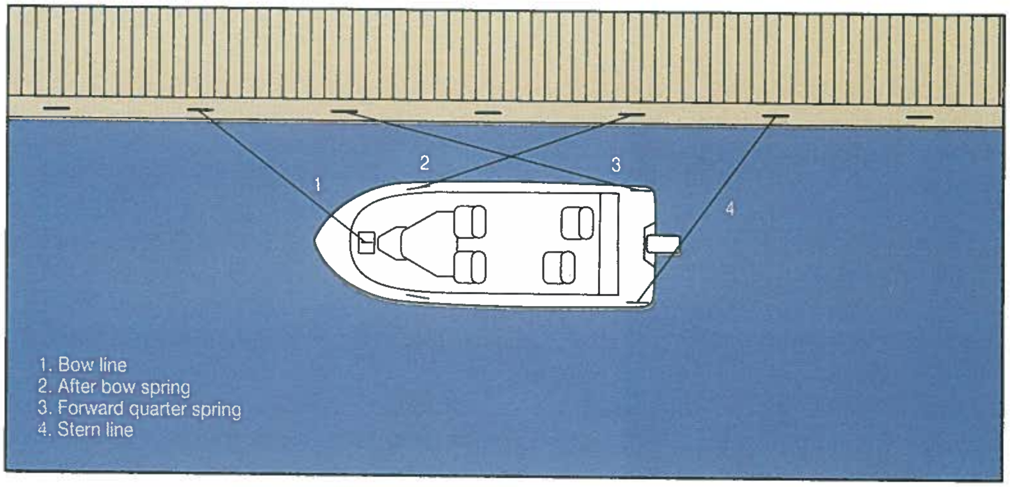
■ **Breast lines.** These are lines, secured to the bow and stern, that lead athwartships nearly at right angles to the vessel and to the pier. They are used on larger vessels to keep the boat from moving away from the pier or to pull the craft in for boarding. Large craft may use bow or quarter breasts, depending on where they are secured. Naturally, breast lines on large vessels are more important than on small ones.

Smaller recreational boats frequently will have only one bitt or cleat forward, and one or two aft, for securing dock lines. Additional cleats along the sides, properly through-bolted, give good flexibility in using dock lines.

■ **Spring lines.** Although only two spring lines generally are used at any one time, there may be as many as four: the forward bow spring, the after bow spring, the forward quarter spring and the after quarter spring. Bow springs are made fast to the vessel near or at the bow; quarter springs are near or at the stern. Forward springs lead forward from the vessel to the pier or wharf, and control movement sternward. After



Possible docking lines for a vessel include the eight types shown at left. A small boat will never need to use all of these. The stern line is best run to the offshore side of the vessel to gain better control while still holding the stern into the pier.



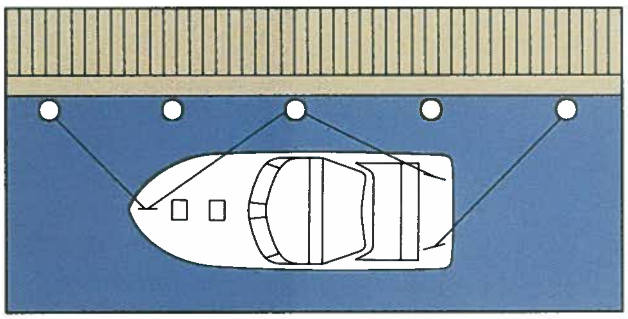
As shown in this typical small boat mooring, crossing spring lines gains greater length for them. This is particularly useful where tidal range is significant.

springs lead aft from the vessel, and check movement ahead. Spring lines are used to prevent movement in a berth, ahead or astern. They work with the bow and stern lines to keep a boat in position where there is a significant rise and fall of tide. This is particularly desirable where fenders must be kept in place against piles.

Sizing the line to the boat

On most recreational boats, dock lines are usually made from nylon, either of twisted rope or braided core and cover. Nylon is the preferred material because it stretches absorbing shock loads, is chafe-resistant for long life, and is easy on the hands.

The line's size varies with the boat. Typically, a 20- to 40-foot craft will use ½-inch-diameter nylon lines, with larger yachts going up to ¾-inch lines. Smaller boats can use ⅜-inch nylon.



Separate spring lines may be placed on the same pile or onshore cleat, or a single line may be secured to bow, pile and stern.

Dock lines should be strong enough to hold the boat and have enough bulk to resist chafe, while not being so heavy as to lose their shock-absorbing characteristics. A light boat pulling against a ⅝-inch line will come up hard against the line because the weight of the boat is not enough to cause the line to begin to stretch. On the other hand, a light ⅜-inch line holding a heavy boat will be very springy and probably strong enough for average conditions. Moreover, ⅜-inch line gives no margin for wear and chafe when under heavy strain.

Mooring a boat

Most average-sized boats can be made fast to a pier or wharf using four lines. The after bow spring is crossed with the forward quarter spring, and secured to separate pier cleats or piles. This arrangement provides longer springs, which can be drawn up rather snugly and still allow for a rise and fall of tide. If only one pile or cleat is available, position your boat so that this point is opposite amidships; then run both springs to it. The lines will be shorter, but still effective.

The bow and stern lines should make roughly a 45-degree angle with the pier. The stern line can be secured to the near-shore quarter cleat, but will work better if run to the offshore quarter cleat. The longer line will allow the boat to rise and fall with the tide with less tending.

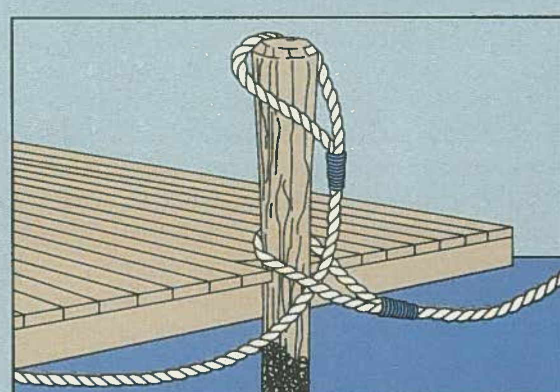
MAKING FAST

When mooring your boat, fasten the lines securely at both ends. Often you will loop the eye splice of the dock line around a pile. If your boat has much freeboard, or the tide is high, the mooring line will lead down sharply from deck to pier. To prevent it from being pulled up off the pile, loop the eye splice around the pile twice. If the eye in your mooring line is too small to go around the pile twice, or even fit over the pile once, pull the line through the spliced eye to make a new loop.

If you must drop a line over a pile that already holds another boat's line, run the eye of your line up through the first eye from below, then loop it over the pile. This will allow either line to be removed without disturbing the other. If you find that another line is dropped over yours on a pile or cleat, simply reverse the process: Get a little slack in the other line, then slip your eye up through its loop and over the top of the pile. Your line then can be dropped through the eye of the other.

When leaving a pier, or maneuvering against spring or other dock lines, it is convenient to be able to release the line from the pile or cleat—from on board the boat—as soon as you get away from the pier. By looping a long line around the pile or cleat, and leading both ends on board, you can easily release it: Slip one end around the pile or cleat, then pull it back on board. Be sure to release the end of the line without the eye splice, so it will run freely around the pile or cleat without hanging up at the splice.

To throw a line to someone on shore, coil the line in your weak hand (left if you are right-handed), making clockwise loops. Coil the line smoothly, avoiding figure-eights, then transfer about half the loops to your throwing hand and hurl them with a strong swinging motion while letting the loops pay out freely from your other hand. Hold tightly to the bitter end or, better yet, secure it to a cleat.



When two lines are needed on a pile, the lower line can be removed without disturbing the upper line if it is slipped through the eye of the upper line and then onto the pile.

If there is an offshore wind blowing, you may want to rig a slack breast line to the near-shore quarter cleat in order to pull the boat into the pier against the wind for easy boarding. However, you must always remember to loosen the line as the tide rises or falls, and to allow plenty of slack during the night, or when the boat is not tended.

Dock lines frequently have an eye splice in one end, but not the other. You must decide whether to use the end with a loop on shore or on the boat. If you are going to be on board, it is better to retain the plain end on board. This means that you can make adjustments without getting off the boat. If there will be no one on the boat, use the end with the eye on board; the plain end ashore will allow adjustment without the necessity of boarding.

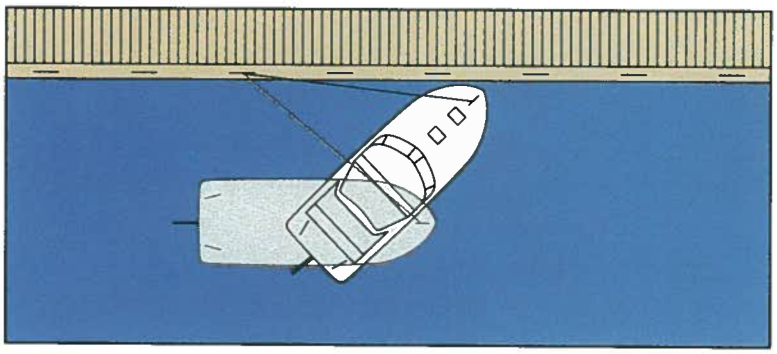
If two lines are used with the idea of getting double the strength of one, they must be of equal length. Otherwise, the short one carries the full load until it breaks, leaving the single longer line to then carry the load.

Allowing for tidal range

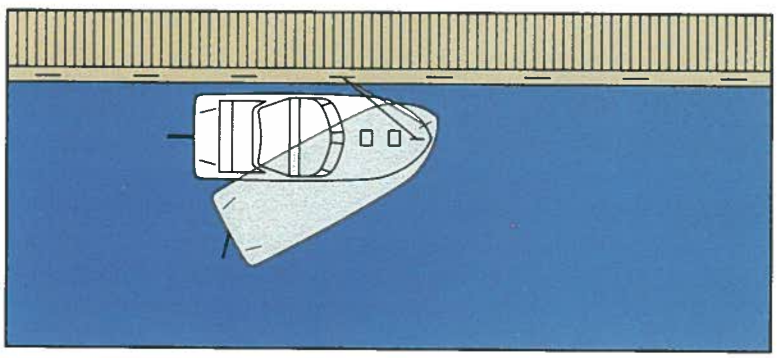
Boaters on fresh-water streams and lakes have no tides to worry about when they make fast to a pier. But in tidal waters, failure to consider the tides can part lines, and may even sink the boat.

Long spring lines provide the most effective method for leaving a boat free to rise and fall. They also keep the boat from going ahead or astern, moving off fenders, or twisting in such a way as to get caught on pier projections. The longer a spring, bow or stern line can be, the greater the tidal range it can accommodate with a minimum of slack. Long lines allow each line to be adjusted, so that all do not come taut together at either extreme stage of the tide.

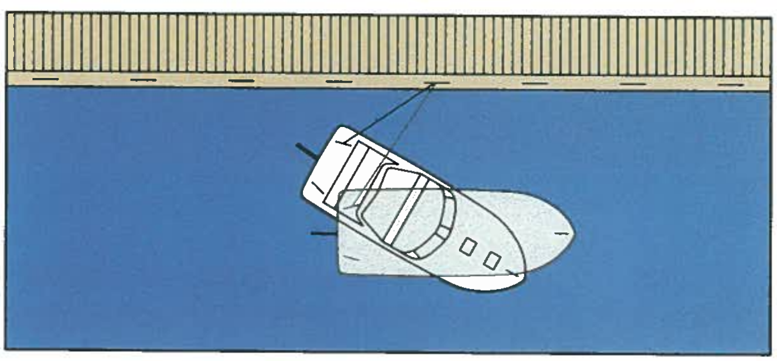
You should adjust the mooring lines to come up almost taut at either of the extreme tidal ranges; this adjustment may take some experimentation. Observe the boat at both high and low tide, and adjust the lines so they are snug, but not tight, at these stages.



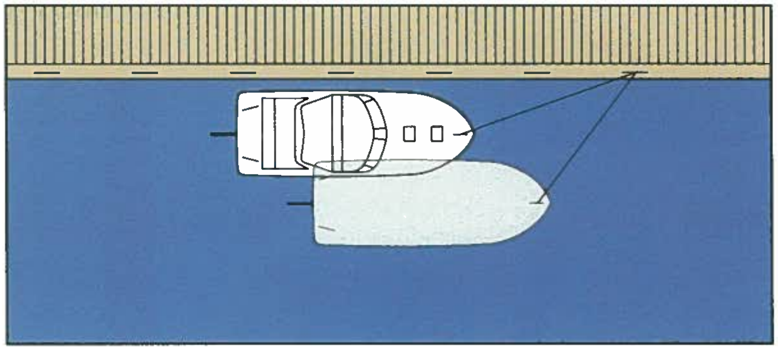
By going ahead on an after bow spring, the boat's bow is pulled into the pier, but the stern springs away.



If the rudder is turned away from the pier, the stern will swing in as power is applied.



When backing on a forward quarter spring, the stern swings in, but the bow swings out away from the pier.



By reversing on a bow line, the boat can be sprung in nearly parallel to the pier or wharf face.

If you keep your boat in a slip, it is important to check the lines at times of extreme high and low tides. Make sure the lines are not so slack that the boat can move against a pile or finger pier. When mooring in a narrow slip with a large tidal range, it may be impossible to keep the boat from coming up against a pile or pier at mid-tide; careful placement of fenders, either on the boat or secured to the pier or piling, may be the only way to protect your boat.

Maneuvering against dock lines

Depending on current or weather conditions, getting in and out of your slip or away from a pier can be challenging. Spring lines are the most useful dock lines since they can be used to assist maneuvering.

■ **Ahead on an after spring.** If it is possible to secure an after spring amidships or close to the boat's pivot point, the boat can then be worked into a pier by running ahead slowly with the rudder turned away from the pier. Since the stern is free to swing as the discharge current acts on the rudder, the boat will move toward—and lie parallel to—the pier. This technique is especially useful when maneuvering short-handed; bringing the boat against the pier is simply a matter of passing a single line ashore. It is also helpful when maneuvering a large boat against a stiff offshore wind, where hauling in on bow and stern lines would require great effort. This is typically more theoretical than practical on many small boats, which have only the bow and stern (or quarter) cleats for securing spring lines to, while the pivot point is well aft of the bow; if it is at all possible, install a cleat on each side of your boat slightly forward of amidships.

■ **Reversing on a spring.** The stern is swung sharply toward the pier by the action of the forward quarter spring when reversing. Since stern movement is restricted, there is much less control. The bow is free to swing away from the pier with the wind or current. If you back on a forward bow spring, the stern is not as restricted, and the line has less effect on turning the boat. Unless there is a strong offshore wind or current, the boat will probably back parallel to the pier.

MAKING USE OF FENDERS

Fenders (they are NOT called "bumpers") are relatively soft objects of rubberlike plastic and filled with air under low pressure. They are used between boats and piles, pier sides and seawalls to protect topsides from scarring and to cushion any shock of the boat striking the fixed object. Some fenders can be inflated to different pressures with a hand pump. Most fenders are circular or square in cross section and of varying length.

Most fenders have eyes molded in each end for attaching a short length of light line that is used to suspend them along the side of a boat. Some models have a hole, through their center, through which a piece of line is run and knotted at each end.

Good quality fenders are not inexpensive but they are well worth the investment. Half a dozen substantial fenders are not too many for the average cruiser to carry.

Fenderboards

When fenders hang vertically from the boat's side, they give protection against the face of a solid pier or wharf as the boat moves fore and aft. If the boat lies against vertical piles, vertical fenders will not stay in place during the boat's forward and aftward movement.

The solution to protecting the hull in many situations is with fenderboards—short lengths (approximately 4 to 6 feet) of heavy boards (2 inches by 6 inches is common), sometimes faced on one side with metal rub strips on rubber cushions. Holes are drilled, and lines attached, allowing the board to be hung horizontally, backed by two fenders hung vertically.

The horizontal fenderboard rests against the pile bridging the two fenders. The boat can then move back and forth the length of the fenderboard, and still be protected from chafing against the pile.

Fenderboards also give excellent cushioning between two or more craft rafted together. One boat should put out the usual two fenders behind a fenderboard; the other puts over only its own two fenders. A second fenderboard should not be used, since one board could tangle with another.

LANDING WITH CONTROL

Whenever you approach a pier or wharf, your close-quarters boat-handling skills will be tested. Although this maneuver is not difficult, wind, current and adjacent congestion can team up to present a challenging situation.

Approaching and pulling alongside a pier is not much different than picking up a mooring, except that you have little choice in the approach. This section covers the basic guidelines to consider when approaching a pier and docking a boat in the type of conditions you will likely encounter.

Approaching with caution

Since boats do not have brakes, and must rely on reversing the propeller thrust to stop, it is prudent to maneuver at slow speeds while in congested areas. Monitor your boat's wake as you make your way to your berth; it can affect your boat, as well as other boats nearby.

Depending on conditions, throttle down gradually to keep the boat under control. The goal is to proceed through the harbor or marina slowly, but with enough way on to maintain control. Approaching a pier too fast will require you to shift into neutral far from your berth. Even though the boat is moving through the water, the propeller is not turning and, consequently, there is no propeller discharge current acting on the rudder. Keep in mind that most boats have better slow-speed maneuverability if the propeller is turning: A slow approach allows you to keep the boat in forward until you are almost alongside the pier.

Have the dock lines ready to use fore and aft. Also have fenders ready so that they can be put in place as soon as the boat is secured, keeping it from chafing against piles or pier edges. Lead all docking lines outboard of stanchions and shrouds, so that they will be clear when taken ashore.

The biggest mistake novice deckhands make is to secure a dock line before the boat has lost all headway. If you have a couple of hands aboard, assign one to the bow and one to the stern, with instructions not to make fast until headway is checked. Use reverse to stop the boat, cautioning your crew that securing the bow or stern lines while the boat is still moving can cause the bow or stern to come crashing into the pier. The after bow spring line is the only dock line that should be used to stop the boat. If you are maneuvering into a tight berth, or against strong current or wind, this line will likely be the first one secured.

Calm conditions

Without wind or current to complicate landing, a skipper operating a boat with a single right-handed propeller will want to make a port-side approach to the pier. Time your approach speed so you will be several boat lengths from the pier when you shift into neutral. Since a reversing right-hand propeller will move the stern to port, approach the pier at a 10- to 20-degree angle. When alongside, shift into reverse to stop headway. Depending on your speed, a short burst of throttle may be necessary to stop the boat and to kick the stern to port, with the boat alongside and parallel to the pier.

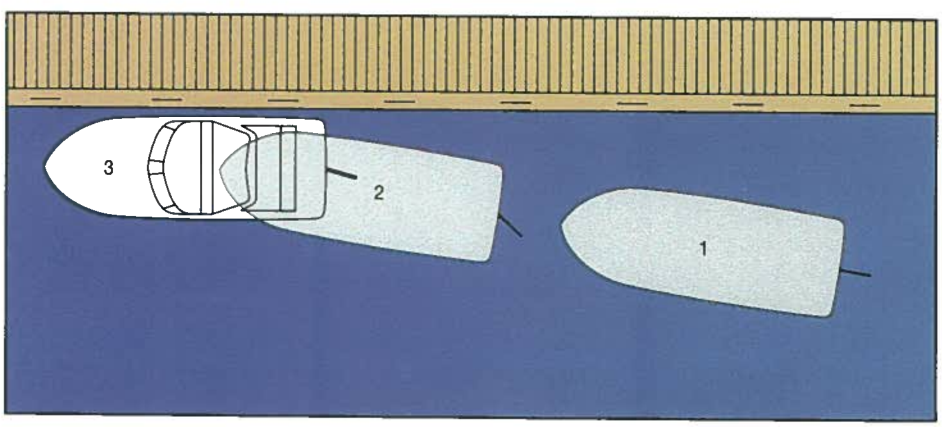
Though a port-side approach is preferable, you can, with care, make a good landing with the pier on the starboard side. Approach the pier slowly at a much shallower angle, as nearly parallel as possible to the pier. Just before you have to reverse to check headway, turn the rudder to full left, swinging the stern in toward the pier. If the boat does not respond, give the propeller a kick ahead while the rudder is full left, in order to kick the stern to starboard. Then reverse to check your headway.

You can also bring the boat in parallel to the pier with an after bow spring line. Secure this line to a pile or cleat ashore, then put the gear in forward with the rudder still full left. The spring line prevents forward movement while the stern moves toward the pier.

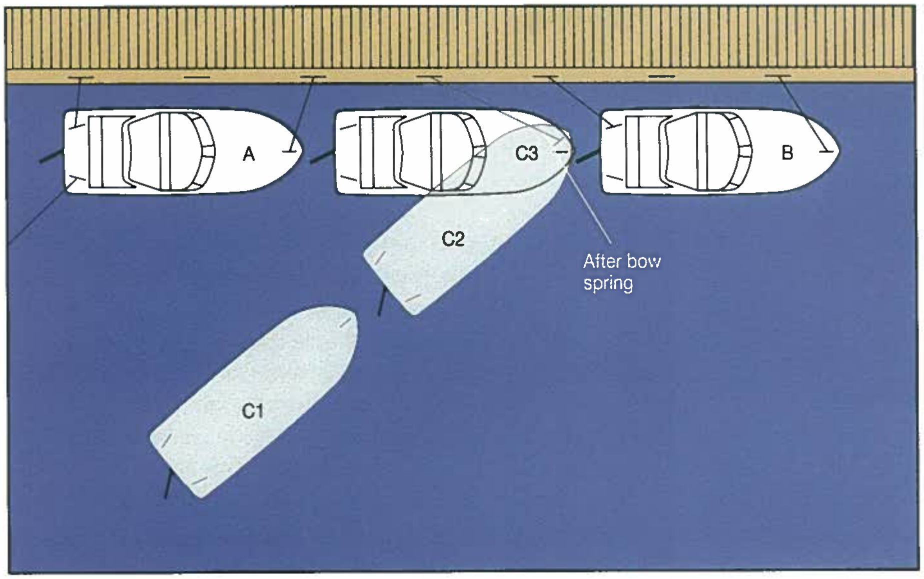
Close quarters

Often you will find that the only empty berth in a crowded marina or yacht club lies between two docked boats. There may be little more than a boat length to squeeze into. Here again, the spring line comes into play.

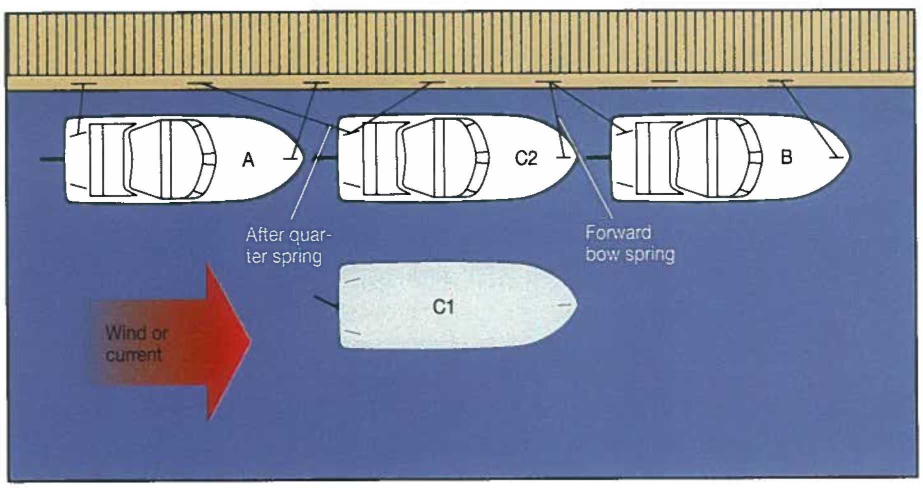
A port side approach is preferable. Since boats are on both sides of the docking area, you will have to approach at a greater angle than if the pier were clear of other vessels. The aim is to place the bow as close to the pier as possible, without running up on the forward boat. Be sure you leave ample clearance



When it is necessary to make a landing starboard side to the pier, with a right-hand propeller, approach slowly at 1, nearly parallel to the pier or wharf face. The rudder is shifted to full left at 2, and the stern is swung to starboard with a short burst of power. Check the forward motion at position 3.



Landing between boats A and B, boat C approaches at a greater than normal angle. At position C2, a spring line is run aft to the pier or wharf from a forward cleat or bitt. Going ahead with propeller and right rudder, the boat swings into its berth at position C3.



The boat can be worked into its berth, using the current, by setting the rudder to port and using just enough power to offset the drift to the current.

on your port side so that, when you back down to check headway, the stern does not hit the pier.

Have your crew stand by, ready to go ashore with the after bow spring line, or ready to throw the line ashore to someone on the pier who will make it fast. After the spring line is secured ashore, put the rudder over full right and go ahead slowly. While the propeller discharge current acting on the right rudder pushes the stern into the pier, make certain that the spring line is adjusted so that the boat cannot possibly move forward, into the boat ahead. Then, as the boat swings in, the spring line may be slacked off a little bit. Quite often you may find that a fender or two might be necessary at the point of contact.

Wind or current parallel to berth

Because water is many times denser than air, in most cases current should be considered first when planning an approach to a wharf. If the wharf happens to be on the shore of a river, or the bank of a tidal stream, the current will flow parallel to it. In this case, the direction of the current should determine how you approach. Heading into the current will enable you to keep the propeller turning over slowly and water moving past the rudder.

If you were to approach the pier from the opposite direction, moving with a half-knot current, you would not only have to stop the boat dead in the water. You would also have to begin making half-knot sternway before your relative movement past the pier would stop.

The wind also must be reckoned with. Since propellers are not as efficient when reversing as when going forward, attempting to stop your boat in a strong following wind takes extra time. During this time, the rudder will be in the propeller's suction current, so it will be of little use in steering the boat. Stopping a boat going upwind is much easier and, if the wind is strong enough, the propeller can be kept turning ahead even as the boat comes dead in the water.

When approaching a pier with a current running or strong wind blowing parallel to it, stop your boat in the channel.

Assess the directions and relative strengths of the wind or current (at the time they may be opposing) before deciding on which approach is best:

- If the wind or current is at your back, then pass downwind or downstream of the pier, turn around and proceed toward the dock upstream.
- In coming up against wind or current, you can use that force to check your headway, instead of reverse. In the case of a strong current, your boat should respond to the helm when it has stopped next to the pier because there will still be a flow of water past the boat and its rudder.

Landings downwind or with current

If you can, avoid any landing in which wind or current are setting you down toward your berth. In this case, you are totally dependent on your reverse gear for stopping the boat. An error in judgment or a motor failure would put you in an embarrassing, if not dangerous, situation.

Sometimes, however, space will not permit you to turn before docking. Suppose, for example, you are coming into a canal lock with a strong wind astern. Proceed in, as slowly as possible while retaining control. With a single-screw right-hand-propeller boat, if possible, choose the port side of the lock, so that your stern will swing in against the lock face when you reverse. Once the boat's headway has been checked, get a line out from the stern or port quarter; the boat can lie temporarily on this line alone. If you get a bow line fast first, and miss making the stern line fast, you risk being turned end-for-end by the wind or current.

Landing on the leeward side

Since the wind can blow from any direction, it's not uncommon to find yourself approaching a pier with the wind blowing at right angles to the pier. If you have a choice as to which side of the pier you land, choose the leeward side. If the wind is strong, the windward side can be uncomfortable and your boat may pound against the piles. The rougher it is, the more important it becomes to dock on the leeward side. The wind will then hold the boat clear of the pier instead of pushing it against it.

Unless there is current to consider, make the leeward approach so the port side will rest against the pier. Depending on wind strength, you may have to point the bow into the wind a bit more than usual to keep it from falling away during your approach. Your biggest problem will be getting the stern to come into the pier against the wind.

Since you are going upwind, you can approach the pier a bit faster then normal, then reverse a bit harder, kicking the stern toward the dock. You may need to put the rudder hard right and go forward for a short burst to help get the stern in.

Have the crew take or pass the bow line ashore first. Then secure the stern line. If the stern begins to drift away from the pier before you can secure the stern line, run ahead on the bow line slowly with the rudder hard right. It will act as an after spring to help bring the stern into the pier. Be careful that neither the bow nor topside is damaged by the pier during this operation; have your fenders ready.

If you have a large, heavy boat, secure the after spring on a beam cleat first; then secure the stern line.

Holding with one spring

The use of a spring line also works well for temporary holding on the lee side of a pier or wharf. After coming alongside, rig the after spring line and go ahead easily until it takes a strain. Then put the rudder hard over, away from shore. Usually only idle speed is necessary to hold the stern up against the pier.

Close-quarters boat handling is one of the most important skills a boater can acquire. The key is practice—an opportunity that is ever-present (often under observation) in most yacht clubs and marinas.

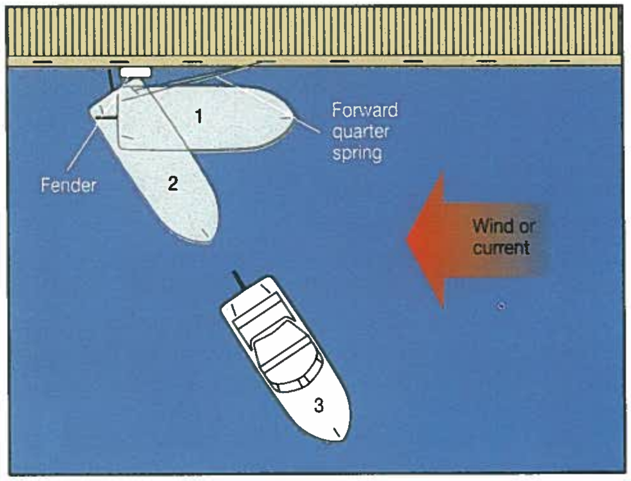
CLEARING A BERTH

Getting safely away from alongside a pier or wharf can be either simple and easy, or complex and difficult, depending on wind direction, the set of any current and the proximity of other craft. Take advantage of any help you can get from the wind and current, and make good use of spring lines.

With wind or current ahead

When facing wind and current ahead, leaving a berth is not difficult. The biggest problem that skippers often create for themselves is to start forward without providing sufficient clearance between the pier and their boat. Remember that, for a boat to turn, the stern must be free to move. To pull away from a port-side pier, the stern must swing to port before the boat will begin to turn to starboard away from the pier. (It is not uncommon to see a boat rub its stern against the whole length of the face of a wharf as the skipper turns the wheel more and more to starboard in an effort to pull away.)

With smaller, lighter craft, all that may be needed to gain the necessary clearance from the pier is for someone to give the bow a push off. On the other hand, a larger boat will find it better to go ahead on the after bow spring, with the rudder turned in toward the pier. The natural action of the propeller plus rudder will swing the stern clear of the pier. You can then back down a short distance, and be clear of the pier to go ahead; remember that as you turn to starboard your stern will swing to port, back toward the pier. With either procedure, don't try to cut away too sharply; your stern could come back in enough that your port quarter would strike the pier.



One technique with wind or current ahead is to back on a forward quarter spring to turn the stern in and bow out, angling to get clear by going ahead with the rudder amidships.

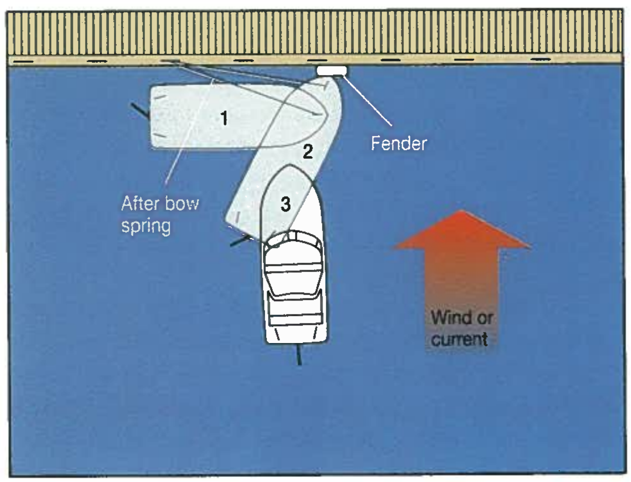
From a windward berth

Clearing a berth where the wind or current is pushing the boat against the pier does not necessarily have to be difficult, except in extreme conditions when it may be impossible to get the boat off the pier without working with the after bow spring.

Since the wind or current is holding the boat against the pier, cast off all dock lines—except the aft bow spring line. If the boat has only bow and stern lines, cast off the stern line, then transfer the bow line to an amidships position on the pier to convert it into an after spring.

Go ahead easy on the spring with the rudder turned toward the wharf. The bow of the boat will come into the pier, and the stern will move away from the pier. If it does not respond with the rudder hard over, open the throttle to provide the kick necessary to work the stern around. Depending on the nature of the pier and the type of boat, you may need a fender or two at the critical spots between pier and boat.

Continue until the boat has turned enough: The stern should be far enough from the pier so it will not be blown back down on the pier when backing away. Get the spring line and fenders on board, and back the boat away with rudder amidships. The stronger the wind or current, the more power is necessary to move the boat against it. If there are other boats moored to the pier near you, back away with considerable power to gain sternway and some steerage as soon as possible. Continue backing away until well clear; a boat that is dead in the water will make much more leeway than one that is moving.

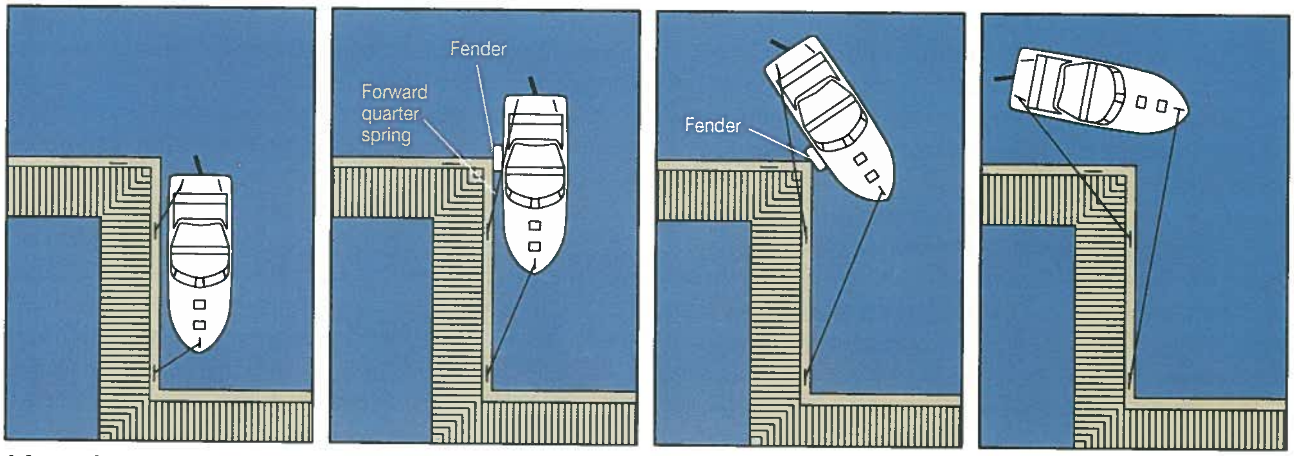


Here is how an after bow spring is used to leave the windward side of a pier or wharf. The boat goes ahead on the spring from 1 to 2, with the rudder set toward the pier. At 3 the line is cast off, and the boat backed into the wind.

With wind or current astern

Instead of merely casting off all lines and going ahead, get the maneuverable stern out away from the pier and go astern before going ahead on the course.

Run ahead on the after bow spring. This allows the stern to go out into the current, or be kicked out if necessary by power, going ahead with the rudder turned toward the wharf. If the current or wind is noticeable, often the stern swings out without aid of the engine. When the boat has swung out,



A forward quarter spring can be used to help the boat back out around the end of a pier. When the spring is taut, the boat reverses with full right rudder. Use a fender as necessary.

anywhere from 45 to 60 degrees depending on the situation, the spring is cast off. The boat backs off far enough to clear the structure before you go ahead with opposite rudder.

Backing around

We have already discussed backing out of a slip. But at times, it may be necessary to back out of the slip and make an almost-immediate sharp turn because of congestion, or to come up to the adjacent pier. In either case, the forward quarter spring line can be used in much the same way as described for using the after spring.

For example, let's say your boat is lying in its slip, starboard side to the land. The first step is to make the spring ready from a point near the corner of the slip to the after cleat—either amidships if there is only one, or the cleat on the starboard quarter, if there are two.

With the spring ready, but left slack and tended, cast off the bow line, or slack it away to be tended by someone on shore. Back the boat slowly with full right rudder. When the boat is about halfway out of the slip, take a strain on the spring to prevent backing farther. This will cause the boat to pivot as the stern is pulled around to starboard by the spring line. Be sure to protect the boat from the pier with a fender.

As you continue to back, the spring will pull the boat up to the pier. At this point, you should slack the spring as the boat comes parallel to the pier so you can back farther. If you plan to secure the boat to the pier, you can use the spring as one of your dock lines, adding others as needed.

This method is especially useful when there is a breeze off the structure that would tend to blow the boat away if maneuvering without lines. No human power is required, and it can be accomplished in a leisurely and seamanlike manner. But, as in any case where the stern is made fast to the shore with the bow free, take special care to keep the boat under control.

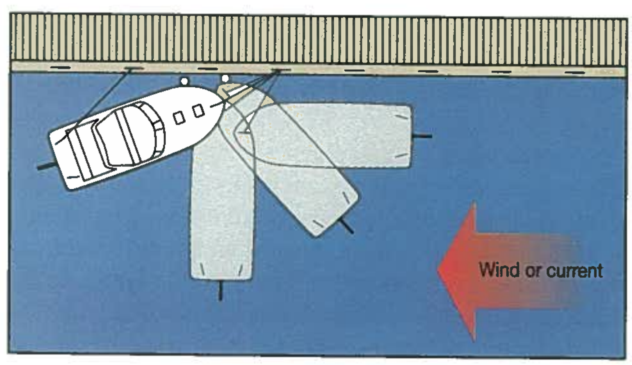
If the boat is to get underway after being backed around, no bow line is needed. When the boat has pivoted far enough, with starboard quarter near the corner of the pier, idle the engine while casting off the shoreward end of the spring and bringing it on board. To get underway from such a position, keep the rudder amidships until the stern of the boat is clear of the pier.

Turning in a berth

At times you may find it easier to turn your boat around at the pier than to attempt to leave the berth with adverse current conditions—particularly if the area surrounding the pier is congested.

To turn a boat with the starboard side against a pier, current coming from astern, first let all lines go except the after bow spring. Often the effect of the current will then be sufficient to throw the bow in toward the pier and the stern out into the current. If any factor, such as a beam wind, tends to keep the stern pinned against the pier, kick the stern out by going ahead easy with right rudder. Keep a fender handy as a protection to the starboard bow.

Take steps to prevent the bow from catching on the pier as it swings. A small boat will usually require a fender, but a large craft may have to reverse the engine just enough to keep the bow clear.



A boat can be turned end for end, using just the current and the spring lines.

As it swings in with the current, the fender should be made ready near the port bow. Also transfer the after bow spring from the starboard side to the port side. As the boat moves with the current, this line becomes the port forward bow spring. If the boat does not come alongside readily, even when helped by going ahead a little with right rudder, rig a forward quarter spring. Take a strain on the quarter spring and ease the bow spring. The current will push the boat back against this line and pull it parallel to the pier.

On a larger vessel, you will need to go ahead on an after bow spring rigged on the port side. Going ahead easily with right rudder on this spring alone, the boat stays under control and eases in nicely. In turning a boat this way, make the turn with the bow to the pier, rather than the stern.

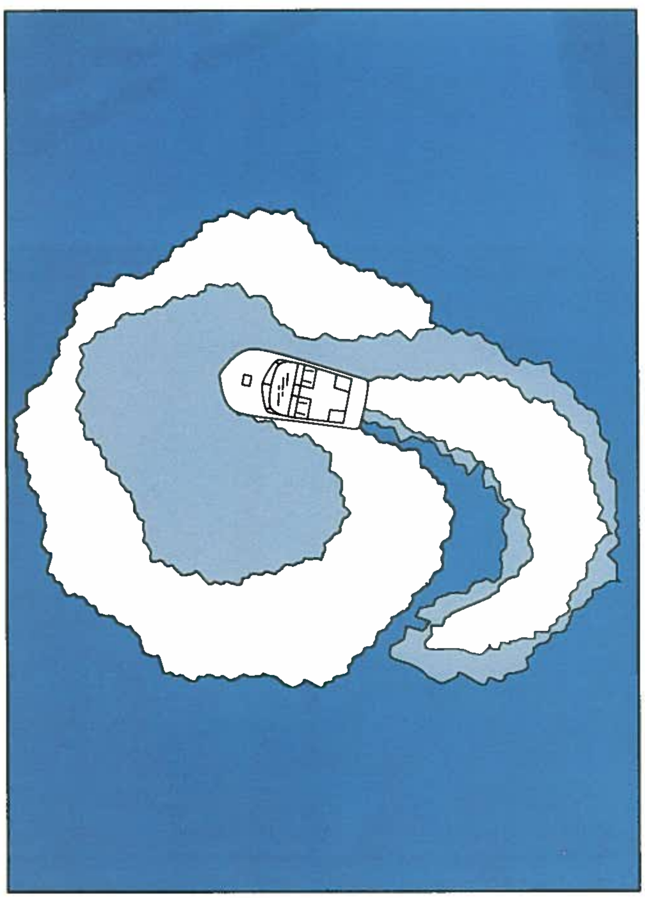
Turning with power

Consider a situation as described above, except there is neither wind nor current to assist in turning. Here the power of the engine can be used to swing the boat. Go ahead on an after bow spring with right rudder (starboard side toward the pier). This throws the stern out away from the pier; use a fender to protect the bow. Allow the stem to nose up against the pier, using another fender, if necessary, to cushion it.

As the boat swings toward a position at right angles to the pier, ease the spring. With the bow against the pier, the engine going ahead slowly, the rudder amidships, hold the boat in this position. Meanwhile, cast off the bow spring from on shore; re-rig it as an after bow spring on the port side (or use a second line for the port side). With right rudder again, the stern will swing all the way around; shift the fenders once more to protect the port bow.

In any maneuver involving the use of engine power against the spring, the strain on the line must be taken up slowly and easily. A surge of power puts a shock load on deck fittings that they were never designed to carry, and may even tear out the cleats. If the fastenings hold, the line may part.

Once the strain has been taken up easily, proper deck fittings and good line of adequate size will stand the application of plenty of power. Always bear this principle in mind when you are preparing to tow, or when you are passing a line to a stranded boat. Also remember that most docking lines are nylon, and can store considerable energy as they stretch. When the boat is put in neutral or the throttle is closed, the boat can be pulled back toward the pier. If nylon is stretched to the breaking point, it can snap back with lethal effect.



Pivoting drive unit of a stern-drive boat *(above, left)* permits a tight speed run, while the inboard *(above, right)* with its fixed propeller, responds only to the rudder.