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CONTROL STATION DESIGN CONCEPTS FOR BASSBOATS, BOWRIDERS, RUNAB--ETC(U)
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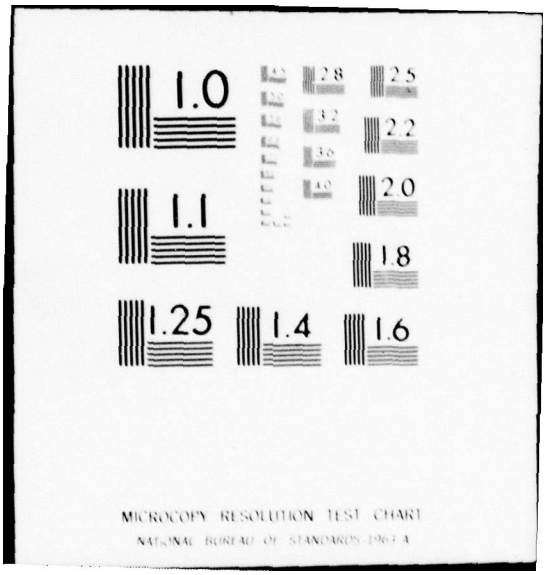
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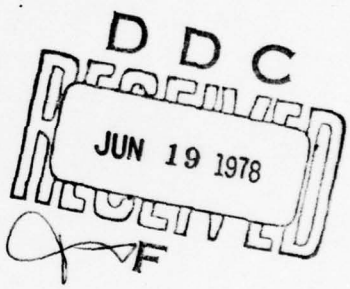
REPORT NO. CG-D-67-77

CONTROL STATION DESIGN CONCEPTS FOR BASSBOATS, BOWRIDERS, RUNABOUTS, SKIBOATS AND ALL CONTROL STATIONS DESIGNED FOR SITDOWN OPERATION ONLY



PREPARED FOR

U.S. DEPARTMENT OF TRANSPORTATION

UNITED STATES COAST GUARD
OFFICE OF BOATING SAFETY
WASHINGTON, D.C. 20590

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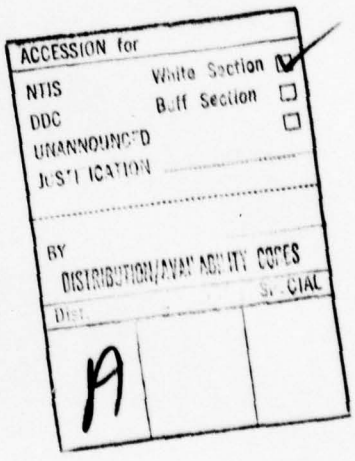

Technical Report Documentation Page

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
USCG-D-67-77		

4. Title and Subtitle
Control Station Design Concepts for Bassboats, Bowriders, Runabouts, Skiboats and All Control Stations Designed for Sitdown Operation Only.

5. Report Date
1 November 77

6. Performing Organization Code

8. Performing Organization Report No.

7. Author(s)
R. MacNeill

9. Performing Organization Name and Address
Wyle Laboratories
P. O. Box 1008
Huntsville, AL 35807

42p.

10. Work Unit No. (TRAIS)

11. Contract or Grant No.
DOT-CG-40672-A (T.O.26)

13. Type of Report and Period Covered
Final Report.
AUG 76 ~~to~~ AUG 77

12. Sponsoring Agency Name and Address
U. S. Department of Transportation
U. S. Coast Guard
Office of Research and Development
Washington, D. C. 20590

14. Sponsoring Agency Code
U. S. Coast Guard (G-DSA)

15. Supplementary Notes
The U. S. Coast Guard Office of Research and Development's technical representative for the work performed herein was ENS S. F. WIKER.

16. Abstract: These concepts have been developed to assist boat builders and designers in planning the control stations of the titled boat types. Utilization of these concepts should provide adequate visibility, space and control locations for 90% of the user population while minimizing safety hazards within the control station envelope.

These concepts cover the design of control stations that approximate the characteristics of the automobile control station, and should be used only for control stations:

a. Design for seated operation;
b. With a seat to floor distance not exceeding 1 1/2 feet;
c. With a steering wheel in the automotive position;
d. Having a cockpit deck less than 3 feet above the waterline.

If your control station will not comply with ~~A, B, C, D,~~ the above do not use this concept. Instead, obtain and use either

a. Control Station Design Concepts for Center Console, Deck, and Pontoon Boats and Other Control Station Designed for Standup/Sitdown Use or

b. Control Station Design Concept for Cabin Curisers and Flying Bridges.

17. Key Words	18. Distribution Statement
Control Station, human factors, anthropometry, recreational boat, bassboat, bowrider, runabout, skiboat	Document is available to the U. S. Public through the National Technical Information Service, Springfield, Virginia 22161.

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	32	405 950

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FOREWORD

These Control Station Design Concepts were developed by the U. S. Coast Guard to assist boatbuilders and designers in planning the control stations of various types of boats. These concepts are non regulatory. Instead they are suggestions based on human factors engineering techniques which if followed will provide adequate visibility, space and control orientations for 90% of the user population. At the same time the designer will be minimizing safety hazards within the control station. Flexibility should be used in applying these concepts to individual designs.

There are three reports in this project. Each covers a different type of boat. Users of these concepts are reminded to make sure that their boats are in compliance with all current regulations. Any questions should be directed to your Coast Guard District Boating Standards Office.

CONTROL STATION DESIGN CONCEPTS
FOR

BASSBOATS, BOWRIDERS, RUNABOUTS, SKIBOATS

AND
OTHER CONTROL STATIONS DESIGNED FOR SITDOWN OPERATION **ONLY**

OBJECTIVE: These concepts have been developed to assist boat builders and designers in planning the control stations of the titled boat types. Utilization of these concepts should provide adequate visibility, space, and control locations for 90% of the user population while minimizing safety hazards within the control station envelope.

SCOPE: These concepts cover the design of control stations that approximate the characteristics of the automobile control station, and should be used only for control stations:

A. Designed for seated operation,
B. With a seat to floor distance not exceeding 1½ feet,
C. With a steering wheel in the automotive position,
D. Having a cockpit deck **less** *than 3 feet above the waterline.*

If your control station will not comply with A, B, C, and D, above **Do Not** use this concept. Instead, obtain and use:

- Control station design concept for center console, deck, and pontoon boats and other control station designed for standup/sitdown use.
- Control station design concept for cabin cruisers and flying bridges.

NOTE: These concepts were developed primarily for boat builders; however, dealer and/or owner-installed equipment may conform to the criteria recommended herein.

There are 2 parts to these concepts:

PART 1 Is for boat builders who do not use detailed drawings. It consists of a step-by-step procedure to develop a designed control station and is structured as follows:

Section 1 Will lead you through a procedure to place the seat and determine if you have adequate visibility from the seated position.

Section 2 Locates the steering wheel, shift/throttle controls, switches and instruments in the proper position.

Section 3 Positions the windshield and top.

PART 2 Profile drawings to scales of ¾"=1'0", 1"=1'0", and 1½=1'0" designed to be slipped under working drawings for tracing purposes.

When using the scale drawings you should consult the text (Part 1) for details of:

Seat heights vs angled footrests	Section 1
Steering wheel dimensions & angles	Section 2
Shift/Throttle mechanism alternatives	Section 2
Instrument and switch placement	Section 2
Windshield & frame details	Section 3
Top & side curtain details	Section 3
Glare	Section 3

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PART 1

CONSTRUCTION OF A CONTROL STATION FOR THOSE WHO DO NOT USE DETAILED DRAWINGS

ASSUMPTIONS: You have a hull sitting on a cradle or somehow blocked up. Any cabins or structures that would limit the operator's visibility of the bow have been installed. The cockpit sole or deck is in place and you have planned the location of the control console. You are ready to plan the dimensional characteristics of the control station including the panel, seat, and controls.

NOTE: The old axiom "Pictures Say a Thousand Words" is true in using this guideline. An **accurate** scale drawing of your boat in scales corresponding to those specified earlier will greatly simplify the use of this guideline. By slipping the scale control station drawing under your tracing you should be able to:

- Determine if you have adequate seated visibility
- Determine where to place the wheel & shift/throttle mechanism
- Locate the windshield
- Provide enough headroom under the top.

SET UP HULL: You should have a pretty good idea of how your boat wil float when it is loaded with engine, fuel & a normal load of people and gear. We are talking about the waterline while the boat is **at rest.** Chock up the hull so that this waterline is level. In most cases the boat will now be sitting in a slight bow up attitude.

If you aren't sure how your boat will sit in the water, look at similar boats in the water or in advertisements. Set yours up at the same angle.

1.0 THE SEAT

The vertical position of the seat is based on an eye height that will allow the small operator (5th percentile male or 50th percentile female) to see over the bow at most running angles.

1.1 GENERAL

Let's assume that you have a pretty good idea of where the seat will go. The cockpit deck is in place and possibly the bulkhead forward of the control station has been positioned. Now where should the seat go? How far should it be from the bulkhead? This distance varies with seat height. Minimum distances are shown in Table I. Position the seat using these figures as your guide.

NOTE: All seat measurements will be made from the intersection of the seat bottom and seat back. This is known as the "Seat Reference Point" and will be designated **SRP.**

1.2 SEAT ANGLES

The seat cushion should be angled up in the front. The backrest should angle back. How much depends on the seat to floor distance. The recommended ranges of seat bottom & back angles are shown in the sketch adjacent to Table I.

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NOTE: If the seat has fore & aft adjustment, the minimum SRP to bulkhead distance should be measured with the seat adjusted to the mid position.

HOW TO FIND THE SRP

Have a person that weighs 150-175 lbs. sit in the seat. Measure the distance from the lowest point on his (her) bottom to the floor. That's the SRP height.

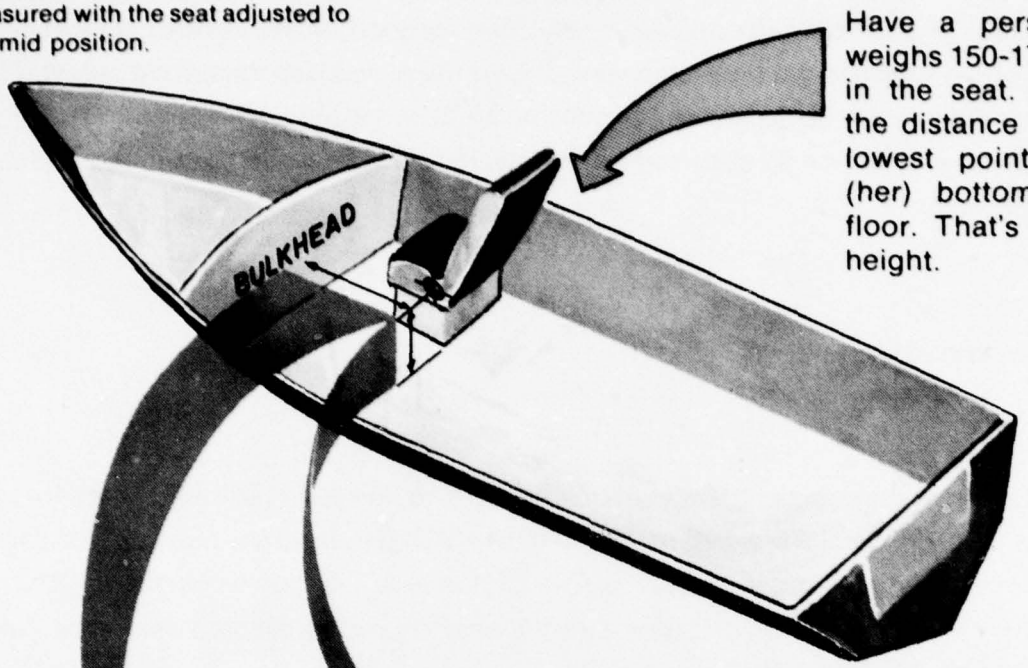
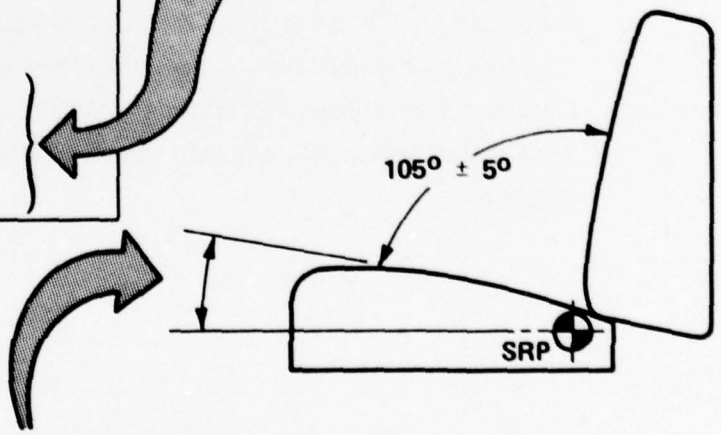


TABLE I

MINIMUM DISTANCE FROM SRP TO BULKHEAD INCHES	SEAT HEIGHT-DISTANCE FROM FLOOR TO SRP INCHES
30	18
38	16
42	14
45	12
46	10
47	8
47	6

NOTE: Minimum SRP to bulkhead distances for these seat heights may be reduced by a maximum of 3" in small runabouts where space does not permit the use of these recommended minimums. **However,** some large males will have insufficient leg room.



Seat angle varies with seat height:
If SRP height is less than 10", angle the seat 5° to 7°
If SRP height is greater than 10" angle the seat 3° to 5°

1.3 SEATED VISIBILITY

Now you've got your seat in place. The next step is to check for adequate seated visibility. If your boat doesn't have anything forward of the control station area that could obscure the bow from view, follow the procedure described below. The first thing you will do is rig a horizontal line aft from the bow. Measurements will be taken from this line to determine if the visibility from your boat meets certain minimums.

Check the sketch above Table II.

Use a board and carpenter's level or a string and line level (shown). Measure the distance from the line (or board) down to the SRP (B). Find the number in the first column of Table II that is closest to your Distance **A**. The number in the right hand column is the maximum distance that the seat should be located below the line *(or board)* (*Distance* **B**).

1.4 OTHER CONSIDERATIONS:

A. You should leave 4" clearance between the side of the seat back and the coaming. This allows room for the driver's elbow and room for the shift/throttle mechanism.

B. If the SRP is 12" or less from the floor you should install an angled footrest. The angle and distance to the heel point vary with seat height. See Table III.

C. Fore & aft adjustment of at least 6" is a desirable feature for the Helmsman's seat. If you order an adjustable seat, position it as described in the note above Table I.

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NOTE: For simplicity the sketches show the keel as being level. If you've leveled the boat to an anticipated static load waterline the keel may not be level.

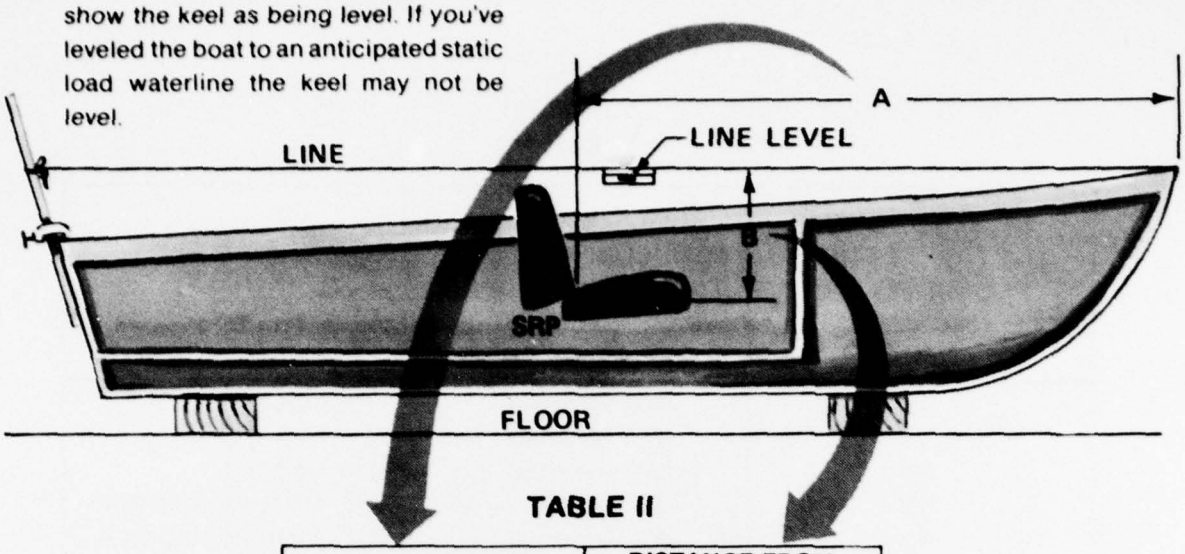

TABLE II

DISTANCE FROM BOW TO SRP COLUMN A	DISTANCE FROM SRP TO LINE HORIZONAL WITH BOW COLUMN B
INCHES	INCHES BELOW LINE
50	20
60	18½
70	17
80	16
90	14½
100	13
110	12
120	10
130	9
140	7½
150	6
160	4½
170	3
180	1½
190	0½

If dimension **A** is greater than 190 inches the seat (SRP) will be above the line to the bow. Table III continues below. When checking your dimension **B** it should be greater than the number in Column B.

INCHES	ABOVE LINE
200	1
210	2½
220	4
230	5½
240	6½
250	8

If your seat (The SRP) is lower, it should be raised to at least that distance for the recommended operator visibility.

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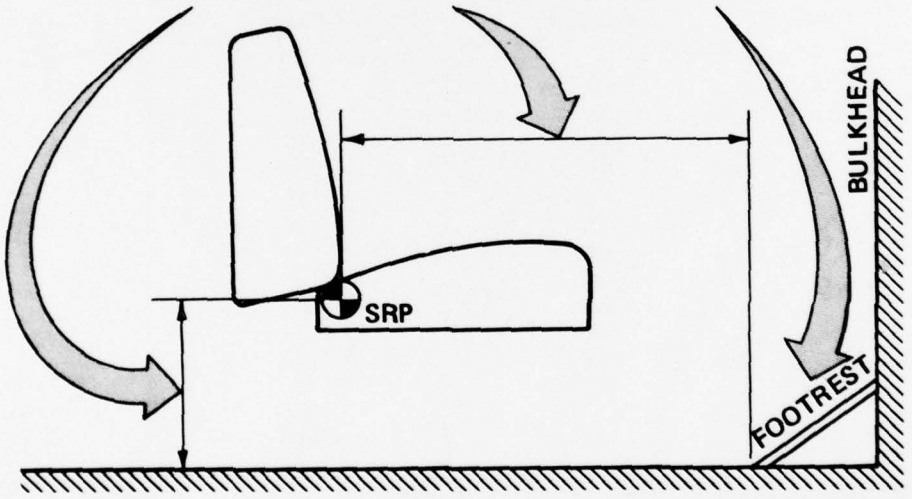
TABLE III

SEAT HEIGHT - DISTANCE FROM FLOOR TO SRP	FLOOR LENGTH - MINIMUM DISTANCE SRP TO HEEL POINT	FOOTREST ANGLE
INCHES	**INCHES**	**DEGREES**
18	Not Needed	Not Needed
16	Not Needed	Not Needed
14	Not Needed	Not Needed
12	35 inches	35° from Horizontal
10	37 inches	40° from Horizontal
8	38.5 inches	45° from Horizontal
6	40 inches	50° from Horizontal



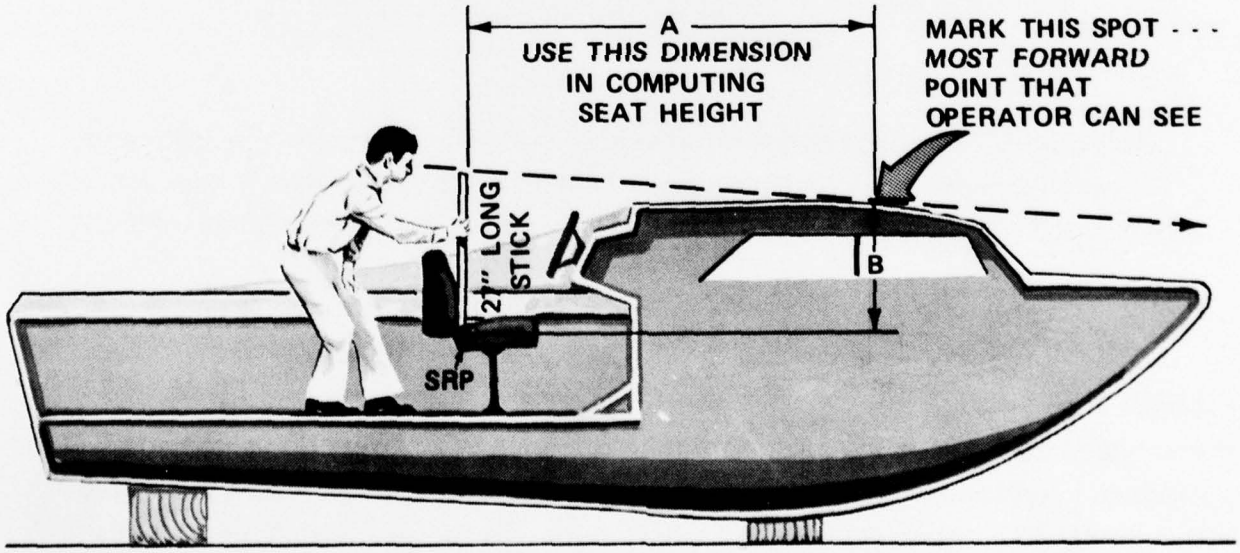
If you have had to move the seat more than an inch you should check the fore and aft position with respect to the bulkhead (if applicable). In that case go back to 1.1.

(12)

1.5 IF YOU CAN'T SEE THE BOW

What if you can't see the bow from a seated position? (or won't be able to when it's finished). Your boat may have the problems illustrated above or similar problems. You can't use the bow as a reference point. Instead you will have to use the most forward point on that structure that you can see instead of the bow.

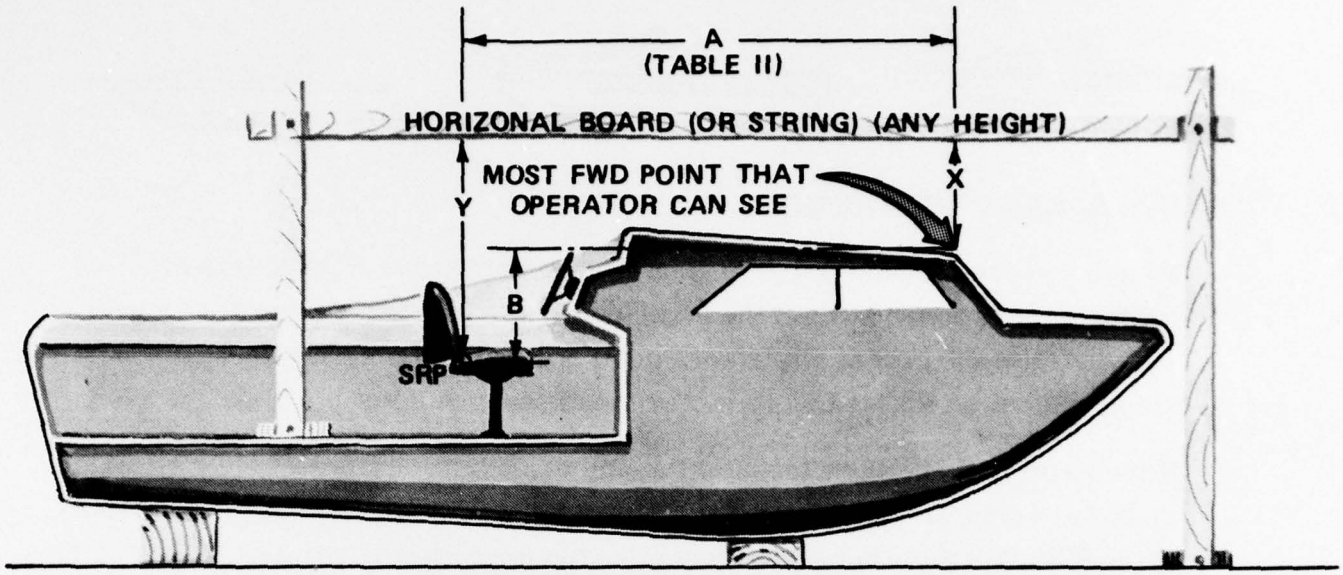
But how do you determine the most forward point that you can see? Here's how to do it. Cut a stick 27" long or mark it 27" from the end. Stand it vertically on the seat at the SRP. You stand behind the seat with your eye at that height. Sight forward. If you can see the bow forget this whole paragraph. If you can't, mark the most forward point on the highest structure in front of the control station. The sketch below illustrates the concept.



CUT-AWAY VIEW OF BOAT

Measure the distance from the SRP to the mark on deck (Distance A). Also measure the vertical distance from that spot to the SRP (Distance B). This may be difficult to do because of other structures in the way. You can rig a horizontal beam or line over the boat.

See Details - Next Page!



CUTAWAY VIEW OF BOAT

	DIMENSION Y	.....inches
Subtract	DIMENSION X	.....inches
	DIMENSION B	.....inches

Go back to Table II. Enter the table with your Dimension A. The difference between dimensions X and Y becomes Dimension B in the table. If your seat is too low it should be raised to at least that dimension to assure adequate visibility.

FINALLY —

If you have had to move the seat more than one inch in any direction since you first positioned it, go back to Table I and make sure that the SRP to bulkhead distance is still within limits. Also check Table III to make sure that the footrest specifications are still within limits.

SUMMARY — SECTION I

1. Position Seat in Boat.
   Table I Assures Adequate Leg Room.
   Table I Also Shows Proper Seat and Back Angles.

2. Check for Adequate Seated Visibility.
   Table II tells you how high your seat should be. It is based on the distance of the seat aft of the bow.

3. You can't see the bow from the seated eye position?
   See Section 1.5

4. Check Table III to see if an angled footrest is needed.
   The need for an angled footrest is based on seat height.

2.0 CONTROLS

2.1 STEERING WHEEL. The steering wheel, being the most used control, should be positioned properly. Important factors are:

- Horizontal distance from SRP to wheel
- Vertical distance from seat to wheel
- Angle of wheel
- Diameter of wheel
- Leg room under steering mechanism
- Hand clearance around wheel.

Most of the factors are interrelated. If you change one, it will affect something else. The concept is illustrated below. Table IV puts dimensions to the concept in the form of ranges. Position your steering wheel within the limits of the ranges.

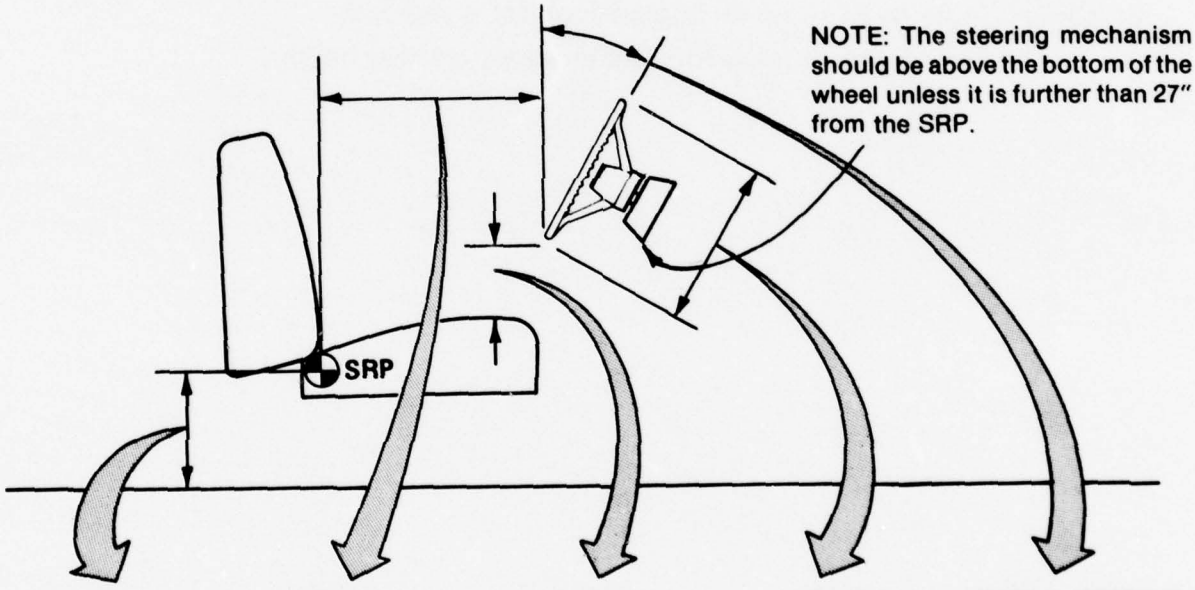


TABLE IV

SRP HEIGHT	HORIZ. DIST. SRP TO WHEEL	VERT. DIST. SEAT TO WHEEL	WHEEL DIAMETER	WHEEL ANGLE (From Vertical)
Under 8"	18" to 21"	7" to 9"	12" to 15"	15° to 25°
8" to 12"	17" to 20"	6" to 9"	12" to 15"	20° to 35°
12" to 18"	15" to 18"	6" to 8"	13" to 15"	20° to 35°

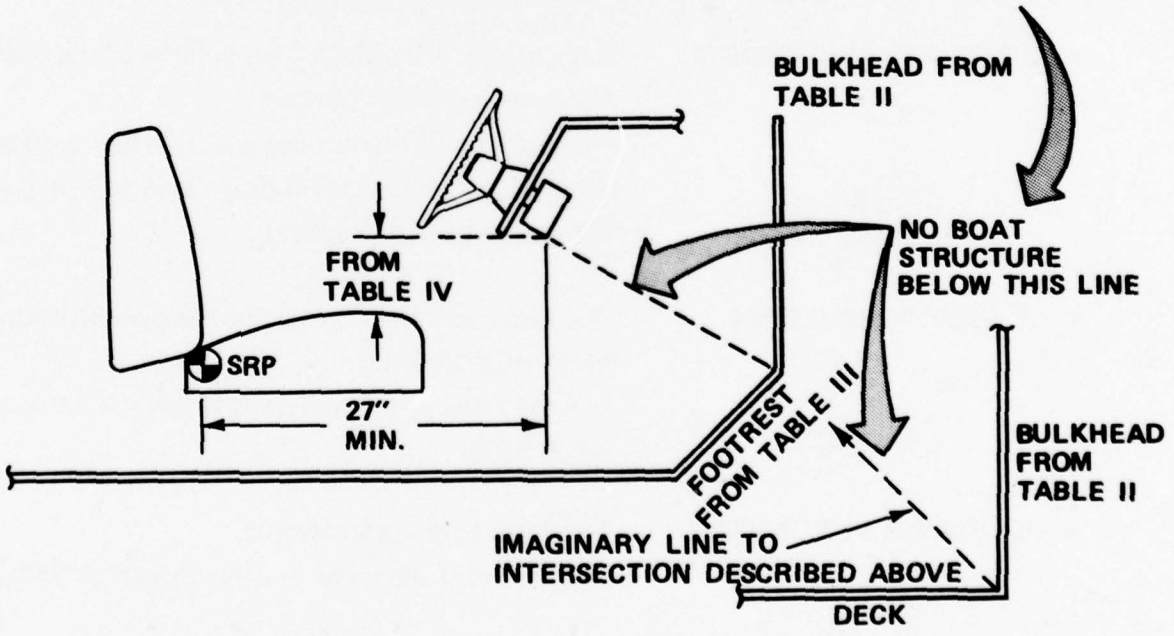
(12)

Mock up a control panel to support the steering mechanism so the wheel is positioned within the limits shown in Table IV. Note that the angle of the steering wheel will always determine the panel angle.

- When looking from above, the centerline of the seat and the centerline of the wheel should coincide within 2 inches.

- Make sure there is at least a 2½" clearance all around the steering wheel rim. If the shift/throttle mechanism will mount on the coaming make sure there is a gap of 2½" plus the width of the widest shift throttle mechanism that may be installed. Check the dimensions of the various shift/throttle mechanisms illustrated in Section 2.2.

- Nothing should extend below the bottom of the wheel for a distance of 27" forward of the SRP. This is to protect the operator's knees. From that point (see sketch) construct an imaginary line to the top of the footrest (as described in table III) or the intersection of the bulkhead and the deck. No boat structure should extend below that line for at least 1 foot on either side of the centerline of the seat. This concept is illustrated below.



2.2 SHIFT/THROTTLE (S/T) MECHANISM

The location of the S/T mechanism will depend on the configuration of the control station. This concept will consider two locations for the S/T mechanism:

- **ON A COAMING BESIDE THE SEAT**

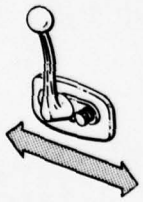
  Most runabouts, bowriders, and bassboats are designed for a coaming mounted S/T lever. Since most installations are now the single lever configuration. The criteria listed below will be for that type.

- **ON THE CONTROL PANEL**

  Many flying bridges are designed so the control station is not adjacent to a coaming. Most builders put the S/T mechanism on the control panel beside the wheel. Turn to page **21.**

Criteria for the location of the S/T handle include:
(Note specific dimensional criteria shown on next page).

- **FORE/AFT PLACEMENT**

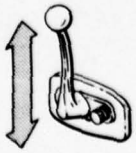


  - If it's too far forward it'll be outside of the reach distance for small people.
  - If it's too far aft the handle will interfere with the backrest in reverse, and one's arm will be bent into an awkward position.

- **IN/OUT PLACEMENT**

  - Too close and the handle hits the operator's arm when he's steering.
  - Too far away and small people will have trouble reaching it.

- **UP/DOWN PLACEMENT**

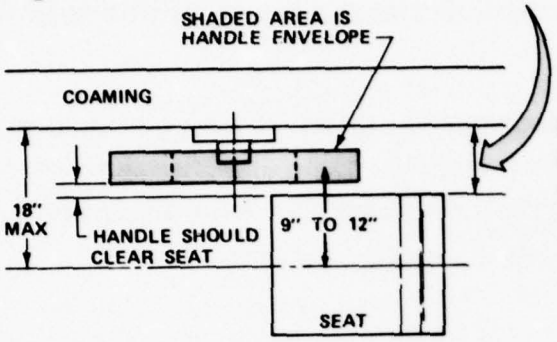


  - Too high and it's awkward.
  - Too low and we have another reach problem.

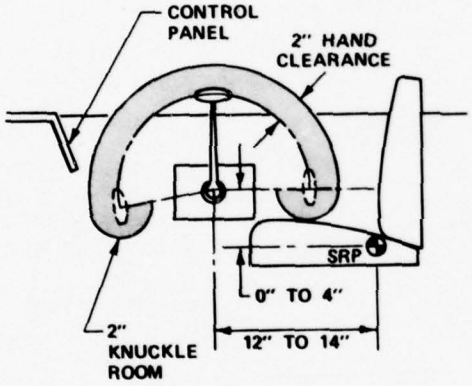
It is up to you to correctly locate the mounting surface for the S/T mechanism so the S/T handle will travel within recommended limits.

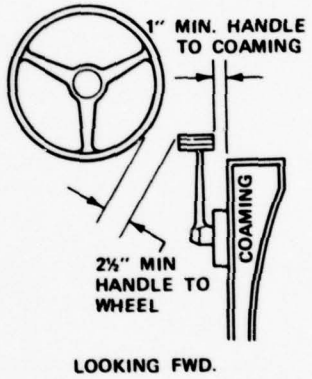
BASIC DIMENSIONAL CRITERIA -SHIFT/THROTTLE MECH.

You should provide 4" minimum from edge of seat to supporting pad for outboard S/T mechanism. 4" gap should extend to backrest to provide elbow room when shifting into reverse.



NOTE: 5" minimum if your boat will use the S/T mechanism described on Page 17.





2.2.1 OUTBOARD BOATS

Your dealer or the customer will be mounting the S/T mechanism when the engine is installed. You have to provide the space. It is to your advantage to somehow indicate the proper S/T mechanism placement on the coaming so that the dealer/customer will know where to mount it.

How? Here are some suggestions:

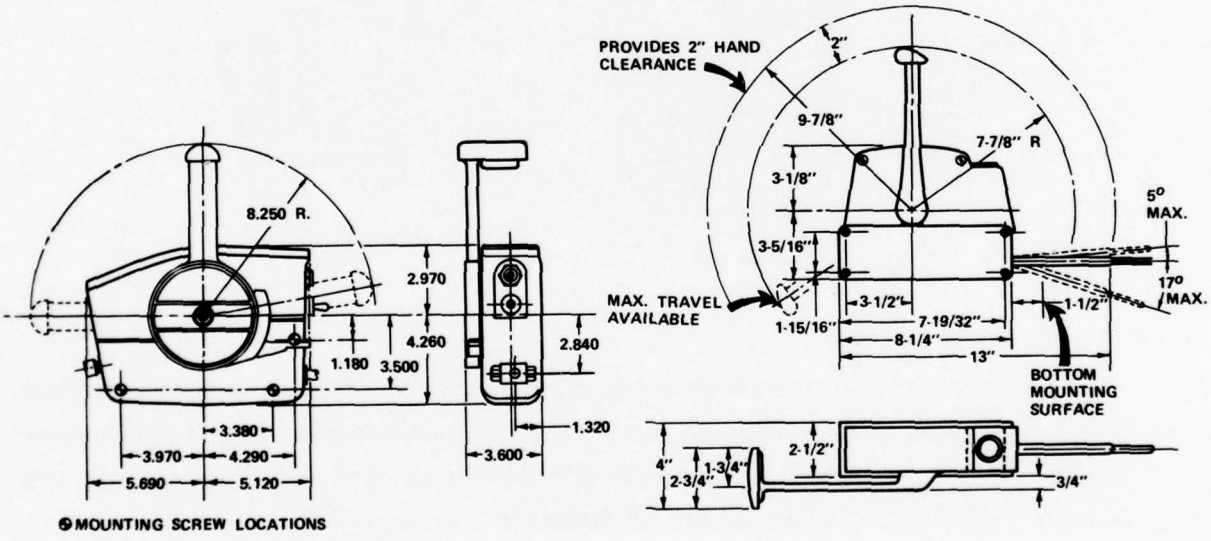
- Mold a boss into the coaming.
- If a separate mounting pad is used, limit its size to force the proper mounting location.
- Design a break or relief into the coaming upholstery at the right place.
- Provide written instructions in your dealer manual.
- Place a decal or tag at the right place.

Most S/T handles are about 8" long and travel thru an arc of 180° to 210°. You should provide clearance for the handle plus 2" hand clearance.

Two brands of outboard shift/throttle mechanisms are shown below. Your mounting pad should be located so that the handles of these mechanisms are within the specified limits.

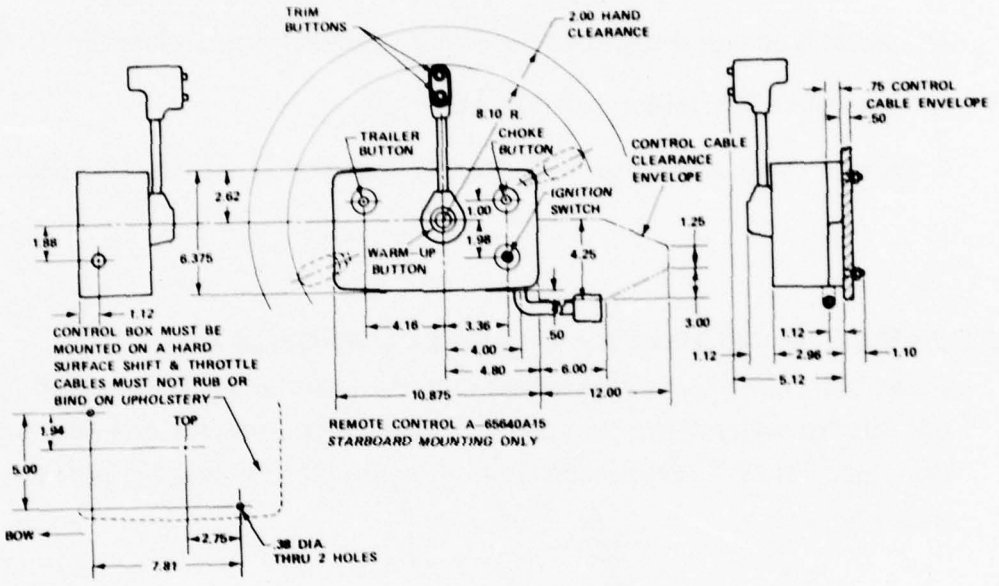
Also make sure that the start key and choke switch can be seen and readily reached.

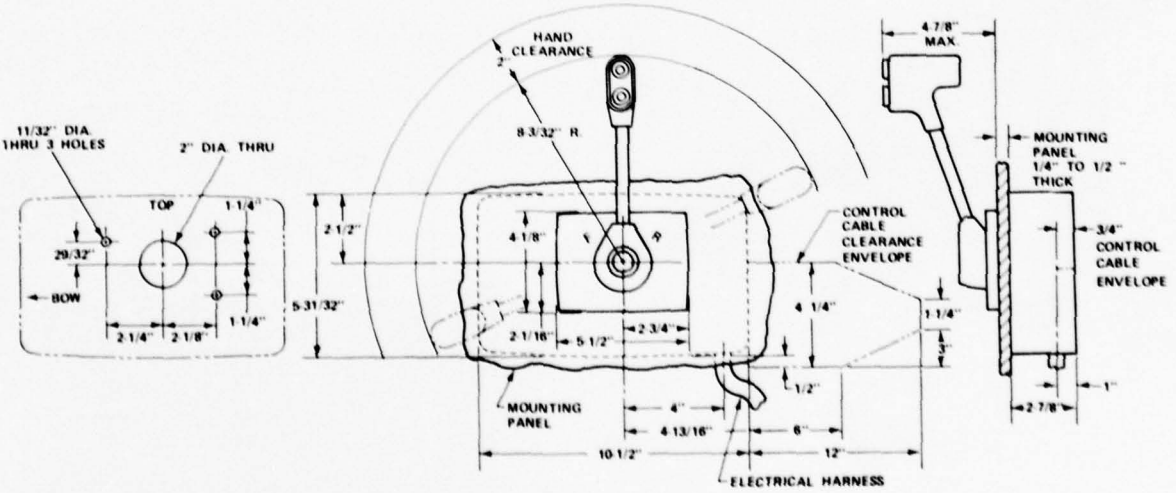
If you have one of these mechanisms, install it on your boat and confirm compliance with the specified dimensions. If you don't have access to one of the S/T mechanisms you should build a mockup to check the dimensions. Also check for an unobstructed cable run to the motor well area.



NOTE: When these two S/T mechanisms are secured to your mounting pad, their handles should fall within the "Basic Dimensional Criteria" established on the previous page.

The Mercury Deluxe Mercontrol is shown below because of its size, the large handgrip, and the ignition switch location on the coaming mounted version. You should have at least 5 inches between the seat and mounting surface. Note that the handle protrudes 5⅛" from the coaming. If the handle swings into the wheel area, the edge of the wheel should be 5⅛" + 2½" = 7⅝" away from the coaming.





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2.2.2 S/T CONTROLS - INBOARD BOATS & OUTBOARD BOATS WITH DECK MOUNTED S/T MECHANISMS

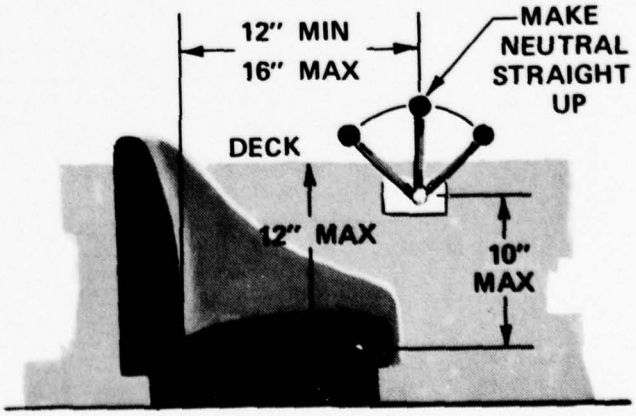
The same dimensional criteria for the S/T handle applies for inboard boats but the location of your mounting surface may change slightly depending on the S/T mechanism that you have chosen.

You should:

1. Obtain the S/T mechanism you plan to use in production.
2. Locate it beside the seat so the handle travels within the recommended limits.
3. Make sure the cables can run freely aft.
4. Design the coaming to hold the S/T mechanism in that position.

2.2.3 SKIBOATS, JETBOATS, & OTHER LOW PROFILE BOATS

Some of the above criteria are based on the "normal" runabout configuration. The operator of many of the "low profile" boats drives with his arm on the deck beside the seat. The S/T handle should be positioned to be usable with the arm in this position.



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2.2.4 S/T CONTROLS - CONTROL PANEL MOUNTED

Some runabouts are designed so the control station is not adjacent to a coaming, so a coaming mounted S/T mechanism would be out of reach of the operator. In this case, the most logical mounting location is the control panel adjacent to the wheel. Care must be taken to avoid the one major problem associated with panel mounted S/T handles:

REACH DISTANCE

Many boats are designed in such a way that the seated operator cannot reach the S/T handles without standing or sliding well forward in his seat. To avoid the problem, make sure the distance from the SRP to the S/T handle in its full forward position is never more than 30".

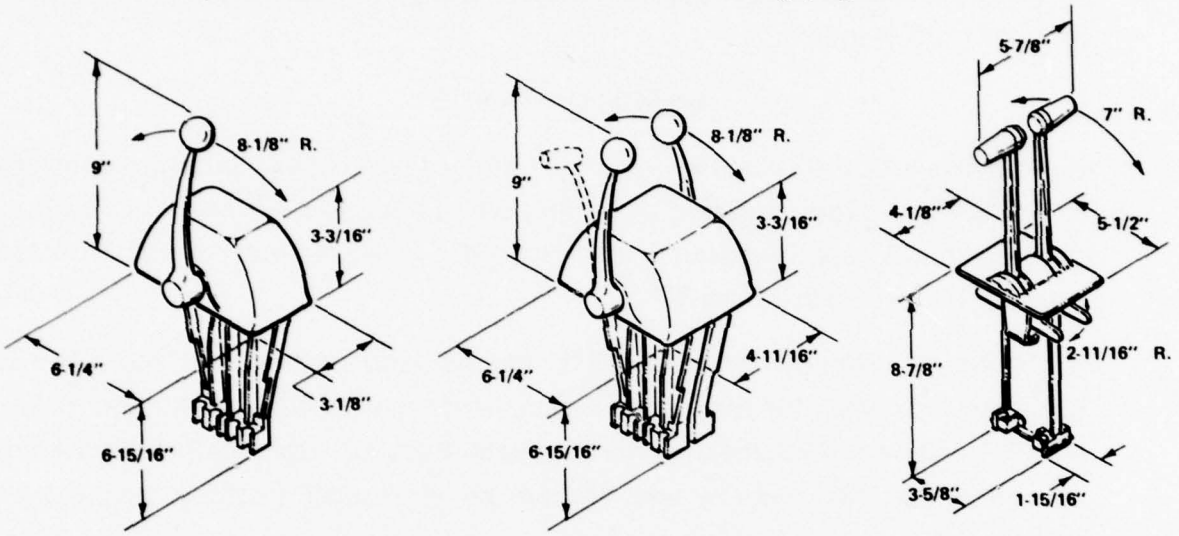
Traditionally, console mounted S/T mechanisms have been mounted on horizontal surfaces, forward of the wheel, which almost dictates that the forward handle position to SRP distance will be greater than 30". The criteria for horizontal mounting was that neutral was vertical so shift lever position was easy to distinguish.

Many builders are now placing S/T mechanisms on the angled control panel adjacent to the wheel with no problems resulting from shift lever position confusion. Points to remember are:

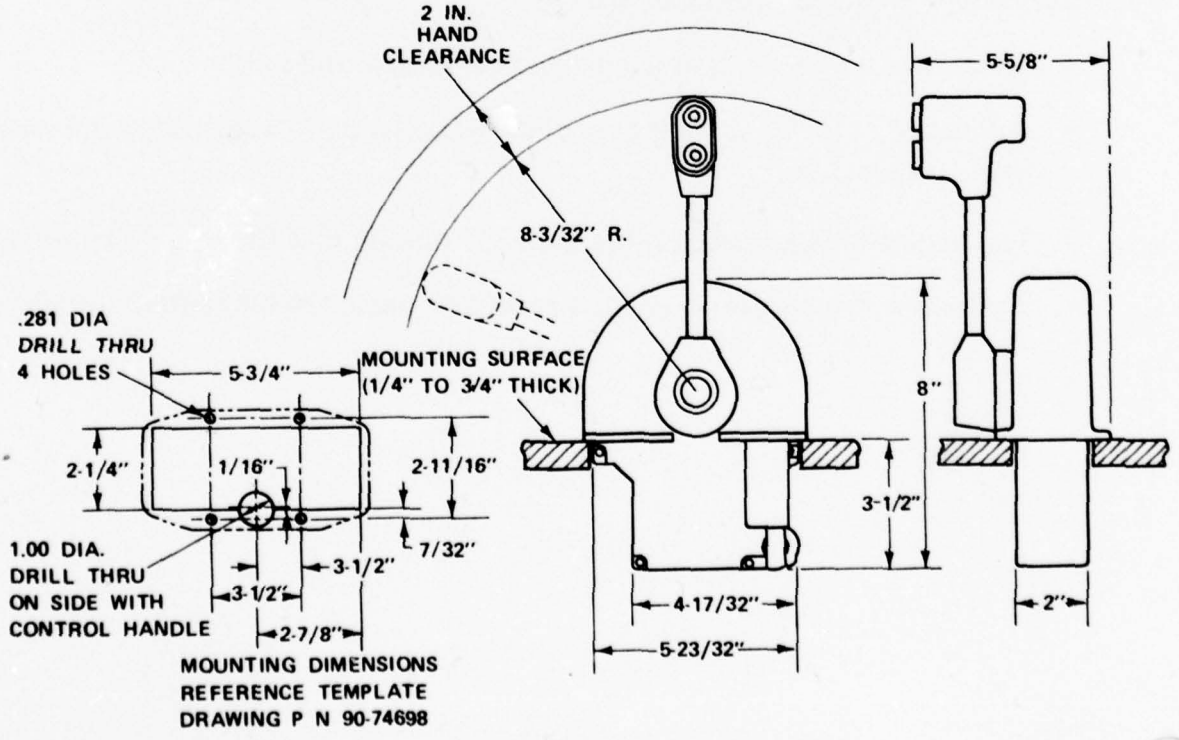
- Make sure the lever-to-wheel distance is greater than 2½".
- A distance of 10" to 12" outboard of the wheel centerline seems to work well in many installations.
- The handle should not be more than 15" outboard of the wheel centerline.
- If only one mechanism is used, it should be placed to the right of the wheel.

2.2.5 TYPICAL DIMENSIONS - S/T MECHANISMS

Several S/T mechanisms are shown below. Their dimensions are typical of the majority of the devices currently manufactured. If your boat is designed to accept such a device, make sure that the ones shown below fit into your panel and comply with the placement criteria shown on the following pages.



The Mercury deck mounted S/T mechanism for their Model 1750 engine is shown below because of the large handgrip. If your boat is capable of using that engine, make sure you have room for their controller.



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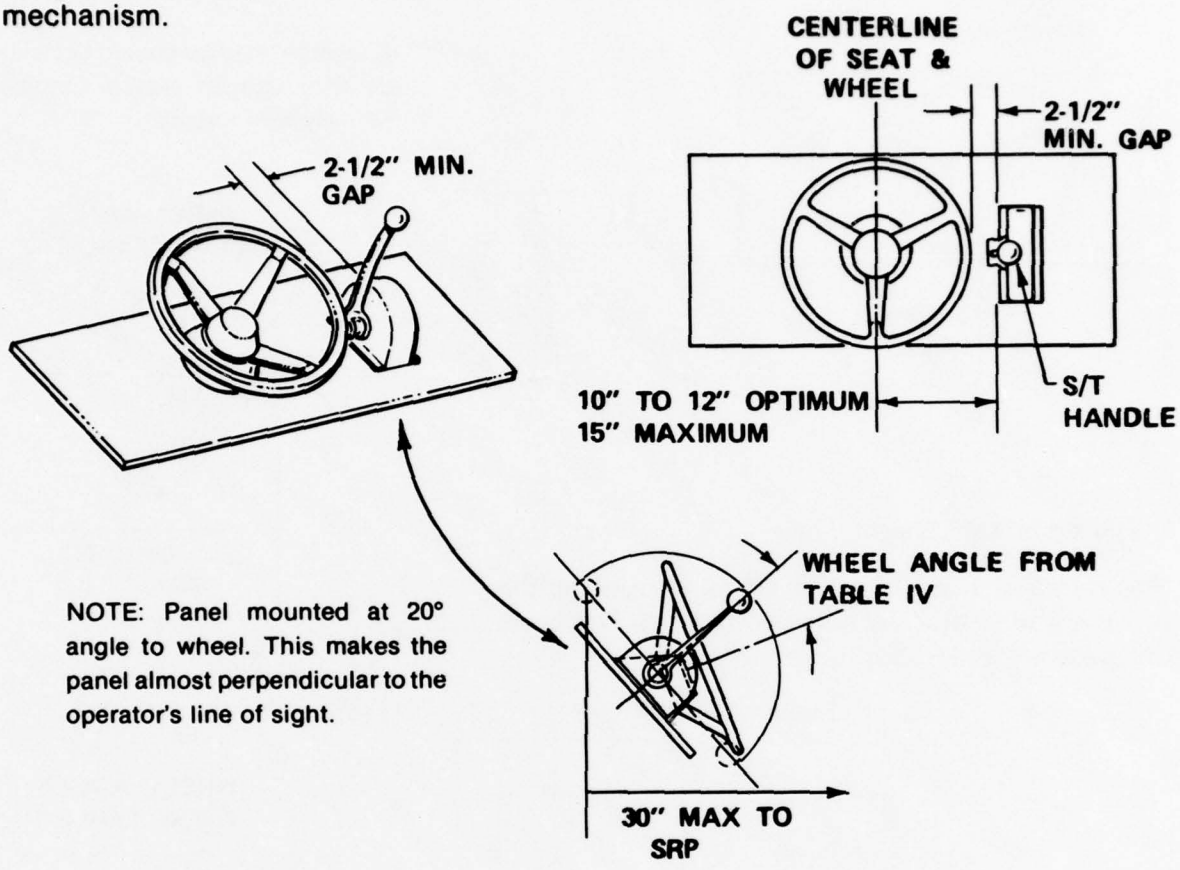
SINGLE ENGINE - Single Lever

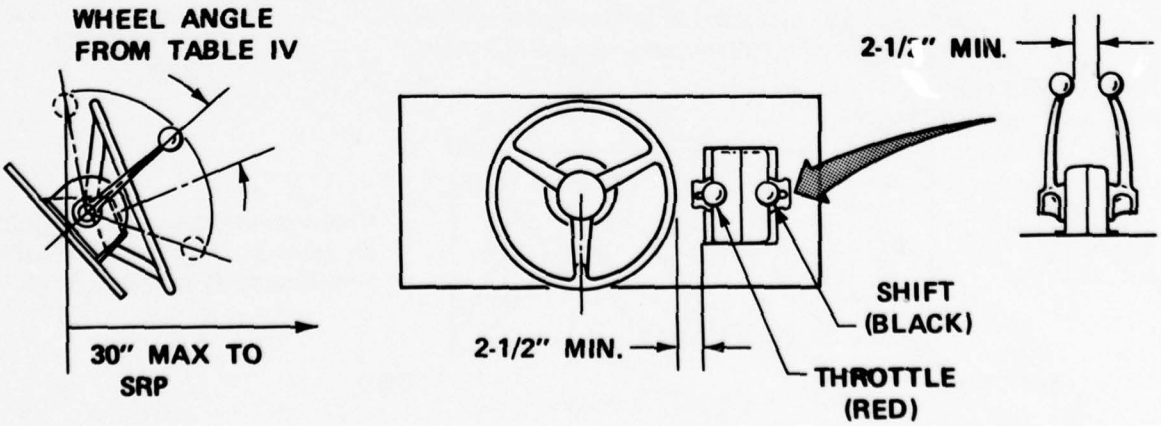
Single lever operates throttle and shift mechanism.



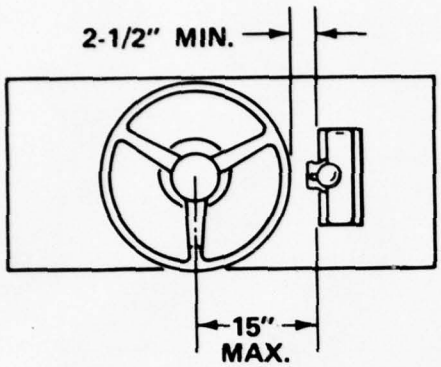
NOTE: Panel mounted at 20° angle to wheel. This makes the panel almost perpendicular to the operator's line of sight.

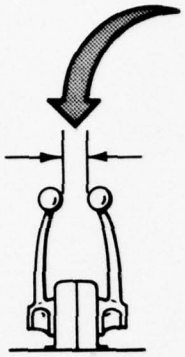
SINGLE ENGINE - Two Levers

The handle closest to the wheel should be the throttle and should be color coded red. The knob on the shift lever should be black.

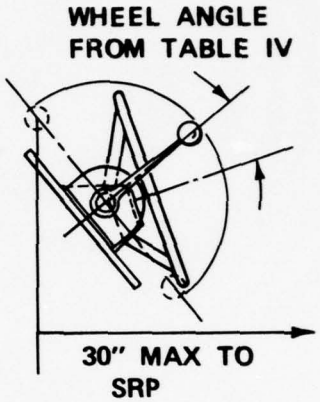


TWIN ENGINE - Single lever for each engine.



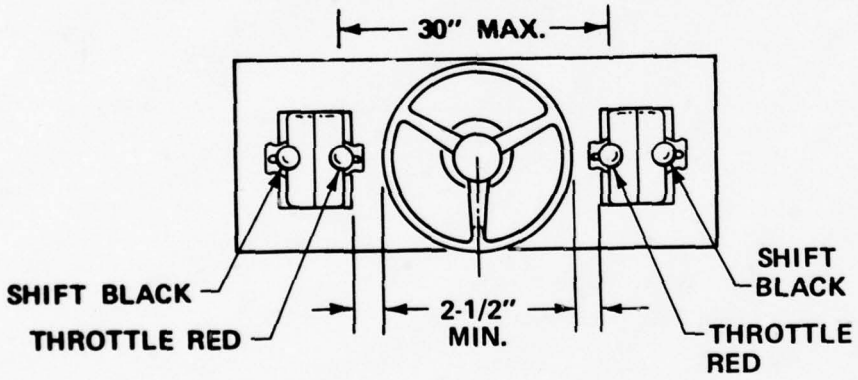


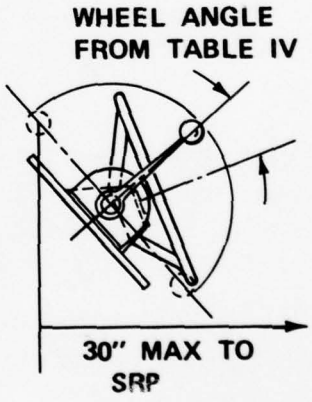
Knobs on handles should be close so they can be moved simultaneously with one hand.



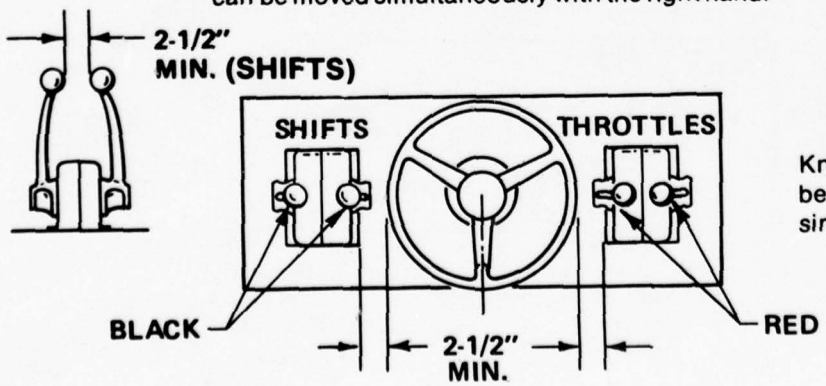
TWIN ENGINE - Two Levers

The handles closest to the wheel should be the throttle and should be color coded red. The knob on the shift lever should be black.





Some people prefer the throttles together so they can be moved simultaneously with the right hand.



Knobs on throttle handles should be close so they can be moved simultaneously with one hand.

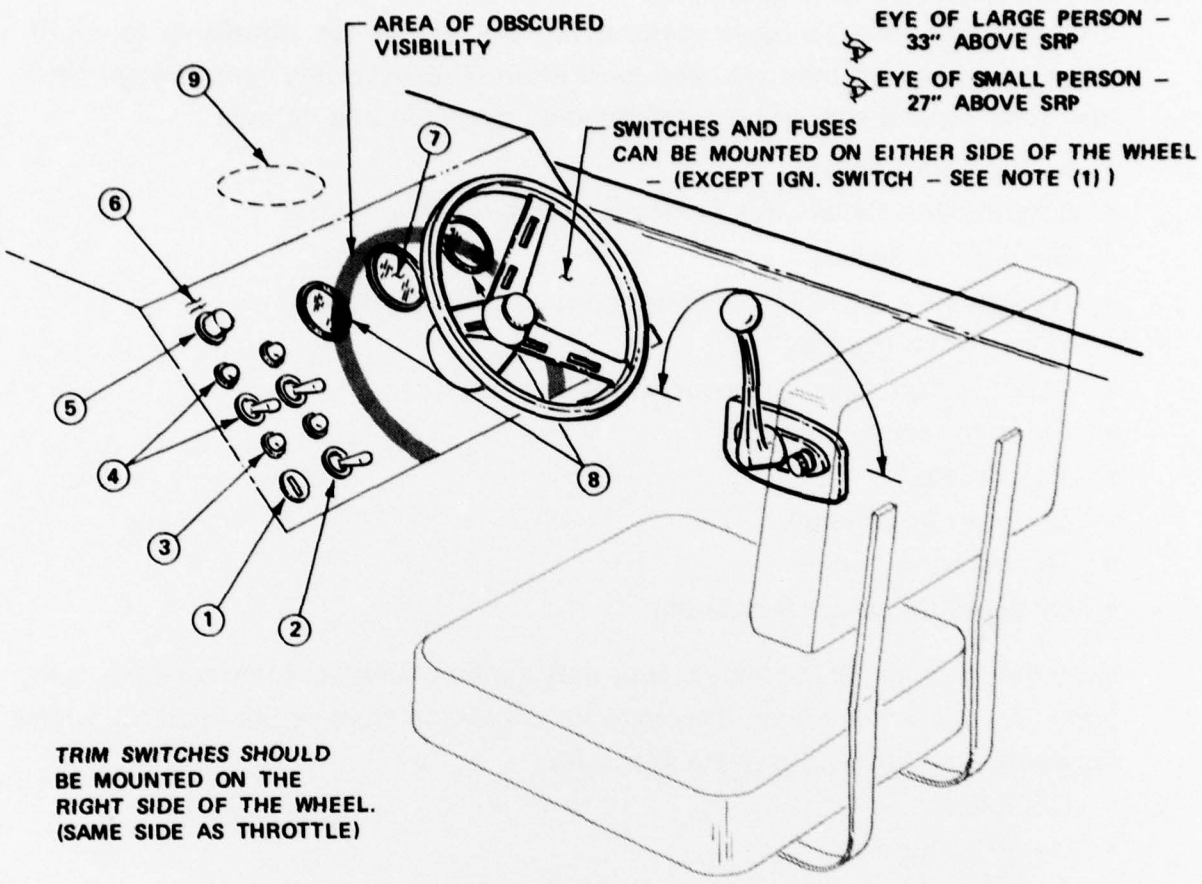
2.3 OTHER CONTROLS & DISPLAYS

The wheel and shift/throttle controls should receive top priority in terms of placement because they are used most often. The rest of the items that go onto the control panel should be considered as a system and include:

- Ignition/start switch
- Bilge blower switch and associated warning statement
- Bilge pump switch
- Navigation light switch (separate switch for panel lights)
- Horn switch (button)
- Wiper and/or other accessory switches
- Fuses for above circuits
- Tachometer
- Ammeter or voltmeter
- Temperature gauge
- Oil pressure gauge (inboards)

Even though some of the above items may not be offered as standard equipment, you should leave space on the panel for dealer installations. In addition, where applicable, you should provide space for:

- Compass
- Depth sounder
- Speedometer
- Communication equipment



(1.) Mount ignition switch on opposite side of wheel from throttle. This lets you operate starter and manipulate throttle simultaneously.

(2.) Blower switch & label should be positioned close to ignition switch. (The operator can't help seeing the switch & label as he inserts the key into the ignition switch).

(3.) Panel mounted fuses are economical, easy to wire, and facilitate easy troubleshooting by the owner.

(4.) Auxiliary switches and fuses.

(5.) Horn switch should look different & be placed in a prominent location.

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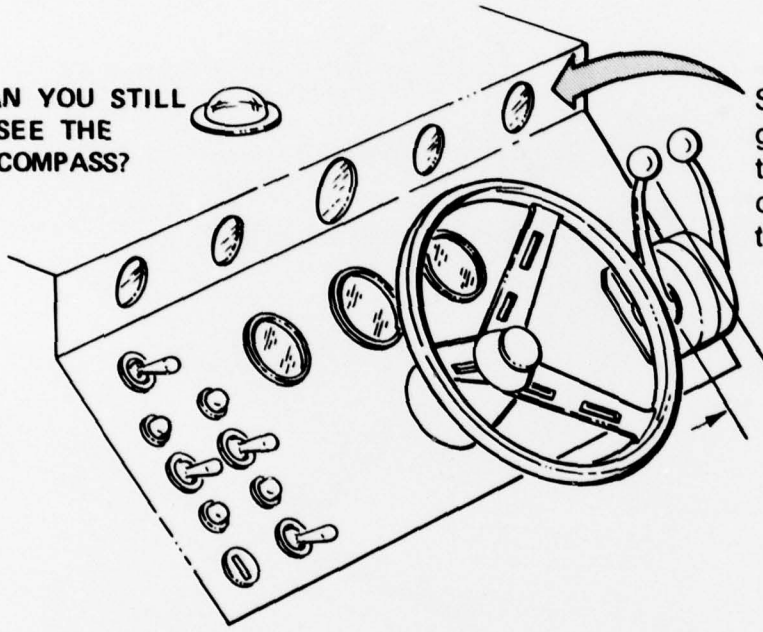
NOTE: 6, 7, 8, & 9 are not necessarily safety oriented but are included because they are good human engineering practices.

(6.) **Label All Switches,** above the switch.

(7.) *Tachometer is the most frequently used display. Make sure the wheel rim doesn't hide it from view.*

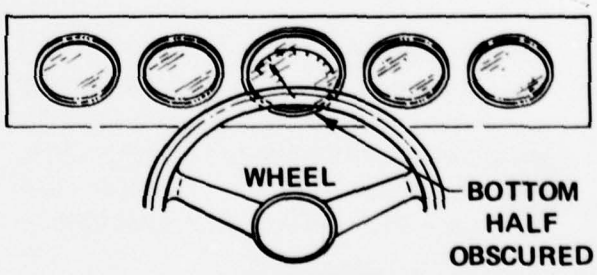
(8.) Try to place other gauges, especially temperature and pressure gauges, where the wheel rim won't obscure them from view.

(9.) Leave space for compass directly in front of center line of wheel and seat.



Some builders prefer to mount gauges so they are visible over the wheel. Check your visibility over the panel! Can you still see the bow?!

Since the bottom of many new tachometers contains no important information you can hide that portion behind the wheel. Sight forward from a position 27" above the SRP. The tachometer can be lowered until you can see the top half of the gauge. (Assuming a 90° meter movement, not applicable for 270° meter movement).



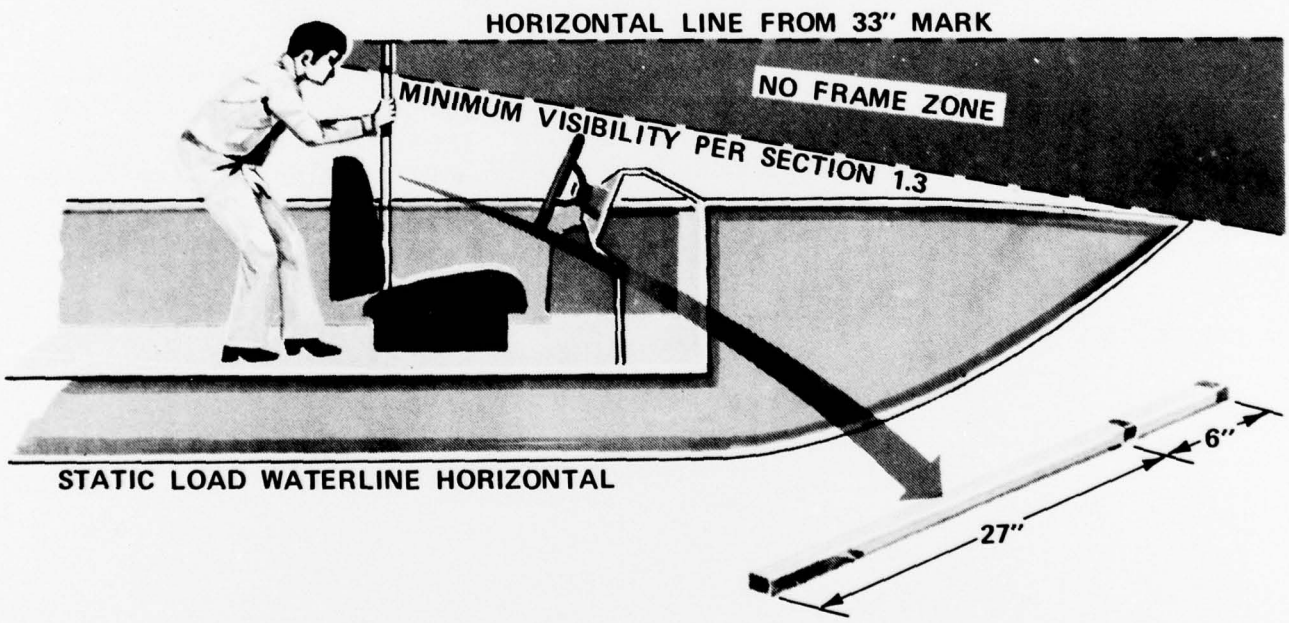
VIEW FROM 27" ABOVE SRP

3.0 WINDSHIELDS & TOPS

Important criteria for windshield placement are:

- Windshield height.
- Horizontal distance from top of windshield to SRP.
- Windshield wiper and wiper motor placement.

The top frame of low, decorative windshields should not interfere with visibility of the water by the small operator. Neither should the top frame of a "regular" windshield interfere with visibility of the horizon by the tall operator. A "no frame" zone can be constructed ahead of the operator. Make sure the top of your windshield is not in this area.



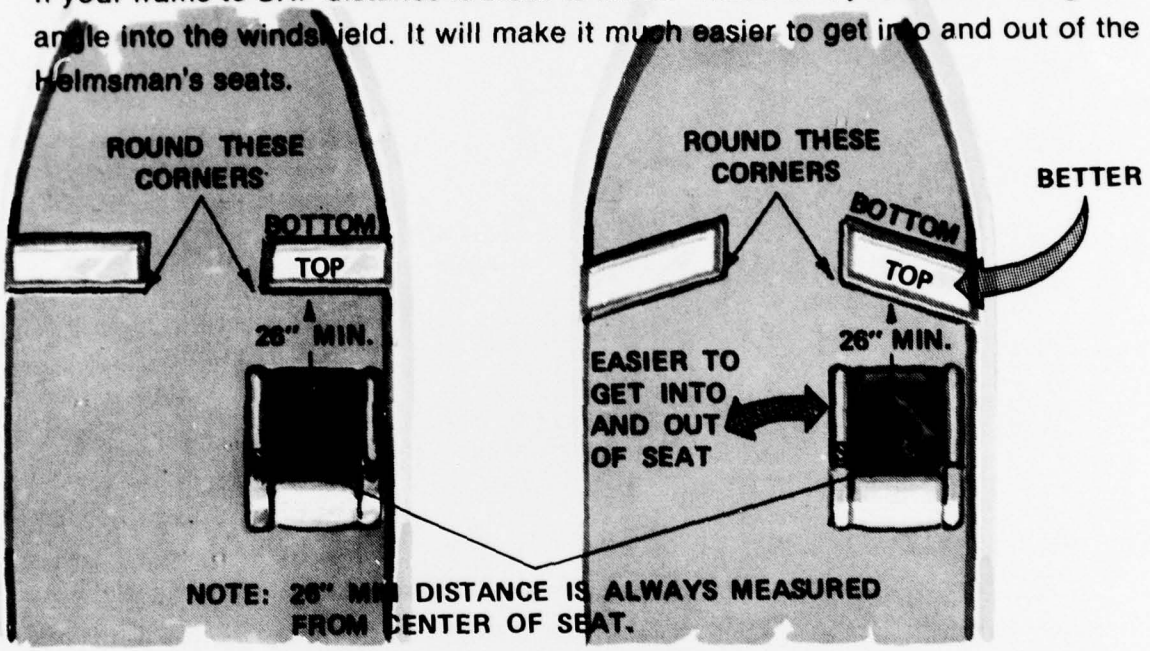
TINTED GLASS

You shouldn't use it in forward facing windows. Tinted glass used in side windows should have greater than 70% transmittance factors. These are generally the lightest tints available.

If the frame along the top of the windshield is too close to the seat, people will tend to hit their heads on it while attempting to get into or out of the seat. In addition, they will tend to grab the top frame and use it to assist them in getting up, out of the seat. Many frames aren't strong enough to support that kind of load.

Make sure that the top frame of your windshield is at least 26 inches forward of the SRP measured horizontally along the seat/wheel centerline.

If your frame to SRP distance is close to the 26" minimum, you should design an angle into the windshield. It will make it much easier to get into and out of the helmsman's seats.

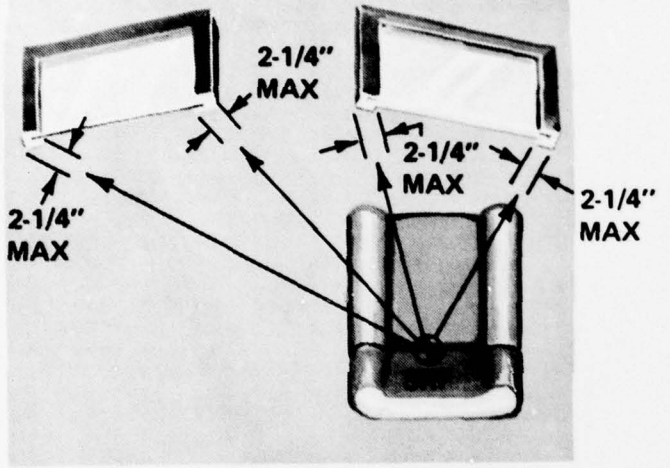


3.1 WINDSHIELD FRAMES - BOWRIDERS

Unfortunantely, many windshield manufacturers will deliver your windshields with sharp corners on the aluminum frames. Those corners that are exposed when the walk-through portion of the windshield is opened should be rounded to reduce the possibility of injury. If your supplier won't do it, you should.

3.2 WINDSHIELD FRAME THICKNESS

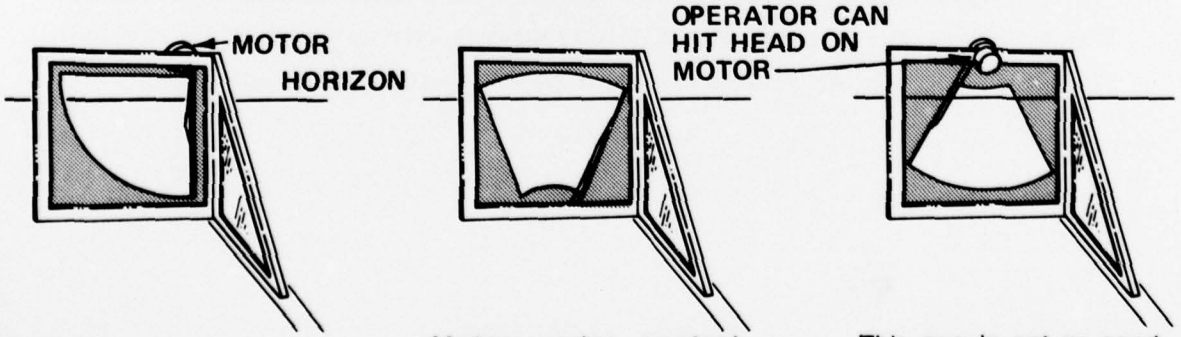
Windshield frames, posts, and any other visual obstructions forward of the SRP should be no wider than 2¼ inches as viewed from the Helmsman's eye position. This means that some rectangular posts will have to be measured diagonally depending on their location.



NOTE: These criteria do not apply to horizontal frames. (or almost horizontal).

3.3 WINDSHIELD WIPERS

If you are going to install a windshield wiper, make sure that the area that you will look through is the area that is wiped the best. For instance, the horizon will appear in the top third of the windshield to most operators of most runabouts. In that case the widest wiped area should be the top third of the windshield. Suggested approaches appear below.



Motor under control console (Look out for compass deviation problems)

This one is not as good. Note widest wiped area is below horizon.

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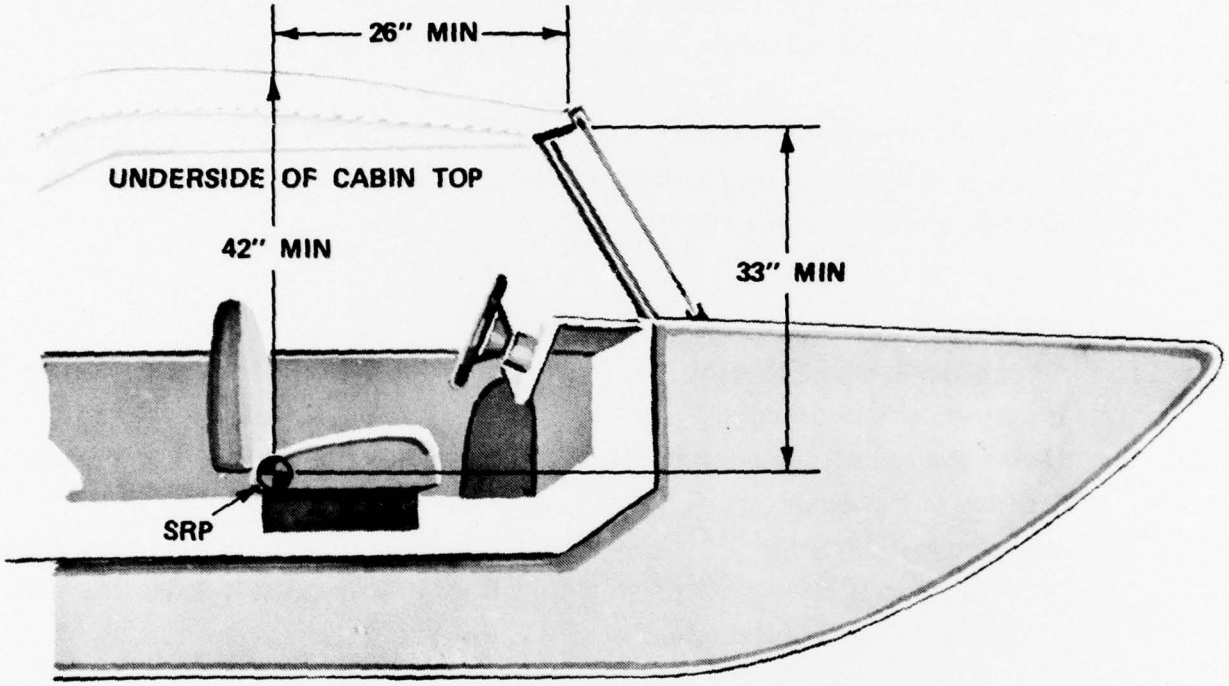
3.4 THE TOP

We have recommended a "no frame" zone. We can also recommend a "no top" zone. Basically the underside of the top should clear the SRP by 42 inches.



3.5 360° VISIBILITY

Soft tops are usually radiused at the sides and have a flap on the back to which the cockpit cover is attached. The lowest extremity of the sides and aft portion should not extend below a point 33 inches above the SRP. Usually the aft corners of a soft top will extend down to and attach to the coaming and will create "blind spots." Make sure the "blind spots" are aft of the SRP and are of minimum width consistent with the strength of the material.

Side curtains will reduce visibility somewhat because the clear plastic must be edged with opaque material onto which are mounted the zippers, snaps, etc. Make the width of the opaque material as narrow as possible consistent with the strength of the material. The top edge and forward edge are critical. Make sure the clear portion of the side curtain extends above a point 33" above the SRP, and the width of the windshield frame plus the opaque area of the side curtain is as close to the 2¼" maximum width as possible.

3.6 GLARE PRODUCING SURFACES

Glare producing surfaces forward of the Helmsman can reduce forward visibility. In order to reduce the amount of glare that the operator must contend with you should:

- Specify brushed metal surfaces on rails, cleats, horns, etc., when possible.
- Try to avoid placing bright metal accessories (horns) directly in front of the operator.
- Use a tinted color for decks.
- Consider a textured surface for the foredeck on runabouts. It will reduce glare and will provide safer footing.

3.7 GLARE FROM LIGHTS

- Check to make sure that the instrument lights don't reflect into the windshield. If they do shield them.
- Install the red and green navigation lights so they don't shine onto the deck forward of the operator.
- Try to install the white 360° light so that it doesn't reflect onto the windshield. By mounting it on a pole or shielding it so that it doesn't strike the boat structure forward of the operator.

SUMMARY - SECTION 2

1. Place the wheel in relation to the seat SRP.
   - Table IV gives the dimensions to follow.
   - Make sure the wheel centerline and seat centerline coincide (± 2").
   - Assure sufficient knee clearance
   - Provide 2½" clearance around wheel.

2. Position the control levers or the mounting pad for them.
   - The drawings in Section 2.2 show the dimensions.
   - Take your dimensions from the sketch that most closely approximates your boat.

3. Position all other controls and displays as described in Section 2.3.

SUMMARY - SECTION 3

1. Design and/or position your windshield to conform to:
   - Windshield height criteria
   - Distance from SRP criteria
   - Wiper blade and motor placement criteria
   - Frame thickness criteria

2. If a canvas top is to be fitted make sure there is:
   - 42" between SRP & top
   - 360° visibility (except where aft corners of a soft top extend down to the deck)

(35)
36X

APPENDIX

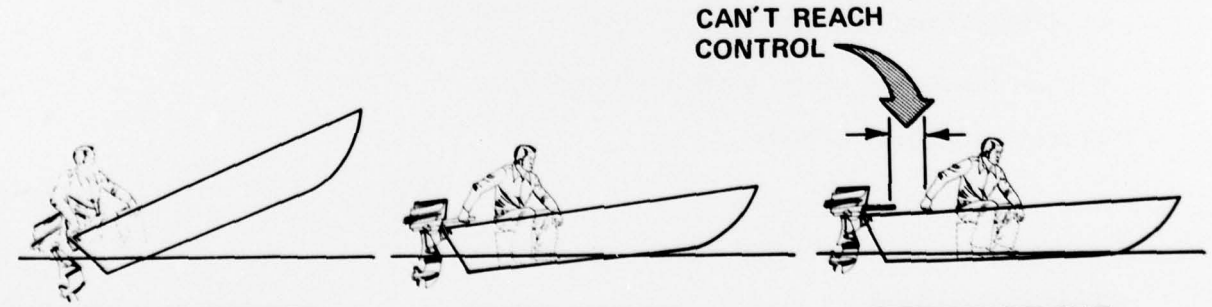
CONTROL STATION DESIGN CONCEPTS FOR AFT PORTION OF SMALL OUTBOARD BOATS CONTROLLED FROM THE ENGINE

OBJECTIVE: This portion of the Control Station Design Concepts have been developed to assist boat builders and designers in designing the seating in the aft portion of small outboard boats so that the user will have optimum access to the steering and throttle handle on the outboard motor.

SCOPE: This portion of the concepts covers small outboard boats that **do not** have remote steering capabilities and deals only with the spatial relationships of the seat to the transom. Visibility recommendations are identical to those in Section 1 of this concept.

BACKGROUND: The operator of small open boats must reach aft and grasp the engine's control handle in order to steer and control the engine RPM. The position of the aft seat determines the reach distance to the handle. This distance is not critical but certain outer limits can be set.

Criteria for seat placement in small lightweight boats is sometimes based on boat balance. The balance criteria should be considered first as long as the seat to transom distance doesn't exceed the maximum specified. See Below.



WEIGHT TOO FAR AFT | REACH DIST OK | OPTIMUM WEIGHT DISTRIBUTION

37

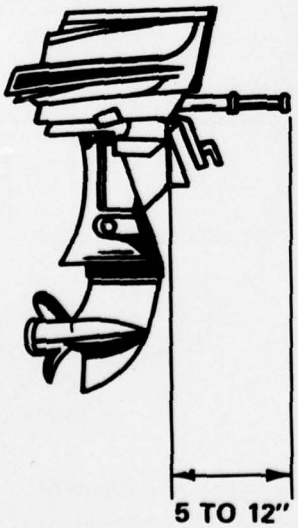
OUTBOARD MOTOR CONTROL HANDLES

HOW FAR AFT DOES THE OPERATOR HAVE TO REACH?

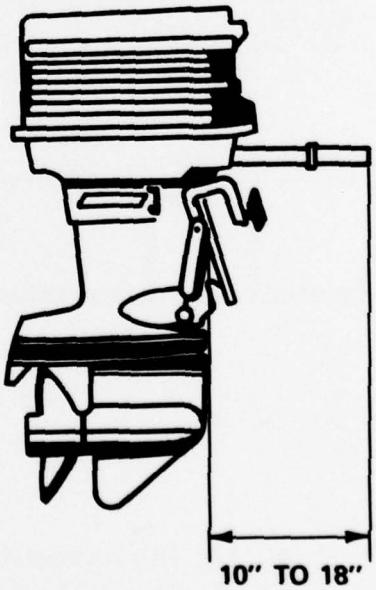
Hand grips on outboard motors are on shafts that generally extend forward from the left portion of the engine just above the transom. The horizontal distance from the outside top edge of the transom to the inboard extremity of the control handle ranges from 5 inches to 18 inches and is generally related to horsepower. Generally engines less than 3 horsepower are equipped with handles that extend from 5 to 12 inches forward of the transom. Engines from 3 to 25 horsepower are equipped with handles that extend from 10 to 18 inches forward of the transom.

NOTE: Measurements were made with engines facing forward. The transom to inboard end of the control handle distance will vary based on the angle that the engine is turned.

UP TO 3 HP



3 TO 25 HP



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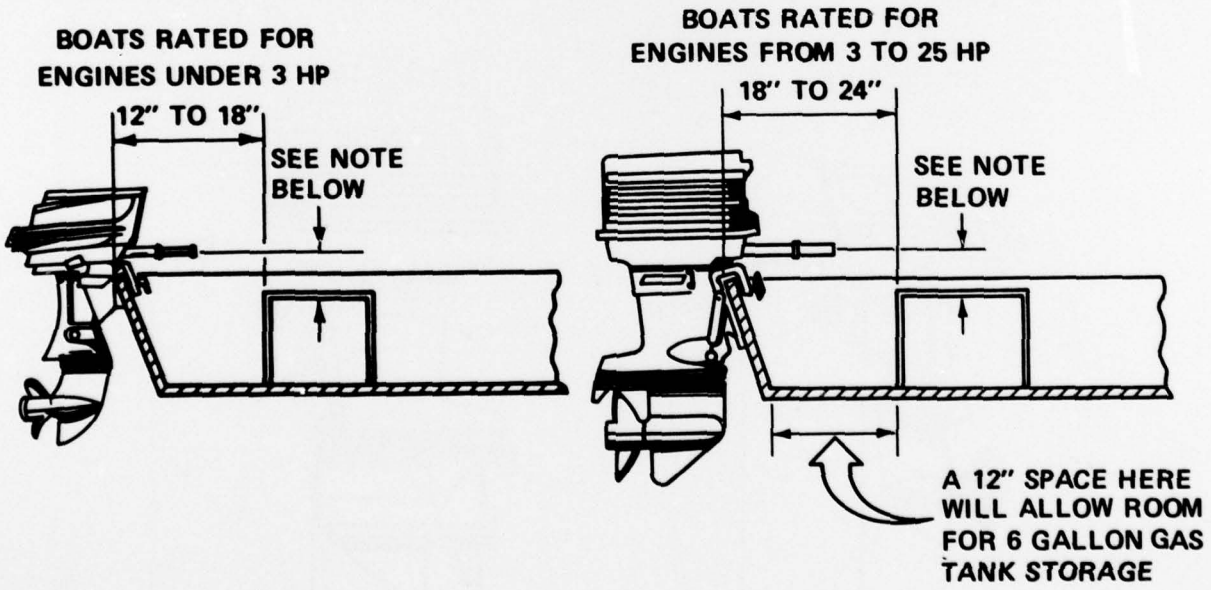
BOATS DESIGNED WITH THWART SEATS AFT

Proper balance in small lightweight boats is greatly affected by operator placement. The fact that his weight must be centered necessitates the use of a thwart seat some distance ahead of the transom. In this case the operator sits on the approximate boat centerline and reaches behind him to manipulate the control handle. Fore-aft seat placement then is a function of how far aft the operator can reach while controlling the engine.

REACH DISTANCE...

The horizontal distance from the operator's buttocks to the forward edge of the control handle should be within a range of 4 to 8 inches.

When we translate these numbers into transom to seat distances we get the following distances:



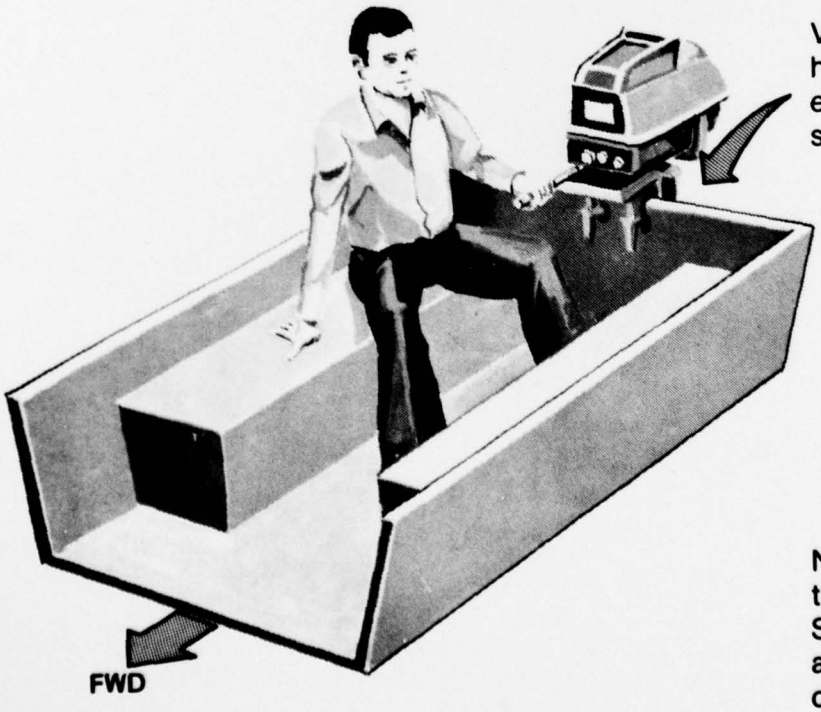
NOTE: The vertical distance from the seat to the control handle should be no greater than 8 inches. The optimum range is between 3 and 5 inches. If a seat or chair will be mounted onto the top of the thwart the above dimensions should be calculated from that seat.

OTHER TYPES OF SEATING

As mentioned previously small, lightweight boats are very sensitive to the placement of the operator's weight. Therefore, thwart seats are installed forward of the transom which allow the operator to center his weight within the boat. The thwart seat has some disadvantages, such as:

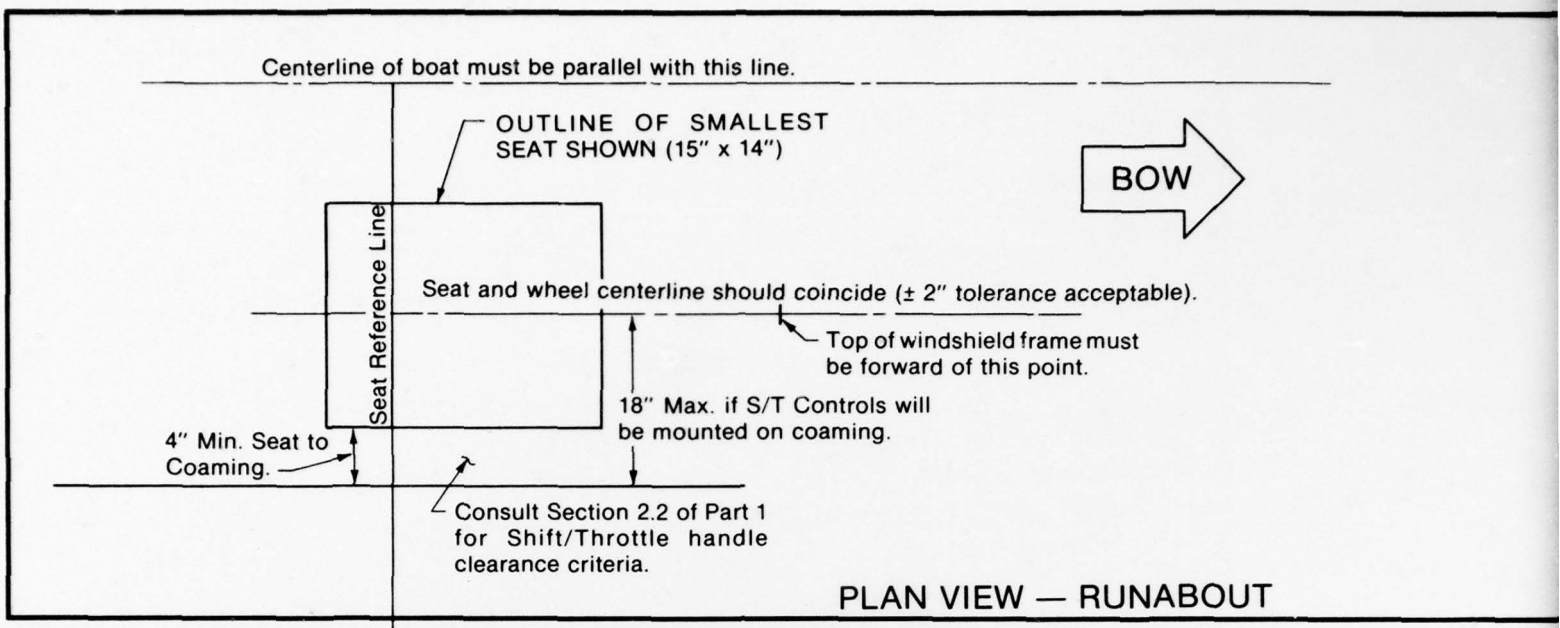
- Motor directly behind operator resulting in:
  - Awkward Steering Posture
  - Difficulty Reaching Shift Lever
  - Awkward Posture to Start Engine
  - Difficulty Reading and Locating Labels and Controls

Longitudinal seats on both sides of the aft portion of the boat offer solutions to those problems noted above but place the weight of the operator off center. Some of the imbalance problem can be solved by judicious placement of fuel tank, battery, anchor and other weighty items. If your boat is not among the very lightweight category, you should consider this alternative.

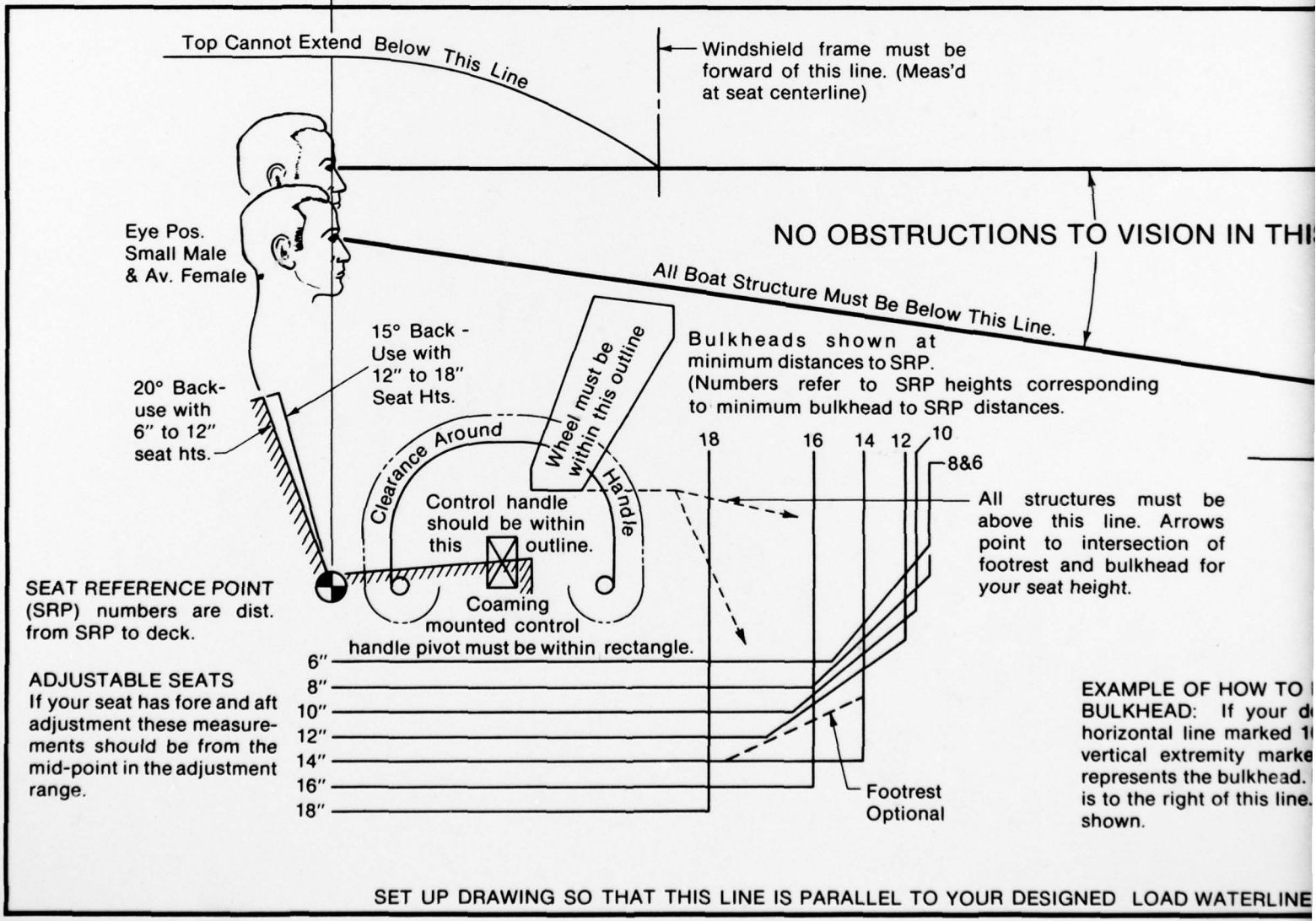


Vertical distance from handle to seat is not critical except that the handle should be above the seat.

NOTE: Good Steering posture - East Shifting - Easy Starting - Good visual access to all labels and controls.



PLAN VIEW — RUNABOUT



SEAT REFERENCE POINT (SRP) numbers are dist. from SRP to deck.

ADJUSTABLE SEATS
If your seat has fore and aft adjustment these measurements should be from the mid-point in the adjustment range.

EXAMPLE OF HOW TO
BULKHEAD: If your d
horizontal line marked 1
vertical extremity marke
represents the bulkhead.
is to the right of this line.
shown.

SET UP DRAWING SO THAT THIS LINE IS PARALLEL TO YOUR DESIGNED LOAD WATERLINE

PART 2

CONTROL STATION DESIGN CONCEPT

FOR

BASSBOATS, BOWRIDERS, RUNABOUTS, SKIBOATS, AND ALL CONTROL STATIONS DESIGNED FOR SITDOWN OPERATION ONLY.

EXCEPTION: DON'T USE THIS CONCEPT ON CABIN CRUISERS

SCALE 1" = 1'0"

1. Position this sheet under your profile drawing so that the base line of this drawing is parallel to the static load waterline of your boat.
2. Position this drawing so that the seat is where you want it.
3. Check to assure that all boat structure is below the visibility line. If it isn't, slide this drawing up until it is. Then move your seat up.
4. Your floor should be close to one of the horizontal lines under the seat. Check to make sure the SRP to bulkhead distance is greater than the minimum shown for your particular seat height. See example below.
5. After the seat has been positioned with respect to the visibility line, the floor, and the bulkhead; locate the steering wheel, shift/throttle controls and windshield within the limits shown.
6. Consult the text (Part 1) for details of:

Seat Heights vs. Angled Footrests	Section 1
Steering Wheel Dimensions and Angles	2
Shift/Throttle Mechanism Alternatives	2
Instrument and Switch Placement	2
Windshield & Frame Details	3
Top & Side Curtain Details	3
Glare	3

TO VISION IN THIS AREA

sponding

tures must be
s line. Arrows
intersection of
nd bulkhead for
height.

Bow or highest portion of the boat structure forward of the control station.

EXAMPLE OF HOW TO POSITION THE DECK & BULKHEAD: If your deck line is close to the horizontal line marked 10", follow that line to its vertical extremity marked 10. That vertical line represents the bulkhead. Make sure your bulkhead is to the right of this line. Position the footrests as shown.

NED LOAD WATERLINE

2

4 1588. (41) 42 x all