Exhaust System

Section 6C - Measuring Exhaust Elbow Height

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Measuring Exhaust Elbow Height

General Information

The height of the exhaust elbows must be within the dimensions specified to prevent water intrusion problems. Install exhaust elbow risers, if needed, to obtain the proper exhaust elbow height and exhaust angle. Risers are limited to 203.2 mm (8 in.) on all 8.1 models with emissions control and without emissions control. Risers are limited to 152.4 mm (6 in.) on all 5.7 and 6.2 models without emissions control. Risers are limited to 203.2 mm (8 in.) on emissions controlled 5.7 L models. Take measurements with the boat in the water and loaded as outlined to simulate the maximum loading conditions likely to be encountered in normal operation.

IMPORTANT: Measure exhaust elbow height to the waterline inside of the water lift muffler (instead of the water line outside of the boat) on applications so equipped. Refer to Water Lift Muffler.

IMPORTANT: Load distribution recommendations are the responsibility of the boat manufacturer. Any load distribution conditions that will affect the exhaust system must be clearly communicated to the operator in the owner's manual. For example, the number of people that can be located on the swim platform simultaneously should be included in the manual, if this could pose a problem.

Measurements under all loading conditions must be within the following specifications.

<table>
<thead>
<tr>
<th>Minimum Exhaust Elbow Height</th>
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</thead>
<tbody>
<tr>
<td>Model</td>
</tr>
<tr>
<td>Inboard and V-drive Tow Sports models</td>
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<tr>
<td>Tow Sports inline models</td>
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</tbody>
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<table>
<thead>
<tr>
<th>Minimum Exhaust Hose Slope</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model</td>
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<tr>
<td>All models</td>
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<td></td>
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</tbody>
</table>

If the exhaust elbow height or exhaust angle is insufficient, modify the exhaust system or install the appropriate exhaust riser. Refer to the Mercury Precision Parts and Accessory Guide for part numbers.

The maximum exhaust riser height is specified in the table below.

<table>
<thead>
<tr>
<th>Riser Options without Emissions Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model</td>
</tr>
<tr>
<td>All 5.7 and 6.2 models</td>
</tr>
<tr>
<td>8.1 H.O. and Horizon 8.1</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Riser Options with Emissions Control</th>
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<tbody>
<tr>
<td>Model</td>
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<td>All models</td>
</tr>
</tbody>
</table>
EXHAUST ANGLE MEASUREMENT WITHOUT EMISSIONS CONTROL

Measure the exhaust angle of each section of the exhaust system using an inclinometer as shown in the diagram below. Begin the measurement at the exhaust elbow outlet continuing along each section to the exhaust exit point of the boat. Perform all exhaust angle measurements with the boat at rest in the water. Perform the first set of measurements without a load in the boat. Perform the second set of measurements with the boat fully loaded. See Loading Requirements.

IMPORTANT: Ensure that the exhaust hose or tube has a minimum of 3º of slope after the first 18 in.

Typical 8.1 exhaust

- a - Inclinometer
- b - Exhaust hose or tube
- c - Minimum 457 mm (18 in.)
EXHAUST ANGLE MEASUREMENT WITH EMISSIONS CONTROL

Measure the exhaust angle of each section of the exhaust system using an inclinometer as shown in the diagram below. Begin the measurement at the exhaust elbow outlet continuing along each section to the exhaust exit point of the boat. Perform all exhaust angle measurements with the boat at rest in the water. Perform the first set of measurements without a load in the boat. Perform the second set of measurements with the boat fully loaded. See Loading Requirements.

IMPORTANT: Ensure that the exhaust hose or tube has a minimum of 3° of slope.

Typical exhaust
a - Minimum 457 mm (18 in.)
b - Inclinometer
c - Exhaust hose or tube

Boat Requirements

IMPORTANT: Consider the following requirements before performing the exhaust elbow waterline height measurement. No prototype hulls or light layup hulls should be considered. Any measurement performed on non-production boats, prototype hulls, or light layup hulls could be inaccurate and could result in product damage.

- All boats that display a CE certification capacity plate must use the maximum capacity as stated on the CE certification capacity plate to perform the exhaust elbow waterline measurement.
- All boats that only display the US Coast Guard (USCG) capacity plate must use the maximum capacity as stated on the USCG capacity plate to perform the exhaust elbow waterline measurement.
- For boats that do not have a capacity plate, the maximum capacity load is the number of persons that can sit on designated seating plus cargo excluding cabin space.
- Measurements used for official Mercury MerCruiser audit at the OEM boat builder must be performed on current production boats. No prototype hulls or light layup hulls will be considered for official audit purposes.
- Measurements used for official Mercury MerCruiser audit at OEM boat builders must use the CE certification maximum load for any boat model that will be sold outside of the United States.
Loading Requirements

1. Fill the fuel tanks, fresh water tanks or holding tanks, ballast tanks, and heater tanks to simulate fully loaded condition.

2. Weights can be used to simulate these load conditions if desired. Place weights in the corresponding area for which the load is being replaced. Refer to the following conversions.
   - 1 U.S. gallon of water = 8.3 lb.
   - 1 liter of water = 1 kg
   - 1 U.S. gallon of gasoline = 6 lb.
   - 1 liter of gasoline = 0.72 kg

3. For the purpose of MerCruiser waterline height measurements:
   - One person is equivalent to 74.84 kg (165 lb.)
   - Cargo per person is equivalent to 11.34 kg (25 lb.)

4. Add weight for any additional boat options: extra battery, battery charger, tower, arch, generator, ballast tanks, ballast sacks, television, carpet, anchor, stereo/entertainment equipment, washer/dryer, safe, etc.

5. If a swim platform is an option, the swim platform must be installed for the waterline height measurement. Use the following guide to determine the correct swim platform load:
   a. Boats less than 8.84 m (29 ft.) long, not including boats that are 8.84 m (29 ft.) long, must add the maximum rated swim platform weight capacity to the swim platform.
   b. Boats less than 8.84 m (29 ft.) long, not including boats that are 8.84 m (29 ft.) long that do not have a maximum rated swim platform weight capacity, must add 181.45 Kg (400 lb.) to the swim platform.
   c. Boats 8.84 m (29 ft.) long and greater than 8.84 m (29 ft.) long, must add the maximum rated swim platform weight capacity to the swim platform.
   d. Boats 8.84 m (29 ft.) long and greater than 8.84 m (29 ft.) long, that do not have a maximum rated swim platform weight capacity must add 226.80 kg (500 lb.) to the swim platform.

Loading the Boat with a Capacity Plate

For boats with a capacity plate, use the maximum load for persons and gear as listed on the capacity plate to determine the number of persons to place onto the boat for exhaust elbow waterline height measurements.

**IMPORTANT:** Use 20 inches for average passenger seat width when measuring bench seating. Round up or down at 0.5 to obtain a whole person. See the examples listed below.

- 48 in. (bench seat length) ÷ 20 in. (seat width) = 2.4 persons. 2.4 persons rounded down = 2 persons.
- 55 in. (bench seat length) ÷ 20 in. (seat width) = 2.75 persons. 2.75 persons rounded up = 3 persons.

1. Take the maximum capacity weight as listed on the capacity plate (XXXX lb. Persons, Gear) and subtract the swim platform load, if applicable.

2. Next divide the weight by 74.84 kg (165 lb.) per person. This gives the whole number and remainder of 74.84 kg (165 lb.) persons to load onto the boat.
3. Put the remainder of a person in the next available seat. See Boat loading diagram.

IMPORTANT: If there is not enough seating for the number of people, treat the leftover weight as cargo. Load cargo weight onto the boat before loading passenger weight.

4. If applicable, load cargo (leftover persons weight) onto the boat. Distribute cargo as described below.

IMPORTANT: If the boat configuration does not allow for aft, center, and bow storage, choose the storage application from the Optional Cargo Distribution table that best applies to your boat configuration.

<table>
<thead>
<tr>
<th>Preferred Cargo Distribution</th>
</tr>
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<tbody>
<tr>
<td>Aft storage</td>
</tr>
<tr>
<td>25%</td>
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</tr>
<tr>
<td>50%</td>
</tr>
<tr>
<td>None</td>
</tr>
<tr>
<td>100%</td>
</tr>
<tr>
<td>None</td>
</tr>
</tbody>
</table>

5. Perform the first measurement with the swim platform loaded and the person taking the waterline measurement on the boat.

6. Load the swim platform if equipped.

7. Measure the exhaust elbow waterline height.

IMPORTANT: View all boat seating as rows that are parallel to the transom of the boat.

8. Load a person weight into a seat, and measure the exhaust elbow waterline height after each person weight is loaded onto the boat. Repeat until a person weight is is loaded into each seat in that row.

9. Continue the process moving forward toward the bow of the boat to the next row of seats until a person weight is loaded into each seat.

NOTE: The total weight loaded onto the boat must not exceed the maximum capacity displayed on the capacity plate.

NOTE: The following example is provided as a reference.

EXAMPLE

NOTE: This example uses a boat that is less than 8.84 m (29 ft.) long, not including a boat that is 8.84 m (29 ft.) long that does not have a maximum rated swim platform weight capacity, and must add 181.45 Kg (400 lb.) to the swim platform.
NOTE: Use 0.50 lb. as the break point to round up or down to obtain a whole pound.

1. Maximum load (persons and gear) from capacity plate – swim platform load = remaining weight to be placed in the boat.
   • 1100 lb. – 400 lb. = 700 lb.

2. Remaining weight to be placed in the boat ÷ MerCruiser person weight = number of persons to load onto the boat
   • 700 lb. ÷ 165 lb. = 4.24 persons

3. Total number of persons – number of whole persons = remaining persons
   • 4.24 persons – 4 persons = 0.24 remaining persons

4. Remainder persons ÷ MerCruiser person weight = remainder MerCruiser person weight
   • 0.24 × 165 lb. = 40 lb.

IMPORTANT: View all boat seating as rows that are parallel to the transom of the boat.

5. Using the totals in this example, load four 165-lb. persons and one 40-lb. person onto boat seating with 400 lb. on the swim platform.
   • 400 lb. + 165 lb. = 565 lb.
   • 565 lb. + 165 lb. = 730 lb.
   • 730 lb. + 165 lb. = 895 lb.
   • 895 lb. + 165 lb. = 1060 lb.
   • 1060 lb. + 40 lb. = 1100 lb.

Loading the Boat—Without a Capacity Plate

For boats that do not display a capacity plate, the number of persons to be loaded onto the boat for measuring purposes is the number of persons that can sit on designated seating excluding cabin space. An additional weight of 25 lb. per person is to be added to the boat before loading passenger weight onto the boat.

IMPORTANT: Use 20 inches for average passenger seat width when measuring bench seating. Round up or down at 0.5 to obtain a whole person. See the examples below.
   • 48 in. (bench seat length) ÷ 20 in. (seat width) = 2.4 persons. 2.4 persons rounded down = 2 persons.
• 55 in. (bench seat length) ÷ 20 in. (seat width) = 2.75 persons. 2.75 persons rounded up = 3 persons.

1. Total number of persons that can sit on designated seating excluding cabin space × MerCruiser person weight = maximum passenger load for measurement.
   • Number of persons × 165 lb. (MerCruiser person weight) = XXXX lb. maximum passenger load.

2. Maximum passenger load from the calculation above – swim platform load if applicable.
3. Divide the weight by 165 lb. per person. This gives the number of 165-lb. persons to load onto the boat. Round up to next whole number. See Example 3.

IMPORTANT: To account for cargo, add a weight of 25 lb. per person to the boat before loading passenger weight onto the boat.

4. Calculate the cargo by multiplying 25 lb. by the number of persons that can sit on designated seating excluding cabin space. See Example.

5. Load the cargo onto the boat. Distribute cargo as described below.

IMPORTANT: If the boat configuration does not allow for aft, center, and bow storage, choose the storage application from the Optional Cargo Distribution table that best applies to your boat configuration.

<table>
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</tr>
<tr>
<td>None</td>
</tr>
<tr>
<td>100%</td>
</tr>
<tr>
<td>None</td>
</tr>
</tbody>
</table>

6. Perform the first measurement with the swim platform loaded and the person measuring the waterline on the boat.
7. Load the swim platform if equipped.
8. Measure the exhaust elbow waterline height.

IMPORTANT: View all boat seating as rows that are parallel to the transom of the boat.
9. Load a person weight into a seat, and measure the exhaust elbow waterline height after each person weight is loaded onto the boat. Repeat until a person weight is is loaded into each seat in that row.
10. Continue the process moving forward toward the bow of the boat to the next row of seats until a person weight is loaded into each seat.

**EXAMPLE**

**NOTE:** The following example is provided as a reference.
This example uses a boat that is 8.84 m (29 ft.) long and greater than 8.84 m (29 ft.) long, that does not have a maximum rated swim platform weight capacity, and must add 226.80 Kg (500 lb.) to the swim platform.
IMPORTANT: The Designated Seating Diagram following illustrates the number of passengers that can sit on designated seating excluding cabin space.

Designated Seating Diagram

This example uses 9 persons as the maximum passenger load.

NOTE: Use 0.50 lb. as the break point to round up or down to obtain a whole pound.

1. To determine the maximum cargo load multiply the maximum passenger load by the maximum cargo weight per passenger.
   • 9 passengers × 25 lb. = 225 lb.

2. To determine the preferred cargo distribution for aft, center, and bow storage:
   a. To determine the maximum aft storage cargo weight, multiply the maximum cargo weight by 25%
   b. 225 lb. × 25% = 56.25 lb.
   c. 56.25 lb. rounded down = 56 lb.

3. To determine the maximum center storage cargo weight, multiply the maximum cargo weight by 50%
   a. 225 lb. × 50% = 112.50 lb.
   b. 112.50 lb. rounded up = 113 lb.

4. To determine the maximum bow storage cargo weight, multiply the maximum cargo weight by 25%
   • 225 lb. × 25% = 56.25 lb.
   • 56.25 lb. rounded down = 56 lb.

5. To determine the maximum number of passengers to load onto the boat, multiply 9 passengers by 165 lb. (MerCruiser person weight) to get a 1485 lb. (total passenger load)
   • 9 passengers × 165 lb. = 1485 lb.

6. Subtract the swim platform load from the total passenger load to get the remaining weight to be placed in the boat.
   • 1485 lb. – 500 lb. = 985 lb.

7. Divide the remaining weight to be placed onto the boat by the MerCruiser person weight to get the maximum number of passengers to load onto the boat.
   • 985 lb. ÷ 165 lb. = 5.9 passengers
   • 5.90 passengers rounded up = 6 passengers

8. Using the totals in this example load 56 lb. cargo in the aft storage, 113 lb. cargo in the center storage, and 56 lb. cargo in the bow storage onto the boat before adding passenger weight. Then, load six 165 lb. passengers, onto the boat with 500 lb. on the swim platform.
   • 500 lb. + 225 lb. = 725 lb.
   • 725 lb. + 165 lb. = 890 lb.
   • 890 lb. + 165 lb. = 1055 lb.
Measuring Exhaust Elbow Height

- 1055 lb. + 165 lb. = 1220 lb.
- 1220 lb. + 165 lb. = 1385 lb.
- 1385 lb. + 165 lb. = 1550 lb.
- 1550 lb. + 165 lb. = 1715 lb.

Cargo, swim platform, and passenger weight loading diagram

- a - Swim platform load
- b - MerCruiser person weight (one)
- c - MerCruiser person weight (two)
- d - MerCruiser person weight (three)
- e - MerCruiser person weight (four)
- f - MerCruiser person weight (five)
- g - MerCruiser person weight (six)
- h - Aft storage
- i - Center storage
- j - Bow storage

Clear Hose Measurement Method

1. Obtain an 8–10 mm (5/16–3/8 in.) ID (inner diameter) clear hose approximately 4.5 m (15 ft.) long. Install a metal fitting or a weight on one end of the hose to keep that end of the hose below the waterline. The fitting or weight must not restrict water from filling the clear hose.

   a - Clear hose
   b - Fitting
   c - Unrestricted opening

   IMPORTANT: On engines equipped with more than one exhaust elbow, perform the exhaust elbow waterline height measurement on the side that sits lowest in the water.

2. Put the weighted end of the clear hose over the side of the boat that is sitting lowest in the water.

3. Submerge the clear hose until completely filled with water.

4. Place a finger over the open end of the clear hose before removing it from the water.
5. Coil the excess clear hose into the bottom of the boat bilge. Keep the coil of clear hose below the waterline.

6. Keeping the clear hose in line with the engine’s exhaust elbow, lift the end of the clear hose up to the highest point of the exhaust elbow.

7. Slowly take the finger off of the end of the clear hose to let the water level stabilize. The water will seek the level of the water outside of the boat. Keep the clear hose close to the exhaust elbow and as vertical as possible.

**Products without emissions control**

- **a** - Waterline
- **b** - Top of exhaust elbow
- **c** - Clear hose
- **d** - Weight
- **e** - Waterline to top of exhaust elbow measurement

**Products with emissions control**

- **a** - Waterline
- **b** - Clear hose
- **c** - Top of exhaust elbow
- **d** - Waterline to top of exhaust elbow measurement
- **e** - Weight

**Clear Hose Measurement Method from Seacock or Muffler Drain**

**IMPORTANT:** Measure the exhaust elbow height to the waterline inside of the water lift muffler (instead of the water line outside of the boat) on applications so equipped.
IMPORTANT: The engine must have been operated previously to fill the muffler with water.

IMPORTANT: On engines equipped with more than one exhaust elbow, perform the exhaust elbow waterline height measurement on the side that sits lower in the water.

1. Attach a clear hose to the muffler drain point or seacock drain point.
2. Start the engine to fill the muffler and hose.
3. If attached to the seacock drain, open the seacock.
4. Route the remainder of the hose toward the engine's exhaust manifold and elbow. Ensure that this open end section of the hose is as vertical as possible from the boat's bilge to the top of the exhaust elbow.
5. Coil excess hose in the bilge of the boat, keeping it below the water line.
6. Lower the open end of the hose and siphon water until it starts to come out of the hose. Put a finger over the hose and lift open end until it is at the top of the exhaust elbow.
7. Slowly take the finger off of the end of the hose to let the water level stabilize. The water will seek the level of the water outside the boat. Keep the hose close to the exhaust elbow and as vertical as possible.
8. The measurement between the water in the hose and the top of the exhaust elbow is the exhaust elbow height. The maximum riser height is 20.3 cm (8 in.) on 8.1 H.O. and Horizon 8.1 models with and without emissions control. Riser height is limited to 15.2 cm (6 in.) on all 5.7 and 6.2 models without emissions control and 20.3 cm (8 in.) on all 5.7 models with emissions control.

**NOTE:** Measure the water line inside the muffler when the drain plug is not available.

**PRODUCTS WITHOUT EMISSIONS CONTROL**

![Typical vertical water lift muffler](image)

- **a** - Minimum exhaust elbow height with maximum load
- **b** - Clear hose for measuring waterline
Typical horizontal water lift muffler

- **a** - Minimum exhaust elbow height with maximum load
- **b** - Clear hose for measuring waterline

**PRODUCTS WITH EMISSIONS CONTROL**

Typical horizontal water lift muffler

- **a** - Clear hose for measuring waterline
- **b** - Minimum exhaust elbow height with maximum load
Typical vertical water lift muffler

- Clear hose for measuring waterline
- Minimum exhaust elbow height with maximum load

Measurement Method without Seacock or Muffler Drain

IMPORTANT: Measure the exhaust elbow height to the waterline inside of the water lift muffler (instead of the water line outside of the boat) on applications so equipped.

IMPORTANT: The engine must have been operated previously to fill the muffler with water.

IMPORTANT: On engines equipped with more than one exhaust elbow, perform the exhaust elbow waterline height measurement on the side that sits lowest in the water.

1. Remove the discharge hose from the waterlift muffler.
2. Measure the water level inside the muffler.
3. Mark the outside of the muffler to show the water line height inside the muffler.
4. Using an appropriate tool measure the distance from the muffler waterline to the top of the exhaust elbow to determine the exhaust elbow height.