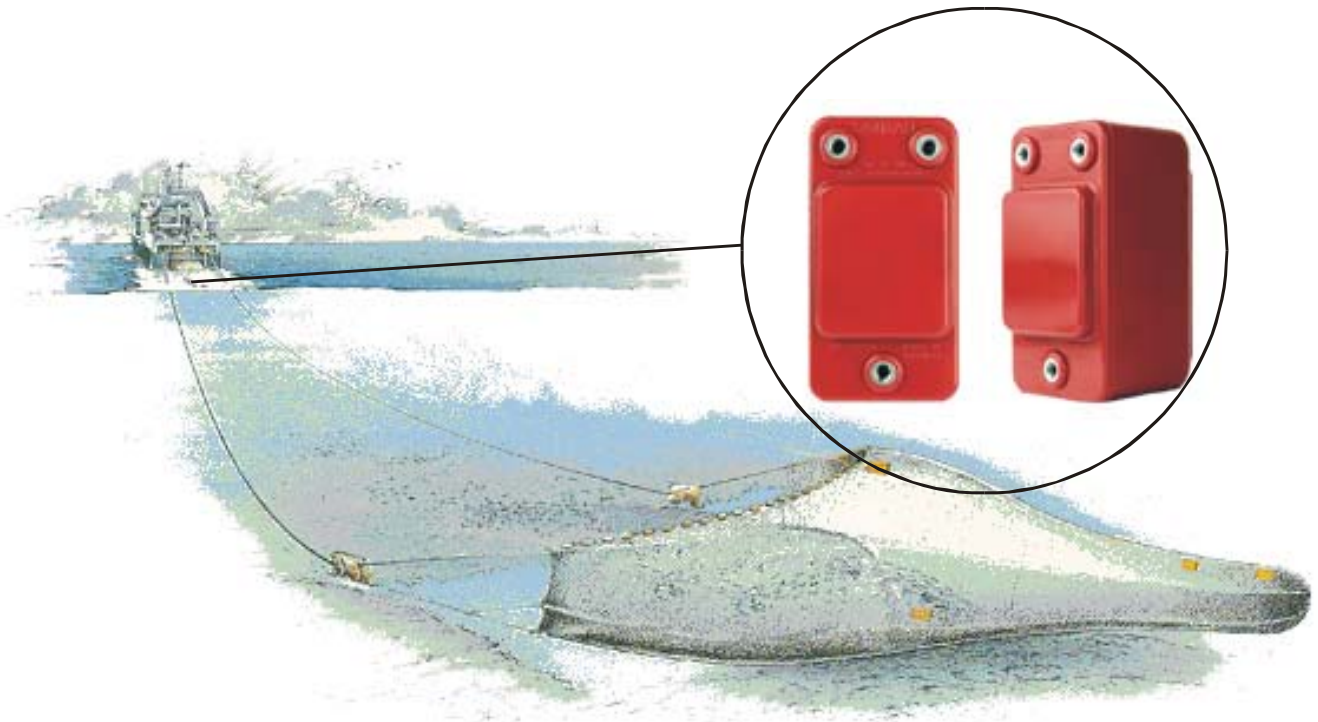


Installation manual

Simrad PI

Catch monitoring system

Trawl hydrophone installation



www.simrad.com

MAXIMIZING YOUR PERFORMANCE AT SEA

SIMRAD
A KONGSBERG Company

851-164472 / Rev.B

Simrad PI
Catch monitoring system
Trawl hydrophone installation

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Introduction

The purpose of this document is to provide general guidelines for the installation of the PI hydrophone for **trawling**.

Note:

If your vessel shall be fitted for purse seine operations, DO NOT install the hydrophone(s) as explained in this document!

Order numbers

Trawl hydrophone, complete: HYD-205254

Trawl hydrophone, without cable gland: HYD-205826

Topics

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Installation precautions

Caution: *The following precautions must be observed. Failure to do so can result in damage to the hydrophone which may render the PI Trawl hydrophone system inoperative.*

- 1** Observe the maximum allowable torque warning of 5 Nm when tightening the hydrophone studs.
- 2** Use only M8x35 socket countersunk head screws for mounting the hydrophone.
- 3** Secure threaded hydrophone hardware with Loctite™ 270 or the equivalent.
- 4** Do not paint the hydrophone.
- 5** Do not sand-blast, power or steam wash the hydrophone.
- 6** Do not scrape the hydrophone with metal or other hard objects that may damage the polyurethane sheathing.
- 7** Do not strike the hydrophone.
- 8** Do not expose the hydrophone to harsh chemicals.
- 9** Do not perform hot work in the vicinity of the hydrophone.
- 10** Do not lift the hydrophone by its cable.

Considerations

Correct installation of PI hydrophone(s) is vital to system performance. Several variables must be taken into consideration, the most important of which is the vessel's construction. This guide is for use in selecting the best location for the hydrophone and includes a brief description of areas to be avoided.

Note:

Simrad strongly suggests that this information is read thoroughly, and that the instructions are understood and followed. Proper hydrophone placement is difficult to achieve, but essential for correct system operation.

Depth

Water just below the sea surface contains a myriad of small air bubbles created by the turbulence of breaking waves. The first five to ten metres may be heavily saturated in moderate seas with the greatest concentration and largest bubbles closest the surface. Air bubbles disrupt sound waves in water. The degree to which they absorb and reflect such energy vary, but in some cases they can block hydrophone reception. It is therefore recommended to mount the unit as deep as possible.

Pounding danger

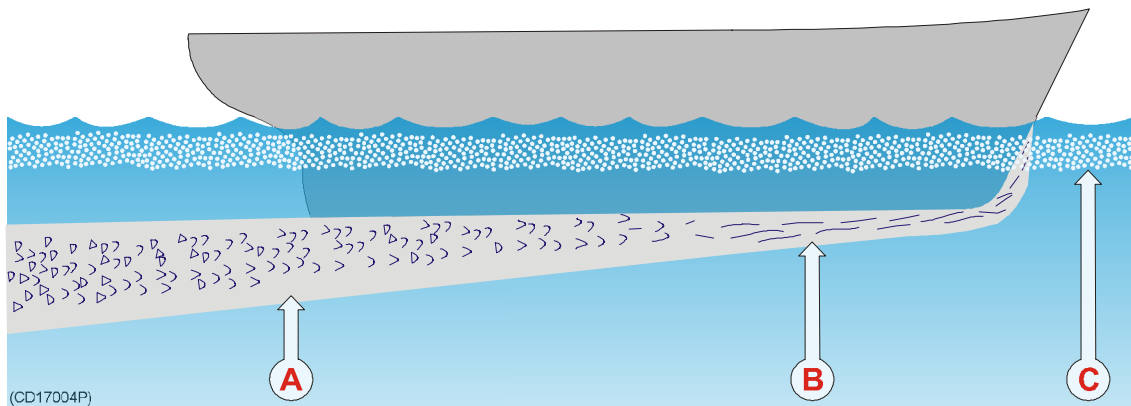
When a vessel is in ballast and pitching in heavy seas, it is important that the hydrophone is not lifted out of the water. Should a vessel pound so heavily that the hydrophone be exposed, sound reception will be interrupted and the unit may be damaged on impact.

The boundary layer

The flow of water in the immediate vicinity of the hull of a moving vessel is known as a boundary layer. This flow is responsible for underwater noise that can disturb hydrophone reception and its thickness is contingent on a vessel's:

- Hull form
- Size and number of underwater protrusions
- Velocity
- Hull roughness

The boundary layer is thin (laminar flow) near the vessel's bow and becomes thicker (turbulent flow) as it moves aft. Laminar flow is smooth with streamlines approximately parallel to the hull and contributes relatively little to noise created by flow. Conversely, turbulent flow is more disorderly and in turn contributes to a greater extent.



Boundary water layers:

(A) = Turbulent flow

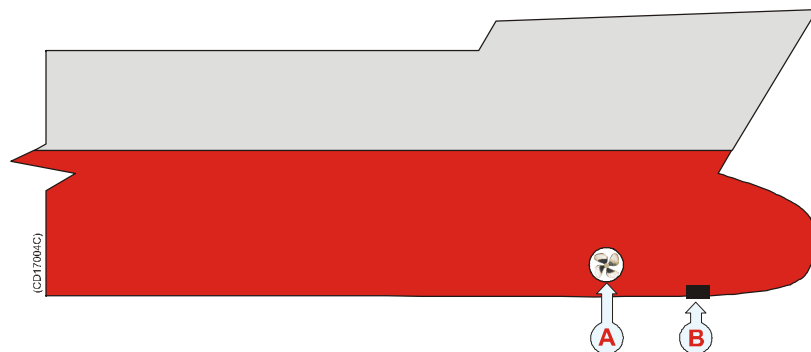
(B) = Laminar flow

(C) = Air bubbles in the water

Air bubbles may also be introduced into the boundary layer. If the vessel's hull has little flare and is relatively narrow, bubbles may escape to the sea surface without incident. On the other hand a wide, flat hull with minimal deadrise is prone to trapping air bubbles no matter how little flare it has. Regardless of a vessel's hull form, hydrophones are generally recommended to be installed on the forward part of the hull to minimising the influence of both turbulence and air bubbles.

Bulbous bow

The bulbous bow may be an acceptable hydrophone location. Should this position be chosen, the foremost part of the bulb is often best, but also the most susceptible to pounding.



Recommended location of the hydrophone on a bulbous hull:

(A) = Thruster

(B) = Hydrophone location

Propeller noise

A vessel's main propeller is the dominant source of underwater acoustic noise. When ever possible, hydrophone(s) should be located as far a way as possible from the main propeller and never closer than ten meters. Hydrophone(s) should not be mounted in the direct acoustic path (line-of-sight) of the main propeller unless absolutely necessary.

The primary cause of propeller noise is cavitation (small bubbles generated by the partial vacuum created by the blades as they pass through the water). The resulting underwater acoustic noise from cavitation is normally weakest on the side of the vessel were the propeller blades rotate toward the surface and most pronounced on the side were they rotate toward the bottom. Most vessels have clock-wise rotating propellers resulting in their port sides being less effected by cavitation induced noise than their starboard.

To minimise the negative effect of cavitation noise on hydrophone performance, installation is generally recommended as follows:

- **Single hydrophone** - if only one hydrophone is to be installed on a vessel with a clock-wise rotating propeller, it should be located on the port side of the hull.
- **Dual hydrophones** - if two hydrophones are to be installed, they should be placed on either side of the vessel's keel. When in doubt about the best fore-and-aft location for hydrophones, they can be placed at different distances from the bow (for example the port hydrophone can be a little further aft than the starboard, approximately three to five meters for a thirty-five meter vessel). When trawling in both deep and shallow water the hydrophones should also be tilted differently with respect to each other. The hydrophone that is closest to the propeller should have the greatest tilt and be located on the port side of the hull for a vessels with clock-wise rotating propellers.

Bow/sternthruster noise

Bow and sternthruster operation may severely effect hydrophone reception. Hydrophone installation closer than four meters to either is strongly discouraged.

When not in operation, bow/sternthruster tunnels create turbulence and hence underwater noise when a vessel is under way. Also, as a vessel pitches in heavy weather, thruster tunnels may fill with air or aerated water which can disturb hydrophone reception when released. Hydrophone installation should take into regard the noise and down stream disturbances found around and aft of thrusters.

Note:

Hydrophone installation must take into regard the noise and down stream disturbances found around and aft of thrusters.

Noise from protruding objects and other sources

The primary sources of underwater disturbance (other than a vessel's main propeller and bow/sternthruster) that affect hydrophone reception are:

- Main or bilge keels
- Zinc anodes
- Cooling elements protruding from the hull
- Equipment such as sonar hydrophones and pitot tubes
- Sea chests
- Overboard discharges
- Dents in the hull

All appendages to the hull, indentations and pipe outlets are potential sources of underwater noise. They may act as resonant cavities amplifying noise at certain frequencies, create cavitation or turbulence. Hydrophones should not be located in the vicinity of such objects and especially not immediately aft of them.

Minimum distance to sonar and echo sounder transducers

To avoid interference, PI hydrophone(s) must be installed as far away as possible from other sources of underwater acoustical energy such as active sonars and echo sounder transducers. Hydrophones should be placed at least two meters from such equipment when ever possible and distances of less than one meter avoided. Hydrophones installed in close proximity to underwater acoustical sources should be located as far aft as possible from them, and most importantly, not be subjected to direct (frontal) transmission from such equipment.

Drop keel

In the event the vessel is equipped with a drop keel, the hydrophones should be mounted aft of it. The choice between installing a one, or two hydrophone system should be based on the same horizontal and vertical coverage requirements for vessels operating under similar conditions with fixed keels.

Pre-installation check-list

Choosing the optimal locations for hydrophones is not always easy, but decisions made at this phase of the installation process are critical to future system performance. Determining the best configuration for a given vessel often involves a compromise between contradicting requirements.

To aid in this evaluation process Simrad recommends that this installation manual be read thoroughly and the following check list completed before deciding on a final installation strategy for the PI system.

- 1 Hydrophones do not have a direct line-of-sight to the main propeller and are placed where the vessel's hull protects them from underwater acoustic noise as well as possible.
- 2 Hydrophones must always have an unobstructed line-of-sight to the sensors attached to the gear for the system to operate properly.
- 3 The distance from the main propeller to the hydrophones should be greater than ten meters. A separation of less than ten meters can reduce system range significantly.
- 4 If thrusters are installed, hydrophones should be located at least four meters from them.
- 5 Avoid locating hydrophones behind thrusters where air bubbles from their tunnels generated when the vessel pounds can block sensor signals.
- 6 Hydrophone should not be placed forward of other underwater acoustic equipment and preferably behind it as far away as possible, distances of less than one meter should be avoided.
- 7 There should never be possible sources of underwater acoustic noise placed in front of hydrophones.
- 8 Hydrophones should be offset twenty degrees from the vessel's centre line for normal single boat trawling. This provides a ten degree overlap and a coverage area of ninety degrees aft. Refer to the corresponding sections of this manual for more information.
- 9 If there is any doubt about the best fore-and-aft location, the port hydrophone can be placed a little farther aft (three to five meters) in relation to the starboard. Hydrophones can be tilted at slightly different angles when operating in both deep and shallow waters. Refer to the corresponding sections of this manual for more information.

- 10 The hydrophone that is closest to the main propeller should be located on the port side of the vessel and have the greatest tilt.
- 11 If both hydrophone are located equally distant from the main propeller, but are tilted differently, the starboard hydrophone should be tilted the most because underwater acoustic noise is more prevalent on that side of the vessel.
- 12 Locating hydrophones at the after end of a bulbous bow can produce good results. Previously installed sonars in this area that can subject hydrophones to direct signals will produce interference.
- 13 Hydrophone can also be mounted in the after end of echo sounder shoes as long as the minimum required distances and orientation with regard to other underwater acoustic equipment is observed.
- 14 Remember that hydrophones are to be mounted with their long axis up (in the vertical plane).
- 15 Hydrophones installed in blisters should be located away from the vessel's keel and as deep as possible on the hull.
- 16 Hydrophones installed in shoes along the vessel's keel should be mounted as deeply as possible.
- 17 Hydrophone cables that are run in conduit along the outside of the vessels hull should be arranged as to produce the least amount of underwater acoustic noise as possible.
- 18 Blisters and shoes should be as streamlined as possible and have all of their corners rounded to minimize the generation of underwater acoustic noise.
- 19 Conduit used to run hydrophone cables in the interior of a vessel's hull should extend well over its water line.
- 20 If you install both trawl and purse seine hydrophones, do not confuse the two types. The Trawl hydrophones are marked with order number **314-205250**, while the Purse seine hydrophones are marked with order number **314-202275**.
- 21 Other well-founded information or experience regarding hydrophone installation be available should also be evaluated even though not directly mentioned in these instructions.

Optimal location of trawl hydrophones

The most influential factors effecting hydrophone reception common to most vessels are:

- Noise from cavitation generated by the main propeller.
- Air bubbles in the water around the hydrophone which impede acoustic signals.
- Noise from other acoustic equipment mounted in close proximity.

If the shipyard or persons responsible for placement and mounting the hydrophone(s) have knowledge and the proper experience with installation of similar equipment, it should be fully exploited when deciding where to locate the hydrophones. This also holds true for adjusting the degree to which a hydrophone should be tilted with regard to the both the vessel's physical characteristics and fishing method. Proper hydrophone installation can increase overall system performance more than any other single factor and therefore it is important that all the variables involved be understood and taken into account. Often, individual hydrophone installation requirements contradict one another and only an in-depth knowledge of the principles involved can aid in deciding which should be given priority.

General rules-of-thumb

Although individual vessel vary greatly with regard to physical construction and fishing methods, the following rules of thumb apply under most circumstances.

- Hydrophones should be located as far forward as possible, normally one-third the length of the water-line from the bow.
- If a vessel has a bow thruster, bubbles generated by its tunnel can block sensor signals. Hydrophones therefore should be either located forward of bow thrusters or far aft out of the stream of bubbles found behind them. Vessels equipped with bulbous bows can mount hydrophones in a specially designed shoe on the after part of the bulb, forward of the bow thruster.
- The minimum distance a hydrophone should be located from the main propeller is ten meters. Systems with hydrophones mounted closer than this will have reduced range due to underwater acoustic noise generated by propeller cavitation.
- For trawlers that do not have to take a pursuing wire into consideration, hydrophones can be mounted in specially constructed blisters offset from the vessel's keel (preferably

1200 mm, but no less than 700 mm) to avoid turbulence. To also aid in reducing the effects of turbulence, hydrophones should be installed as deeply as possible (preferably 600 mm, but not less than 400 mm) from the vessel's outer hull. When ever possible, the distance from the keel to the bottom of the hydrophone blister should not exceed 50 mm which can be adjusted by countersinking the installation.

- Keel installation of hydrophones is recommended for combined trawl/purse seining vessels that can not have blisters projecting from their hulls.

On the starboard side of such vessels a purse seine hydrophone can be installed together with a trawl hydrophone.

- Hydrophones should have and unobstructed “view” of the sensors attached to the gear, but not be located in the line-of-sight of the main propeller.
- Hydrophones should be located aft of echo sounder transducers or sonar installations, preferable at a distance of two meters or more. A proximity of less than one meter should be avoided and hydrophones should never be subject to their direct (frontal) transmission.
- Objects protruding from the hull will generate noise, the areas aft of which should not be used to mount hydrophones.
- Thruster tunnels generate air bubbles which disrupt signals from the sensors. The areas aft of thruster tunnels or other sunken areas of the hull should not be used to mount hydrophones.
- If there is any doubt about the fore-and-aft positions for the hydrophones, they should be located at different distances from the bow (three to five meters relative to each other for a thirty-five meter vessel). The hydrophone that is closest the main propeller should be located on the port side of the vessel.
- Hydrophones have a *horizontal* coverage of approximately 50 degrees. To maximise coverage using two hydrophones they should be offset preferably 20 degrees outboard. With this configuration the two hydrophones will overlap each other by preferably 10 degrees and provide a total system coverage of 90 degrees.
- Hydrophones have a *vertical* coverage of approximately 30 degrees. The normal tilt angle is 20 degrees; if the system is to be used in deep water the hydrophones should be tilted preferably 30 degrees and in shallow water preferably 10

degrees. To maximise coverage using two hydrophones when trawling in both deep and shallow water tilt one preferably 15 degrees and the other preferably 30 degrees. The hydrophone closest to the propeller should be tilted the most and care should be taken with regard to underwater acoustical noise.

- Hydrophone cables pass through a vessel's hull below its water-line. It is therefore strongly recommended that a length of conduit be fitted (using approved fastening procedures) to the interior of hull around the opening made for the hydrophone's cable. This conduit should extend vertically (inside the vessel) over the water-line so that hydrophone cables can be safely passed through the hull without the danger of flooding in the event of gland failure. Hydrophones with steel through-hull fittings installed in this manner can be replaced without the necessity of dry docking.
- The cable between the hydrophone and the cabinet must be properly shielded from other potential sources of electrical interference. A good practice is to run the hydrophone cable in a steel conduit to the wheel house.

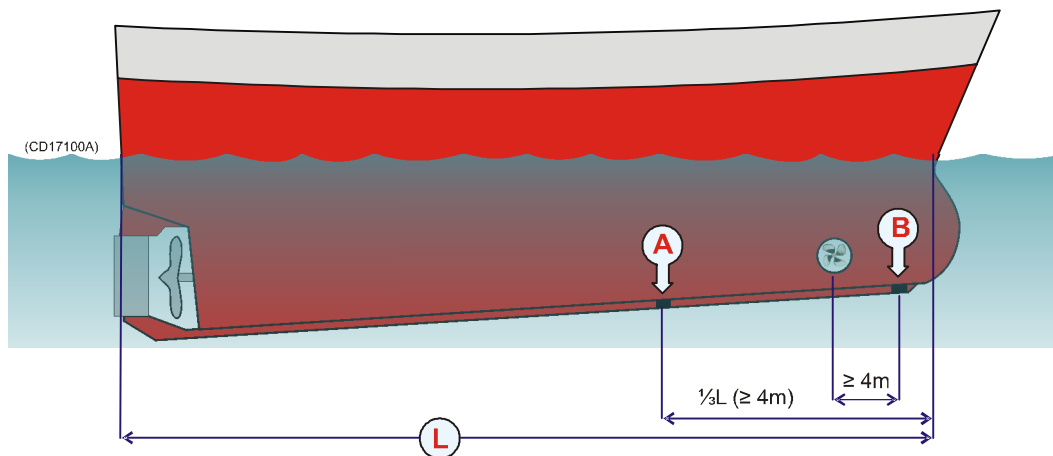


Figure 1 Recommended hydrophone locations

The illustration shows the recommended (A) and the alternative (B) locations for single hydrophone locations. For a dual installation, use position (A), and place the port hydrophone further aft than the starboard. (L) is the total length of the hull measured at the waterline.

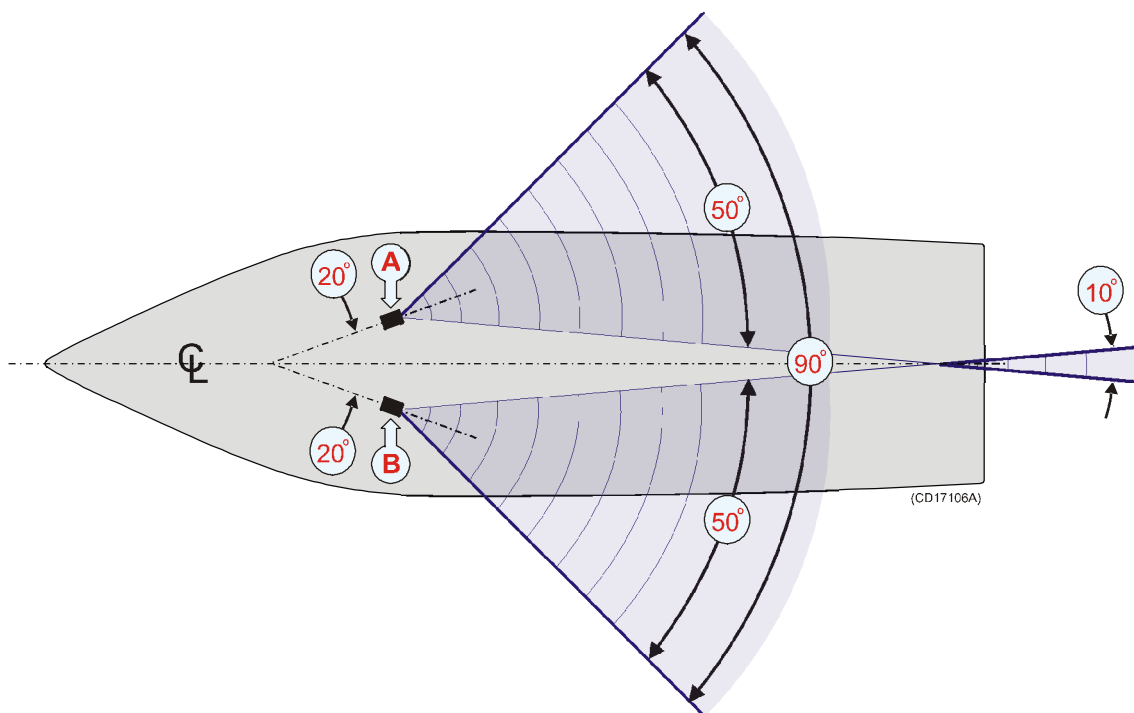
Coverage area, orientation and tilt

Once the fore-and-aft placement of the hydrophone is decided, it is equally important to carefully consider its horizontal and vertical orientation. Hydrophone orientation can have a large influence on system performance.

Hydrophones must be configured so that they overlap one another in the horizontal plane. Tilt is decided by the actual depth of the gear. If fishing operations are to be conducted in both deep and shallow water the hydrophones can be tilted differently.

Horizontal coverage area

The hydrophone's beam sensitivity is concentrated within a 50 degrees horizontal and -30 degrees vertical sector. By off-setting hydrophones by 20 degrees each from the vessel's centre line an overlapping coverage area of 20 degrees is provided with a total coverage area of 90 degrees.



Horizontal coverage area

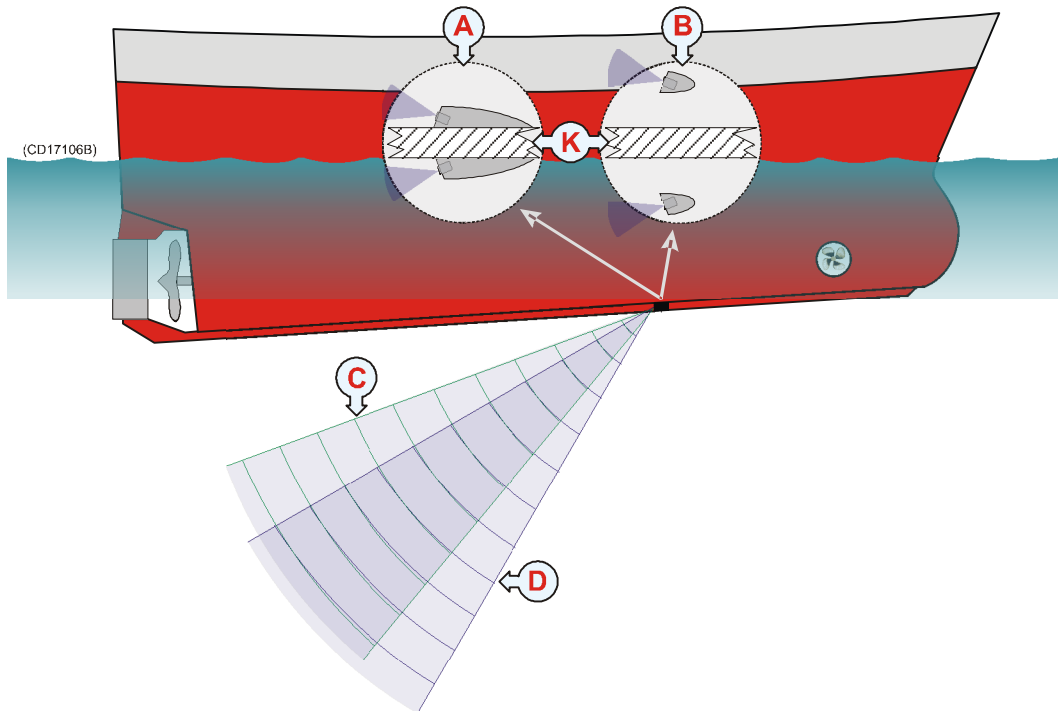
(A) = *Starboard hydrophone*

(B) = *Port hydrophone*

This “rule-of-thumb” is for normal trawling operations. For pair-trawling or when fishing with Danish seines, the horizontal position of the hydrophones should be configured with regard to the operation in question.

Vertical coverage area I

Dual hydrophone installation with hydrophones **equally distant** from the bow, but tilted differently.



Typical tilt configuration for operation in both deep and shallow water when the hydrophones have the same distance from bow. The hydrophones may be installed in shoes or blisters.

(A) = Using shoes (top view)

(B) = Using blisters (top view)

(C) = Port hydrophone tilted 10 to 20 degrees

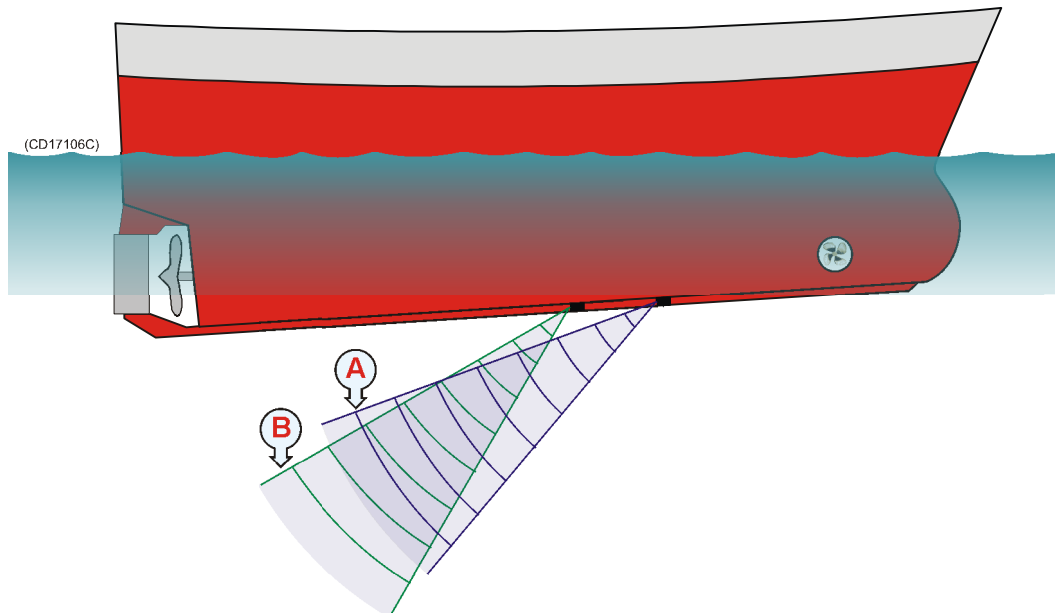
(D) = Starboard hydrophone tilted 20 to 35 degrees

(K) = Keel

The hydrophone on the starboard side of the hull should have the greater tilt of the two, approximately 20 to 35 degrees. The hydrophone on the port side of the hull should be tilted approximately 10 to 20 degrees

Vertical coverage area II

Dual hydrophone installation with hydrophones **different distances** from the bow, and tilted differently.



Typical tilt configuration for operation in both deep and shallow water when hydrophones have different distances from bow.

(A) = Port hydrophone tilted 20 to 35 degrees

(B) = Starboard hydrophone tilted 10 to 20 degrees

The hydrophone closest to the main propeller should be on the port side of the hull and have the greater tilt of the two, approximately 20 to 35 degrees. The hydrophone on the starboard side of the hull should be tilted approximately 10 to 20 degrees

Note:

The “tilt angle” is measured from the vessel’s water-line toward the bottom when in operation. A vessel’s hull and keel are normally not parallel with the water-line and/or the bow may lift when trawling. These factors must be noted and taken into consideration when deciding on the best possible hydrophone configuration for a given vessel. Refer to the theoretic penetration depth table for more information.

Hydrophones have a vertical beam width of 30 degrees and should be tilted so with regard to optimizing system performance at the particular trawl depth in use. This configuration should be decided upon before hydrophone installation commences.

Simrad recommends that hydrophone tilt be preferably 20 degrees for normal trawling. If the vessel plans to operate in deep water the tilt can be increased to approximately 30 to 35 degrees or reduced to 10 degrees if trawling will be performed at or near the surface. Should a vessel need to operate in both deep and shallow waters two hydrophones be employed, each tilted preferably 15 and 30 degrees respectively.

Theoretic penetration depth table

Tilt	Distance in meters							
	250	500	750	1000	1250	1500	1750	2000
10 deg	50	100	150	175	225	250	300	350
15 deg	70	150	200	250	350	400	450	535
20 deg	90	180	275	350	450	550	650	750
25 deg	120	225	350	450	600	700	800	925
30 deg	150	300	450	575	700	850	1000	1150
35 deg	175	350	525	700	875	1050	1200	1400
<i>Theoretic penetration depths for hydrophone beams</i>								

The table shows the theoretical penetration depths for hydrophone beams (measure from their centres) with regard to different tilt angles and varying distances to the sensors.

Recommendations:

- Normal trawling: approximately 20 degrees
- Deep sea trawling: 30 to 35 degrees
- Shallow water trawling: 10 to 15 degrees.

Mounting arrangement

The PI trawl hydrophones are delivered ready for installation in either freestanding or keel mounted shoes (which are to be built by the shipyard responsible for the installation). Several alternatives with corresponding detailed drawings have been included in this manual to cover the majority of installation options available. Information regarding through-hull penetration is also described to compliment the rules and regulations of the respective vessel's classification society.

For easy mounting and access a mounting flange is suggested. This is described in drawing 871-207229, and it has part number 599-207228.

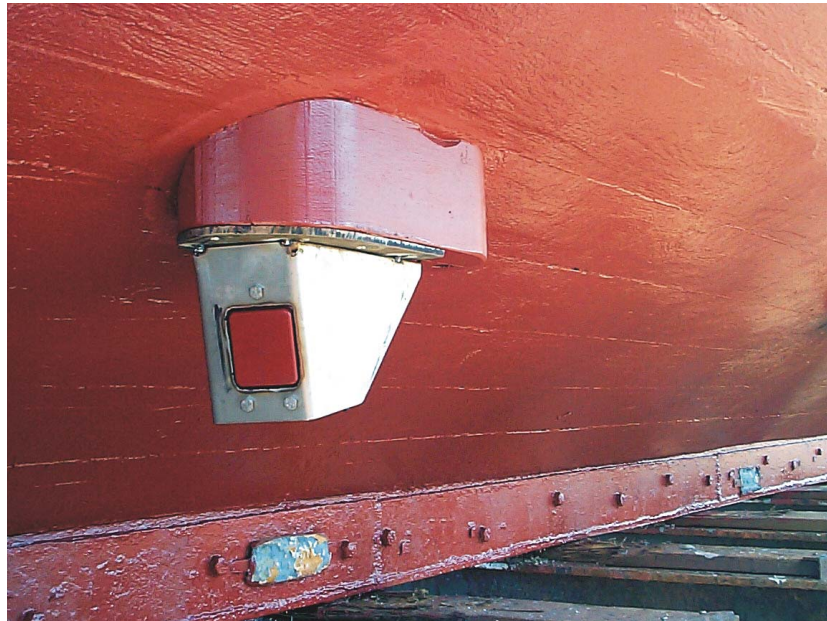
Other well-founded information or previous experience with the installation of similar systems may also be evaluated even if not specifically described.

Referenced drawings

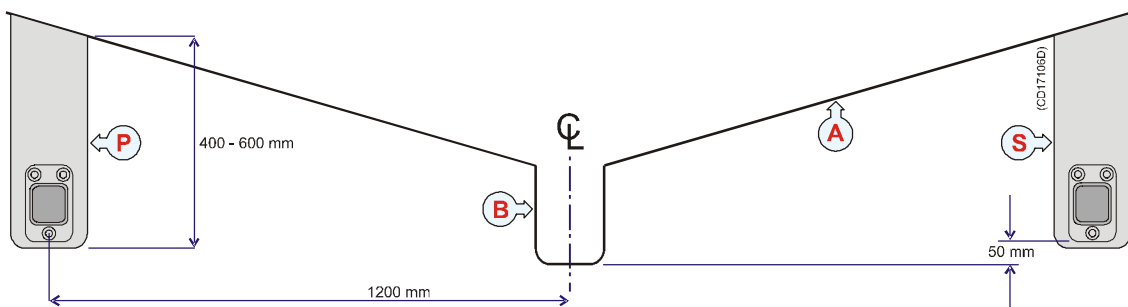
- *PI Trawl hydrophone, outline dimensions, page 33*
- *PI Trawl hydrophone, cut-out, page 34*
- *PI Trawl hydrophone, mounting flange, page 36*
- *Free standing hydrophone in blister, page 38*
- *Hydrophone in keel mounted shoes, page 40*

Freestanding hydrophones in blisters

For trawlers that do not have to take a pursuing wire into consideration, hydrophones can be mounted in specially constructed blisters offset from the vessel's keel (preferably 1200 mm, but no less than 700 mm) to avoid turbulence.



The picture shows an example of a freestanding hydrophone offset from the keel on a wooden vessel.



Approximate blister location, view from stern. All measurements are approximate, and the drawing is not in scale.

(A) = Outer hull

(B) = Keel

(P) = Port hydrophone blister

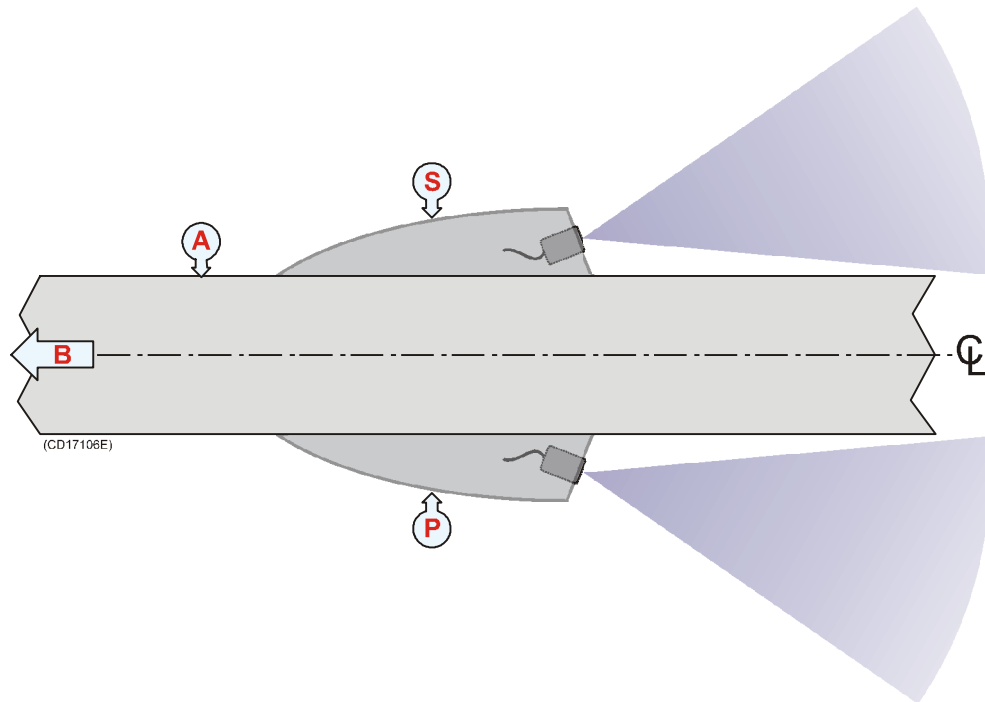
(S) = Starboard hydrophone blister

The farther away from the hull a hydrophone is mounted the more the effects of turbulence are reduced. Simrad recommends that hydrophones be installed as deeply as possible (preferably 600 mm, but not less than 400 mm) from the vessel's outer hull. When ever possible, the distance from the keel to the bottom of the hydrophone blister should not exceed 50 mm.

The section regarding hydrophone coverage including horizontal orientation and tilt also applies to hydrophones mounted in blisters.

Keel mounted shoes

Hydrophones can be keel mounted to avoid creating appendages to the hull that could foul the purse wire.



Keel mounted hydrophone shoes, top view.

(A) = Keel

(B) = Towards the bow

(S) = Starboard shoe with hydrophone

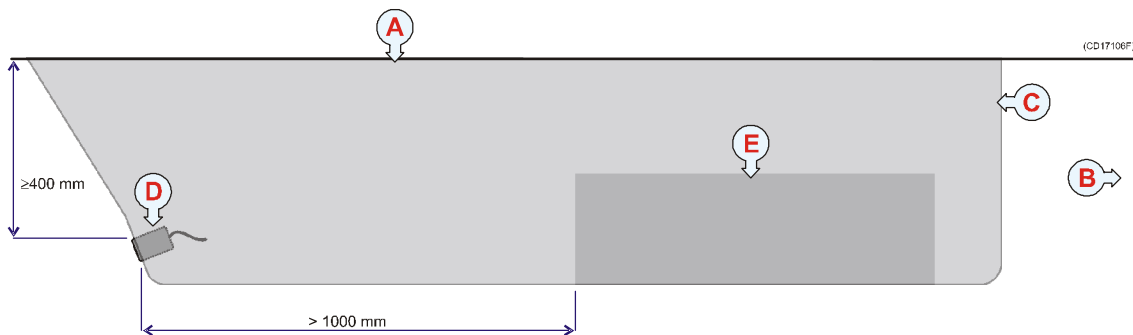
(P) = Port shoe with hydrophone

Should this solution be chosen, the following must be taken into consideration:

- Hydrophones must have an unobstructed line-of-sight to the sensors attached to the trawl.
- Hydrophones should be trained 20 degrees to either side of the vessel's centre line providing a 10 degree overlap and a horizontal coverage area of 90 degrees.
- Hydrophones should be mounted as deeply as possible on the hull, but not so deep that they may be damaged when docking the vessel.
- For combined purse seine and trawl applications a seine hydrophone may be mounted in the starboard (or port) blister/shoe along with the trawl hydrophone.

Mounting at the aft end of a shoe

Hydrophones can be mounted at the after end of a transducer shoe for an echo sounder or other underwater acoustic equipment. The distance between the hydrophone and such equipment must not be less than one meter and the greater the separation, the better. Installing a hydrophone in close proximity to underwater acoustic equipment can reduce system performance due to interference.



Hydrophone mounted at the aft end of a echo sounder transducer shoe. The drawing is shown from the side, and it is not to scale.

(A) = Outer hull.

(B) = Towards the bow

(C) = Fairing

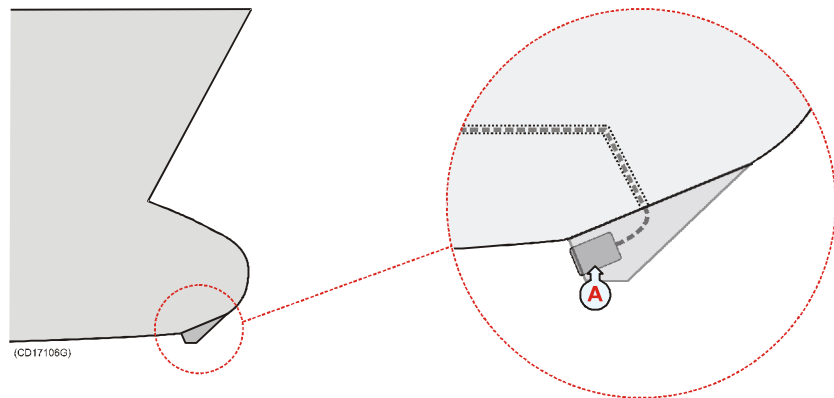
(D) = Hydrophone

(E) = Area allocated for echo sounder transducer(s)

The illustration shows a PI hydrophone installed aft of an echo sounder arrangement for one or more transducers and/or other underwater acoustic equipment. Note the minimum allowable distance between the PI hydrophone and the other equipment. As with other mounting options, hydrophones mounted at the after end of a transducer shoe must have an unobstructed line-of-sight to the sensors attached to the trawl.

Mounting at the after end of a bulbous bow

Trawling hydrophones have been successfully installed at the after end of bulbous bows (for vessels trawling in deep water and require tilt angles from 25 to 35 degrees). Vessels equipped in this manner may experience signal loss in heavy weather due to bubbles or when pounding lifts the hydrophone out of the water. Normally these types of interruptions are short and sensor signals can be again received once the hydrophone(s) is immersed.



Mounting the hydrophone (A) at the after end of a bulbous bow.

Hydrophones installed at the after end of bulbous bows should be tilted and oriented horizontally as explained in the corresponding sections of this manual. It is recommended that other underwater acoustic equipment not be installed together with the hydrophone(s).

Dual hydrophone installation

The PI system trawl hydrophones receive horizontally and vertically within 50 and 30 degree sectors respectively. Signals transmitted from sensors attached to towed gear must be able to be received on both sides of a vessel's keel under normal operating conditions. When a single hydrophone is installed, it must therefore be mounted no more than five centimetres higher than the lowest point on the keel to ensure proper coverage on both sides of the vessel. Hydrophones that protrude from the hull in this manner are often subject to damage when for example dry-docking and special precautions should be taken to safeguard their protection.

Simrad recommends the use of two hydrophones to ensure the necessary horizontal and vertical coverage for proper system operation. This also allow the respective coverage areas of the hydrophones located on opposite sides of the hull to overlap each other providing the system with the ability to be optimized for a specific type and method of fishing. The use of dual hydrophones have the following benefits:

- They provide a larger area of coverage with the ability to receive signals even when the trawl is being substantially set.
- The hydrophone on the lee side of the vessel can provide better signals in heavy weather.
- Hydrophone placement can be optimized without having to take into account signal clearance over the vessel's keel.
- Each hydrophone can be placed at a different distance from the bow if there is any doubt about which configuration is best.
- The hydrophones can be tilted individually to optimise performance when trawling in deep or shallow water and to provide wider overall coverage.

Hydrophone protection

Warning: *Do not perform hot work near, paint, scrape, hit, pry, force, sandblast, high-pressure wash or otherwise subject hydrophones to excessive force.*

Installation precautions

The following precautions must be observed. Failure to do so can result in damage to the trawl hydrophone which may render the PI system inoperative.

- 1 Do not install the hydrophone until all hot work is complete!
- 2 Do not over-tighten the packing nipple as this could damage the hydrophone's cable!
- 3 Observe the maximum allowable torque warning of 5 Nm when tightening hydrophone studs!
- 4 Use only stainless steel M8x35 socket countersunk head screws for mounting the hydrophone!
- 5 Secure threaded hydrophone hardware with Loctite™ 270 or the equivalent!
- 6 The PI cabinet should always be connected to the ship's ground to reduce the effects of electrical interference on the system!

Under installation

Hydrophones must not be installed until all structural work, specifically welding sandblasting and other potentially harmful operations are completed. If hot work, sandblasting, spay painting or water blasting is to be performed in the vicinity of a hydrophone it must be properly protected. PI hydrophones although very rugged, contain sensitive ceramic elements and electronic circuits and therefore should never be struck, prided, clamped or subject to other types of potentially damaging force as for example over-tightening mounting hardware.

Deflection plates

Simrad recommends that hydrophones mounted in blisters be protected by rope deflections plates both forward and aft. Such precautions will help protect the hydrophones, especially in the event the vessel passes over a wire, line or net.

Vessels operation in colder climates should weld steel fins and protection plates installed around hydrophones to protect them from being damaged by ice. Detailed drawing must be made specifically to suite each individual vessel in question and the installation performed by an authority with the expertise to do so.

Surface protection

Maintenance and replacement costs can be reduced if those parts of the hydrophone installation that are open to the sea are protected correctly. Any new metal or original plating involved in the hydrophone installation which has been cut, sand-blasted, welded or otherwise had its protective coating compromised must be thoroughly cleaned and repainted. For steel vessels use polyester primer, undercoat and top-coat according to the manufacture's instructions, then apply the same anti-fouling paint used on the rest of the hull.

Hydrophone face

This is Simrad's list of approved antifouling paints for hydrophone faces.

From Jotun Paints, Sandefjord Norway:

- Antifouling Seamate HB 33, HB 66 and HB 99
- Racing
- Non-stop

From International Paints:

- Intersleek tie coat + 425 FCS
 - BXA386/BXA390/BXA391 Grey
 - HKA563/HKA570/HKA571 Yellow

Mix BXA386, BXA390 and BXA391 first, then apply. When dry, mix HKA563, HKA570 and HKA571, apply.

From Hempel IFA Coatings AS:

- Hempel A/F Classic 76550

From Jotun-Henry Clark Ltd:

- Anti-fouling Seaguardian

From International Marine Coatings:

- Intersmooth 360 Ecoloflex SPC
- Micron Ekstra

Note:

Refer to the manufacturer's documentation and data sheets for a complete procedure.

Location and marking

After installation, the location of hydrophones should be clearly marked on the vessel's hull (above the water-line) directly over them. This information will help prevent hydrophone damage when dry-docking the vessel. It is very important to amend the docking-plans of larger vessels to also reflect this information so that blocks will not be placed in the vicinity of hydrophones, fins, deflection plates or other associated appendages.

After installation / Sea trials

Once the installation is complete and the vessel afloat, the system's performance should be documented. Refer to the appropriate section in the PI Operation manual regarding the measurement of a noise vs. speed curve.

Hydrophone cable

The trawl hydrophone is delivered with a 22 m cable. The cable is fitted with plug that fits the ANT socket on the rear side of the PI Operator Unit. The standard hydrophone delivery includes cable gland kit 599-202216 for steel hulls, and the hydrophone cable has been cut to allow this cable gland to be installed.

General cable gland guidelines

Hydrophone cables are passed through the hull using approved cable glands for the type of vessel in question. The standard delivery consists of a **steel** cable gland that is to be welded to the hull.

A **bronze** cable gland can be delivered as an option for vessels with wood or fibreglass construction. Vessel not to be classified can as an option use a cable gland made of **plastic**.

Note:

Simrad strongly recommends that a length of conduit be fitted around hydrophone cable glands made of steel or bronze and extended over the water-line inside the vessel. This precaution reduces the danger of flooding in the event of gland failure and hydrophones installed in this manner are also easier to replace.

Some vessels may experience difficulties finding suitable areas of the hull for mounting hydrophone cable glands due to existing water tanks, concrete ballast or other obstacles. A possible solution in such cases is to run the hydrophone cables in a steel conduit aft along the hull until a suitable cable gland location is available. The respective cable gland can then be installed as described in the following instructions.

Note:

Simrad takes no responsibility for the correct installation of cable glands, associated hull modifications and/or structural support of hydrophone cable penetration. These activities are subject to individual approval by the respective classification society for the vessel in question.

Order numbers

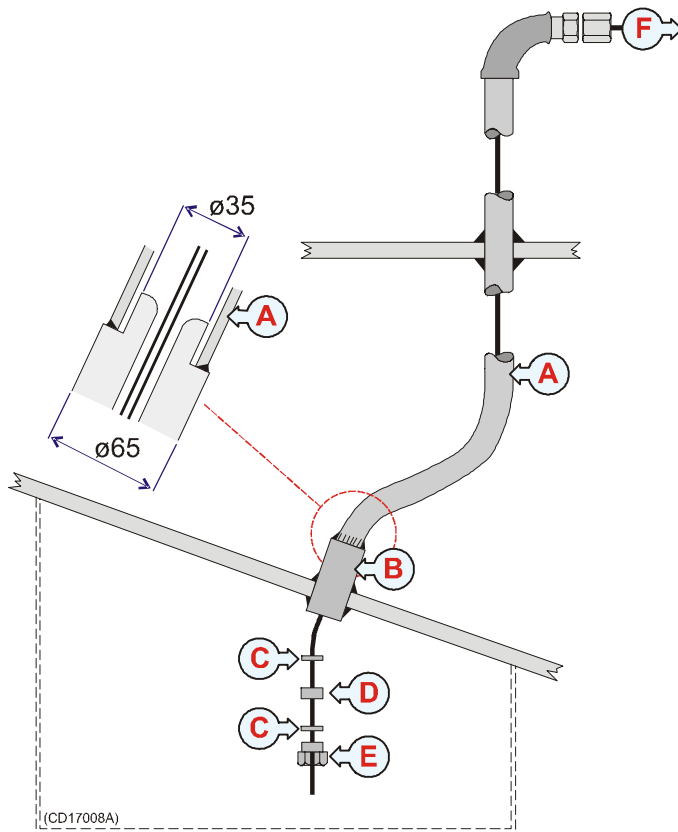
Steel hull cable gland kit: 599-202216

Wood/GRP hull cable gland kit: 119-038200

Small vessel cable gland kit: 599-202182

Cable gland installation for steel hulls

The cable gland kit for steel vessels is included with standard deliveries. The drawing shows a single hydrophone, but normally a typical installation includes two hydrophones with respective cables spliced in a junction box and run to the wheelhouse in a conduit.



Cable gland for steel hull vessels.

(A) = Steel conduit

(B) = Stuffing tube, DNV approved carbon steel st52.3

(C) = Washers, 24 x 8 x 2 mm

(D) = Rubber gasket

(E) = Packing nipple. Make sure that you do not damage the hydrophone cable by tightening the packing nipple too hard!

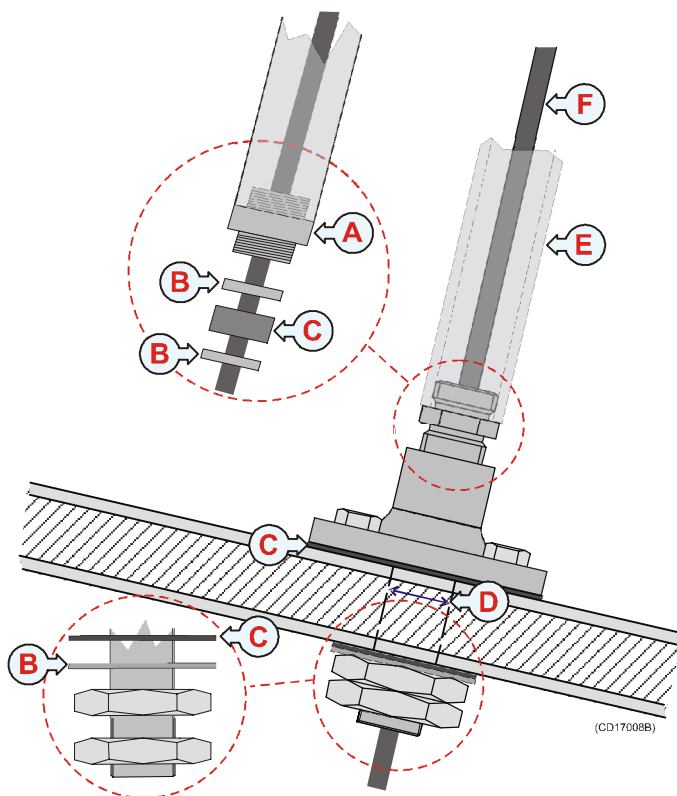
(F) = Cable to the PI Operator unit (or a junction box)

The gland gland kit includes all of the necessary parts needed to install the unit excluding screws.

Gland installation for wood or GRP hulled vessels

A bronze cable gland kit is available for wood and GRP vessels. This kit is not included in the standard delivery, and must be ordered separately.

The drawing shows a single hydrophone, but normally a typical installation includes two hydrophones with respective cables spliced in a junction box and run to the wheelhouse in a conduit.



Cable gland for wood and GRP hulls.

(A) = Packing nipple. Make sure that you do not damage the hydrophone cable by tightening the packing nipple too hard!

(B) = Washers

(C) = Rubber gaskets

(D) = Hole diameter 28 mm

(E) = Steel conduit

(F) = Hydrophone cable

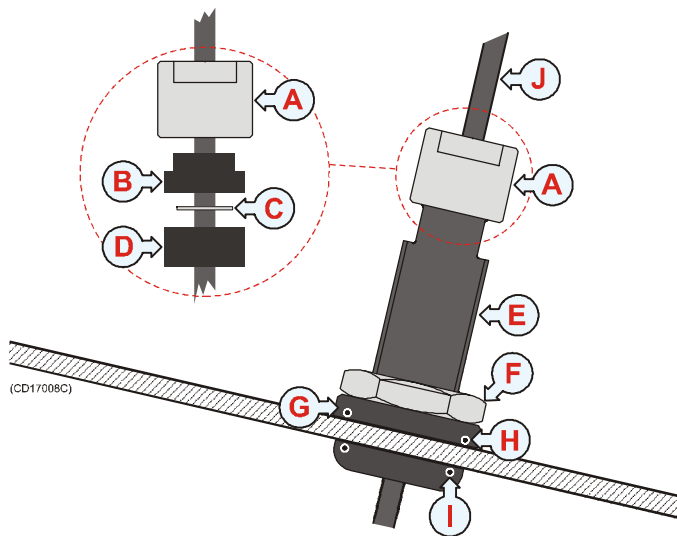
The gland gland kit includes all of the necessary parts needed to install the unit excluding screws.

Simrad recommends that a one inch conduit (that the hydrophone cable will be run through) with an inside threaded diameter of three-quarter inches be attached to the gland's packing nipple. This connection must be watertight, and the conduit must extend to over the vessel's water line and terminated as described for steel hulled vessels.

Cable gland installation for smaller vessels

Cable glands made of plastic for those smaller vessels that do not need to be classified are optional equipment for standard deliveries. This cable gland kit is not included in the standard delivery, and must be ordered separately.

The drawing shows a single hydrophone, but normally a typical installation includes two hydrophones with respective cables spliced in a junction box and run to the wheelhouse in a conduit.



Hydrophone cable gland for small vessels.

*(A) = Packing nut (bronze).
Ensure that you do not to damage the hydrophone cable by tightening the packing nut too hard!*

(B) = Rubber gasket

(C) = Plastic disk

(D) = Rubber gasket

(E) = Stuffing tube

(F) = Backing nut (bronze)

(G) = Backing washer (plastic)

(H) = O-ring 42.5 x 3.0 N

(I) = O-ring 39.5 x 3.0 N

(J) = Hydrophone cable

Stuffing tube hole diameter: 36 mm \pm 1.5 mm.

Apply ample amount of sealant between the backing washer (H) and the hull plate.

The cable gland kit contains all the listed parts, except the sealant.

Note:

The two O-rings must be clean, in good condition and free of cuts or other defects which could affect their water-tight integrity.

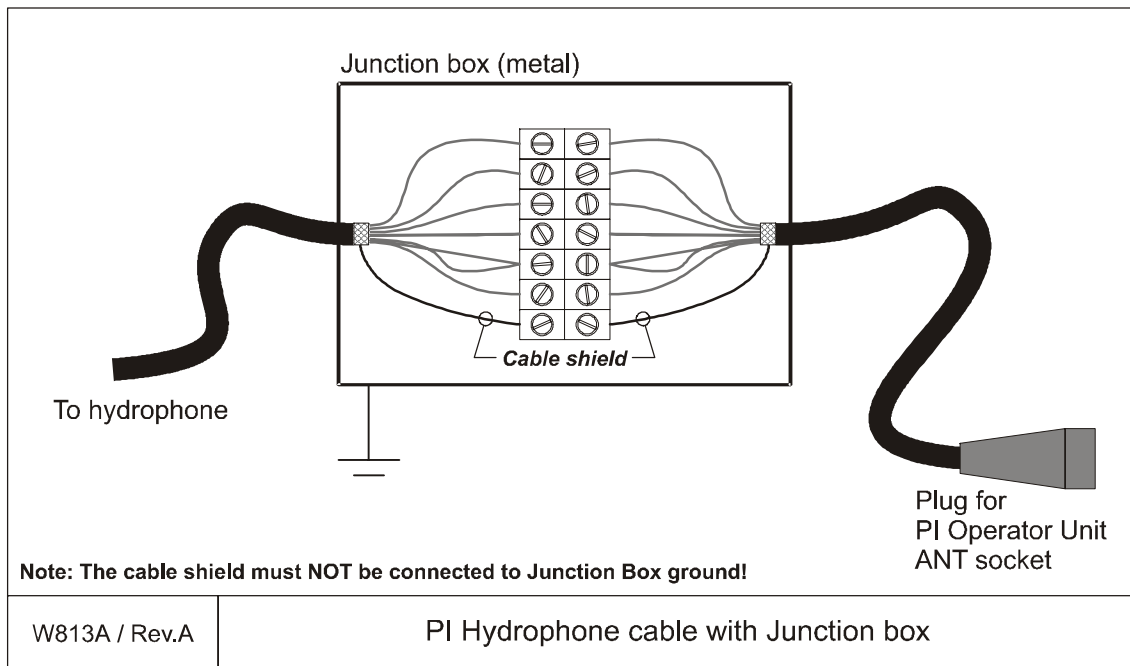
Splicing

If you need to cut the cable, you must splice it correctly.

Note:

DO NOT solder the wires together with only electrical tape for insulation, as this will result in electrical noise and reduced operational performance.

To splice the cable, use a metal junction box. The chassis of the junction box must be grounded, but the cable shielding must NOT be connected to the junction box ground.



Note:

Make sure that you connect the cables 1:1! The red cable in the “input” cable MUST be connected to the red cable in the “output” cable etc.

Cable specification

If extension cables are used, these must be supplied by the installation shipyard. The following specifications must be regarded as a minimum:

2 x 2 x 0.5 mm² / Twisted pairs / Overall braided

Observe the information regarding cable splicing.

Grounding and shielding

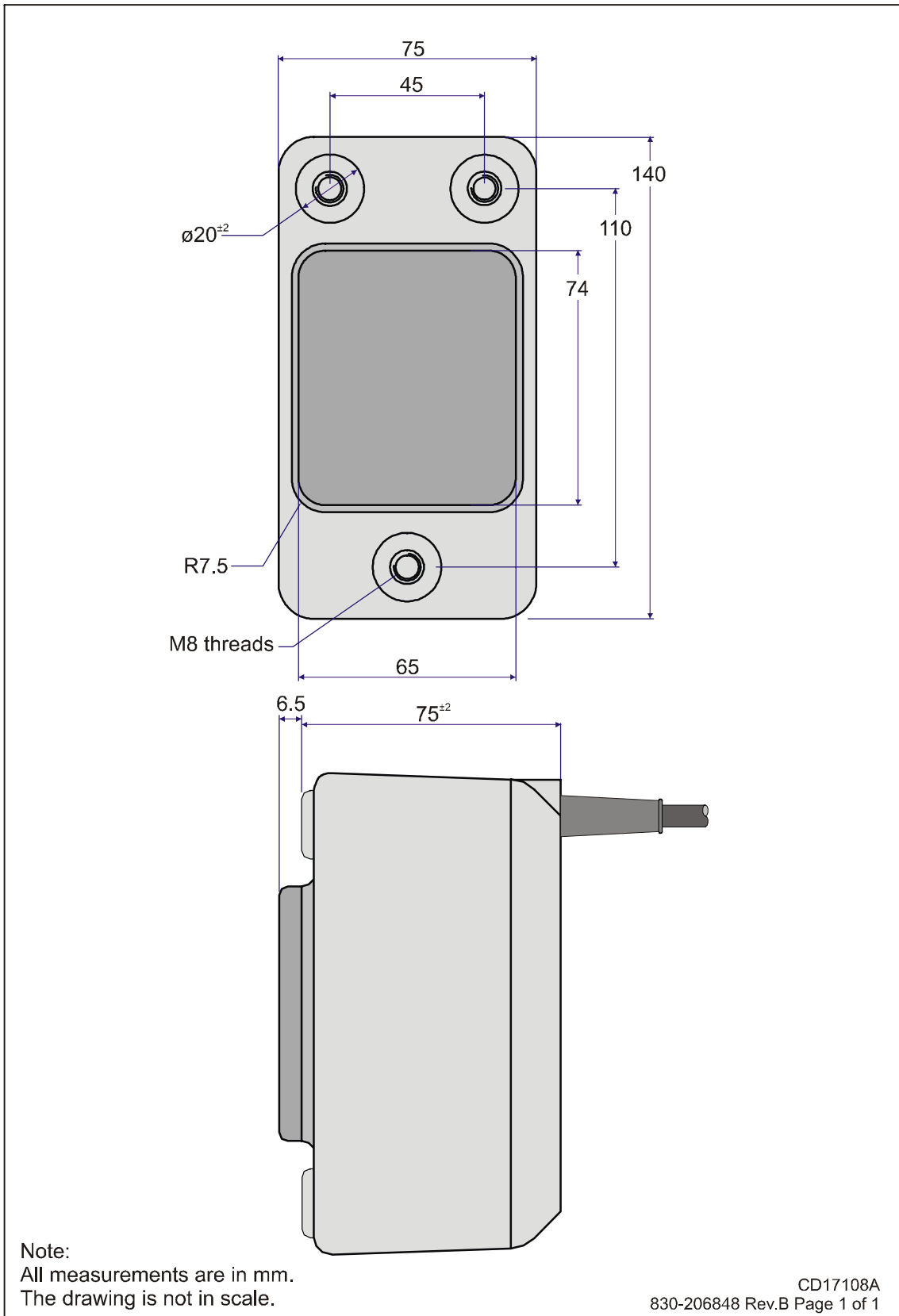
Cable shielding must be continuous. The shielding is terminated in the cabinet and must not be grounded in the junction boxes.

In order to minimize electrical interference, Simrad strongly recommends that the hydrophone cable is installed in a metal conduit between the hydrophone and the PI cabinet.

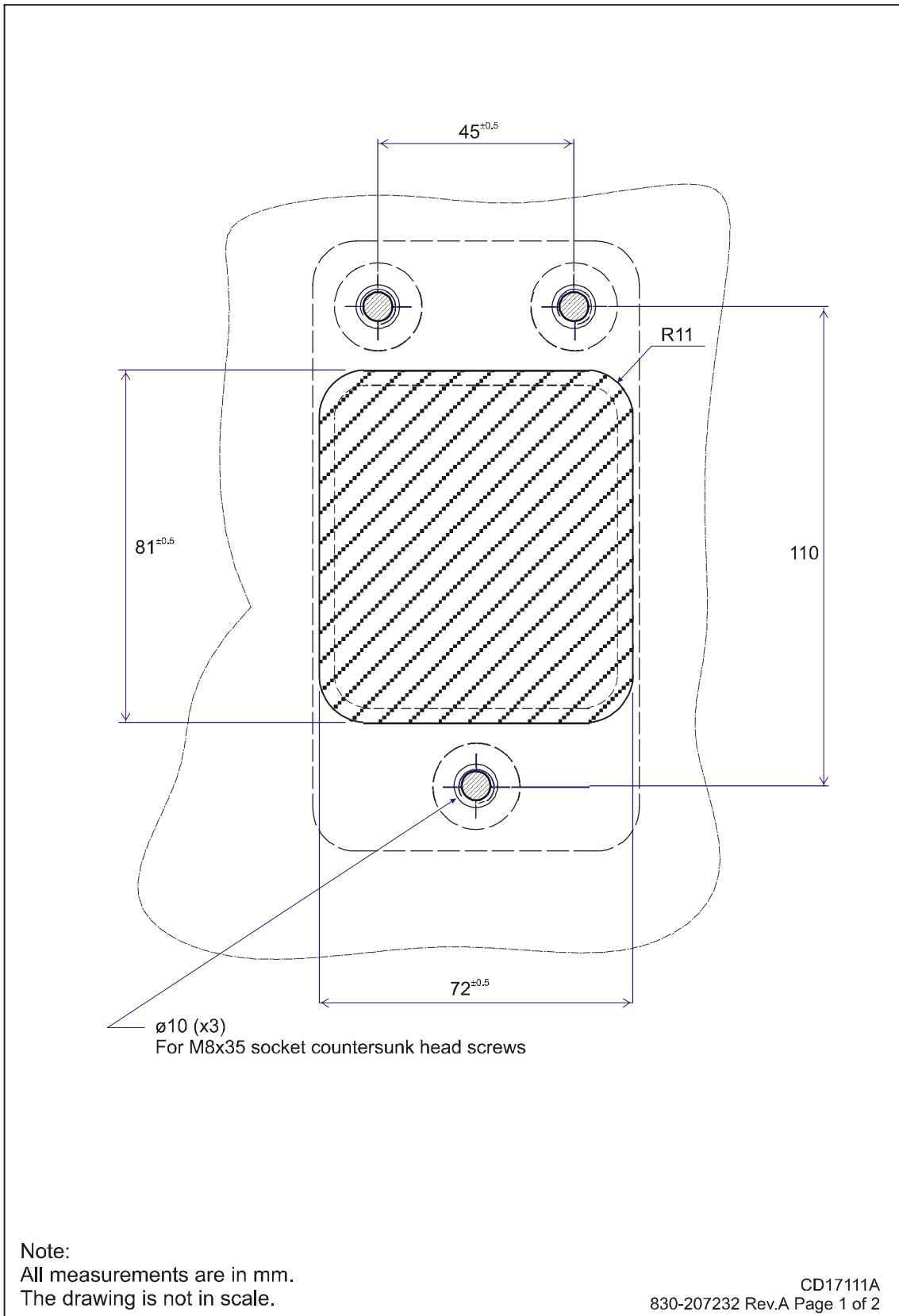
Installation drawings

Observe the following drawings. The drawings are also available on electronic format (DWG or PDF), consult your local dealer.

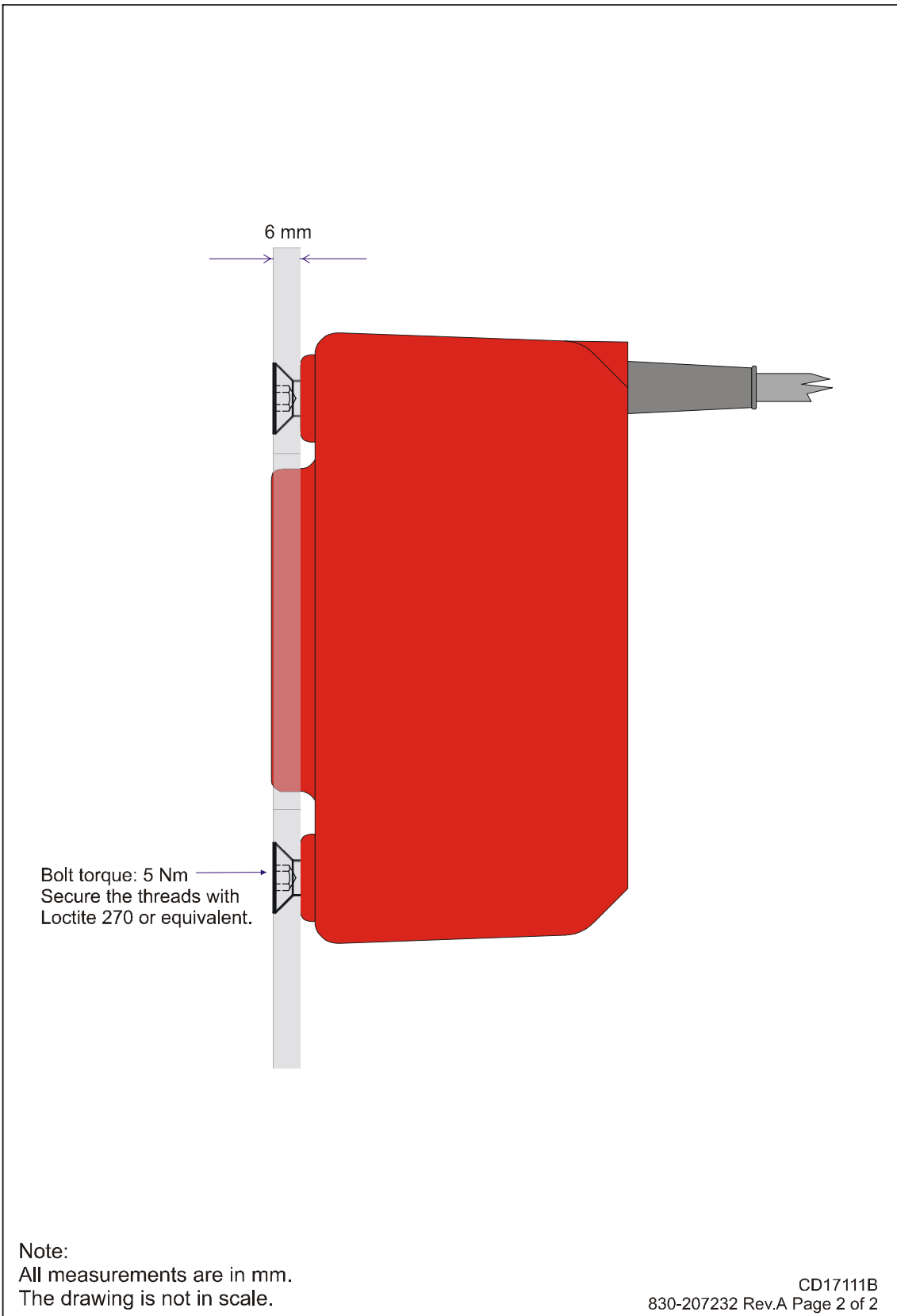
- *PI Trawl hydrophone, outline dimensions, page 33*
- *PI Trawl hydrophone, cut-out, page 34*
- *PI Trawl hydrophone, mounting flange, page 36*
- *Free standing hydrophone in blister, page 38*
- *Hydrophone in keel mounted shoes, page 40*

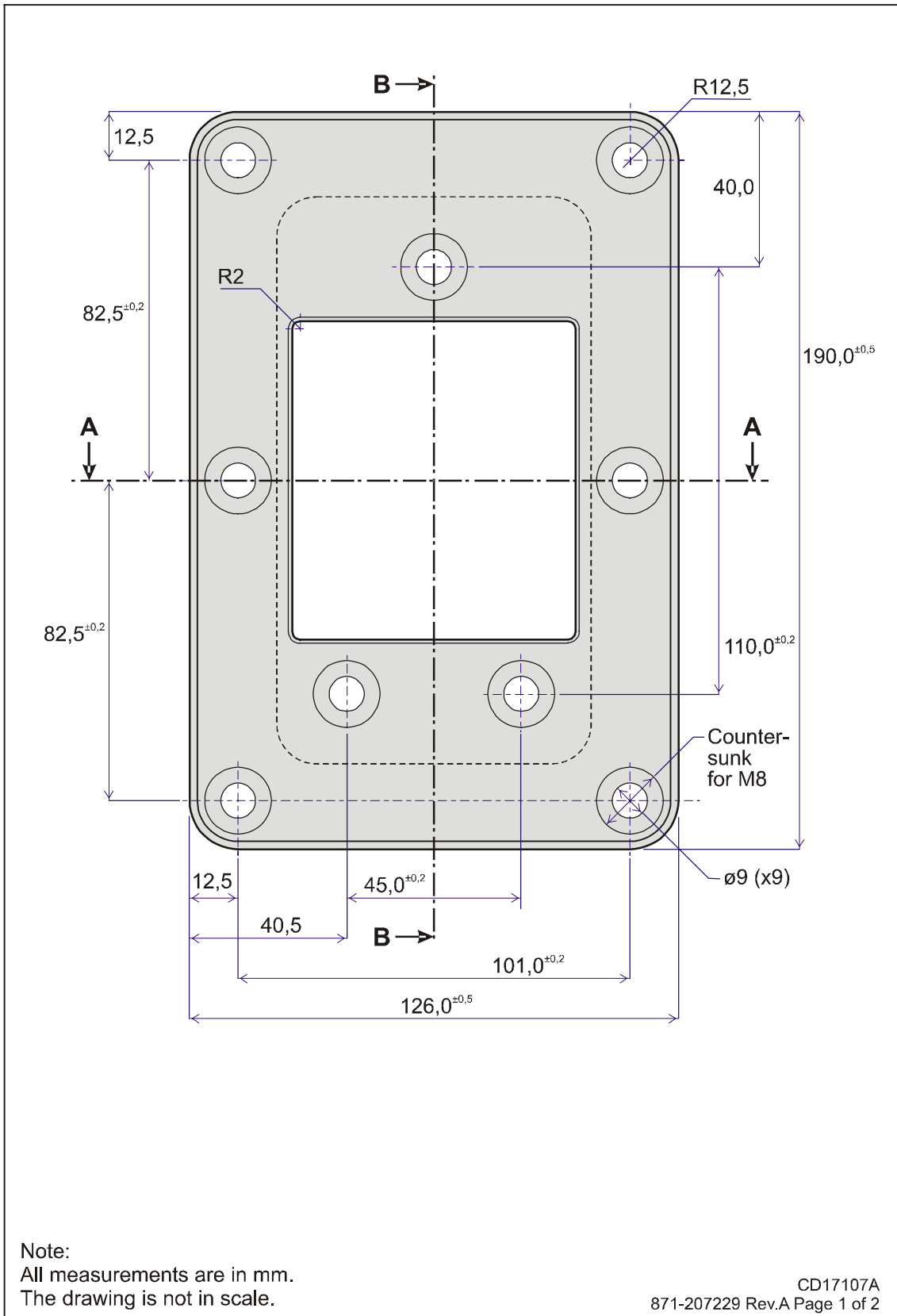


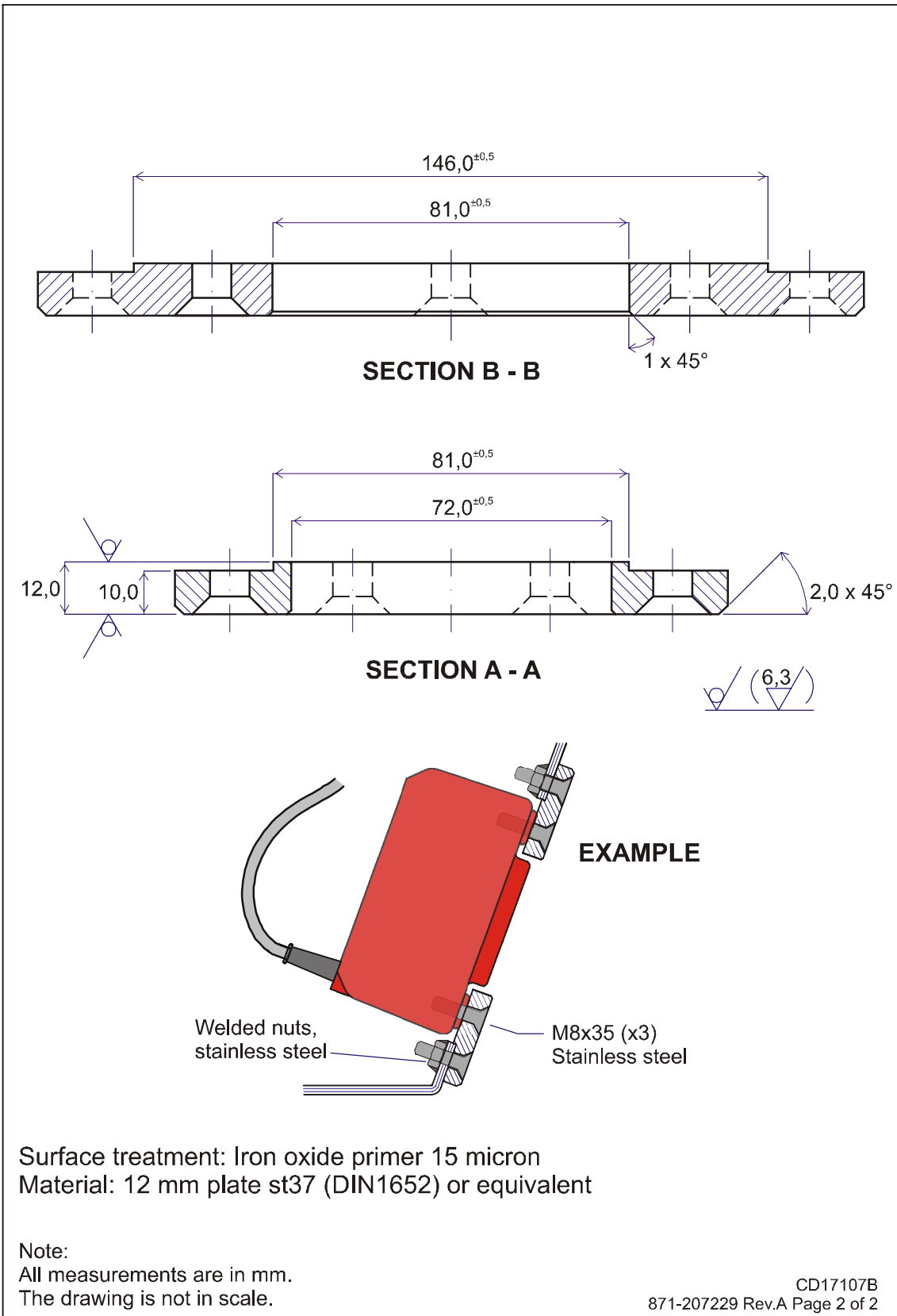
PI Trawl hydrophone - Outline dimensions

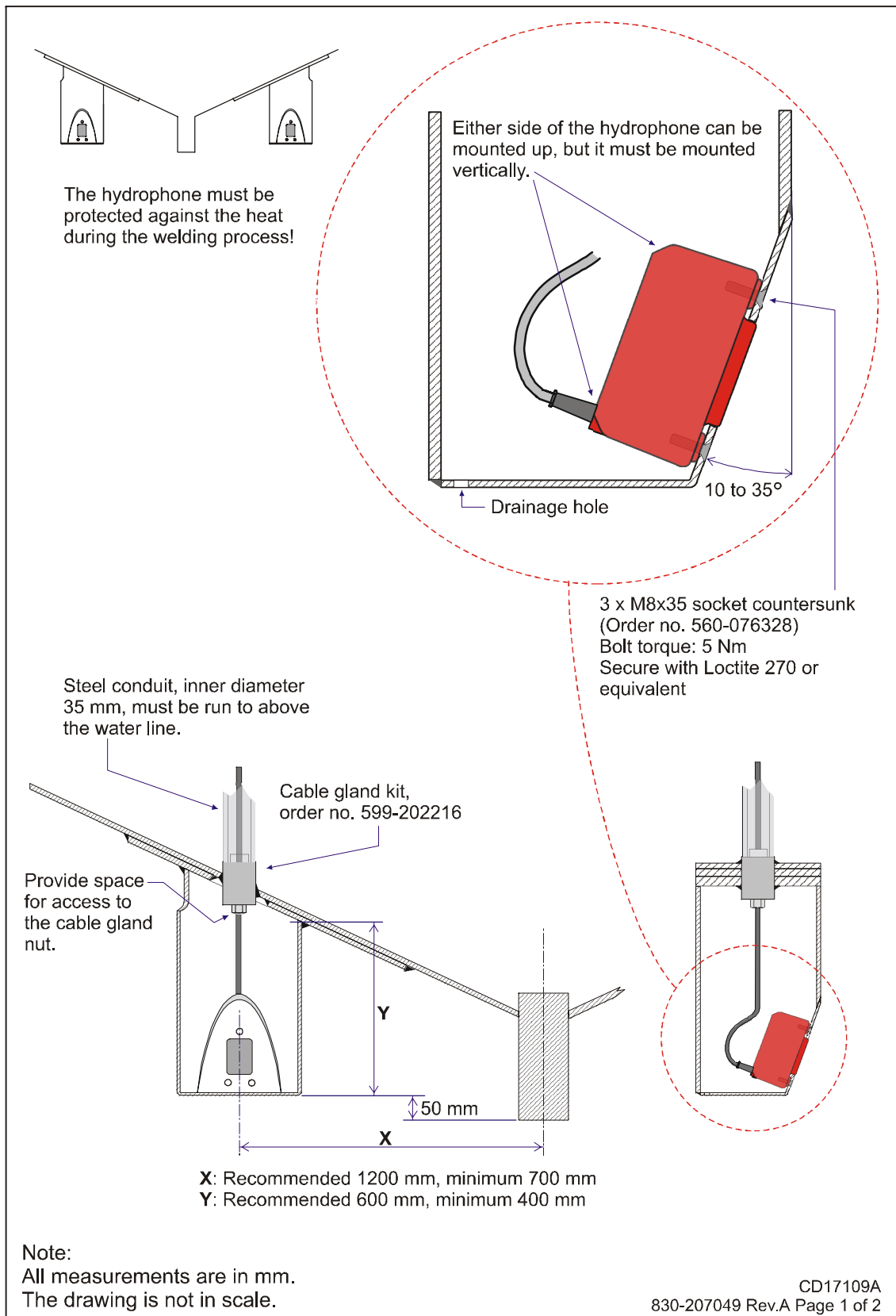


PI Trawl hydrophone - Cut-out - Page 1

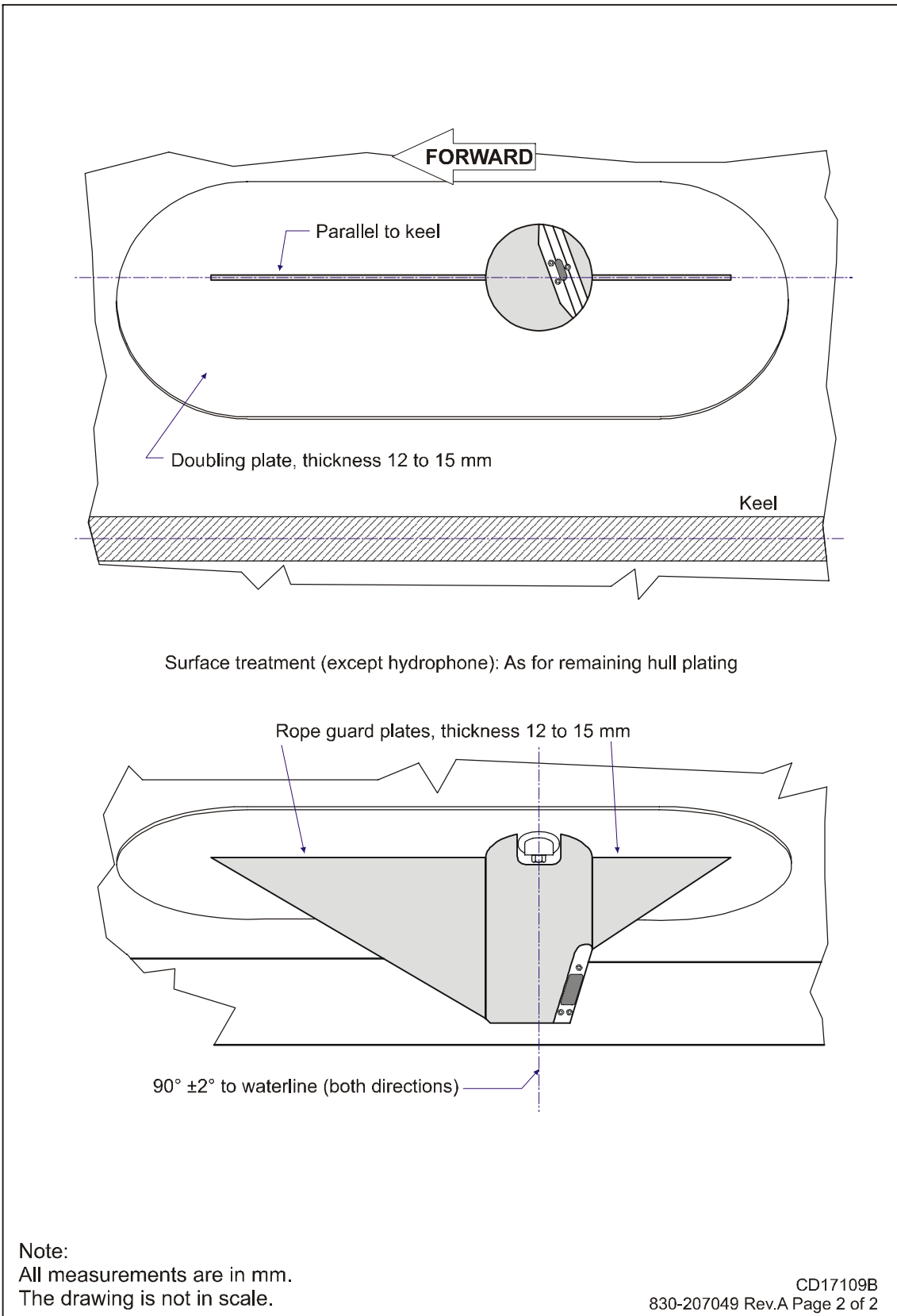




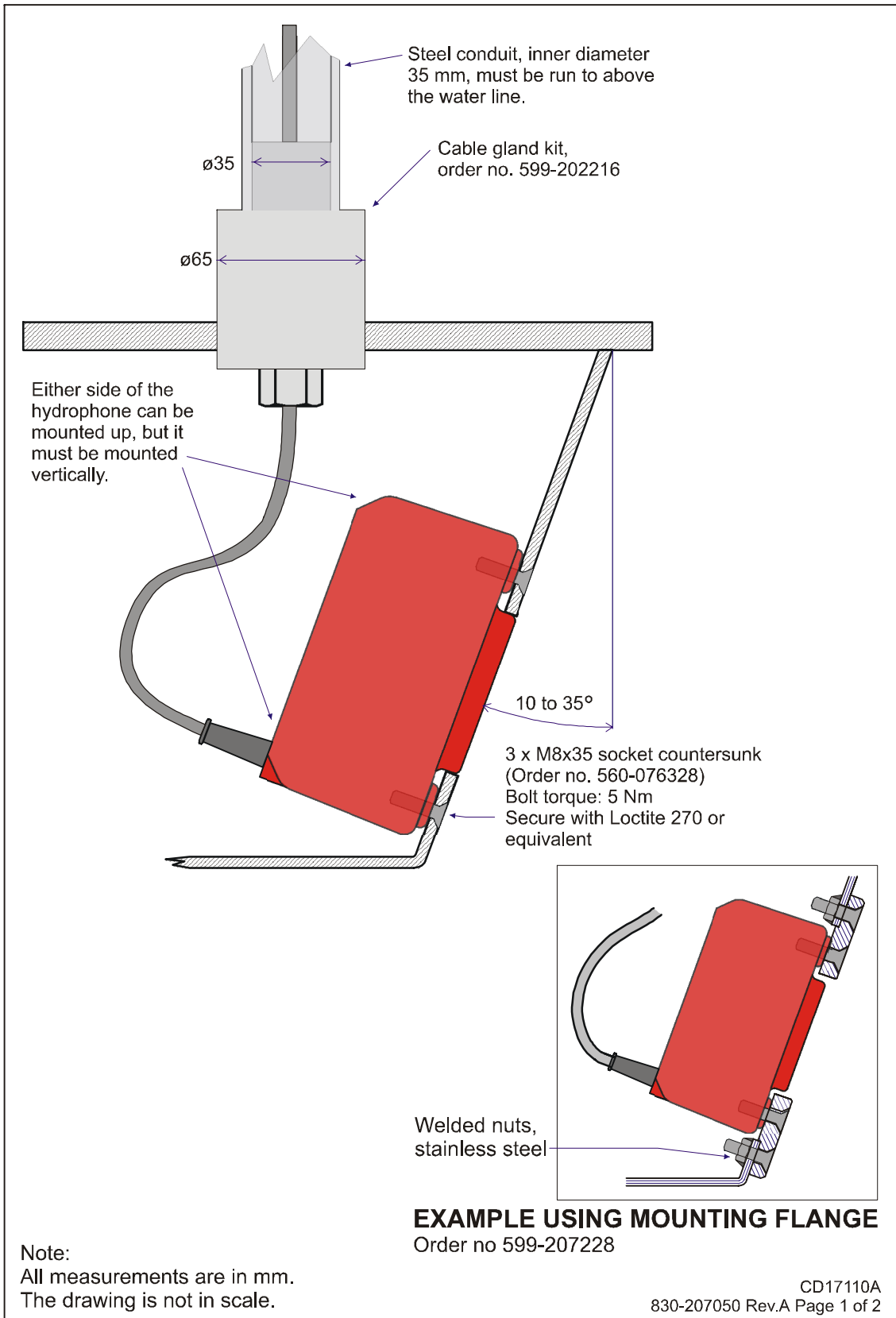


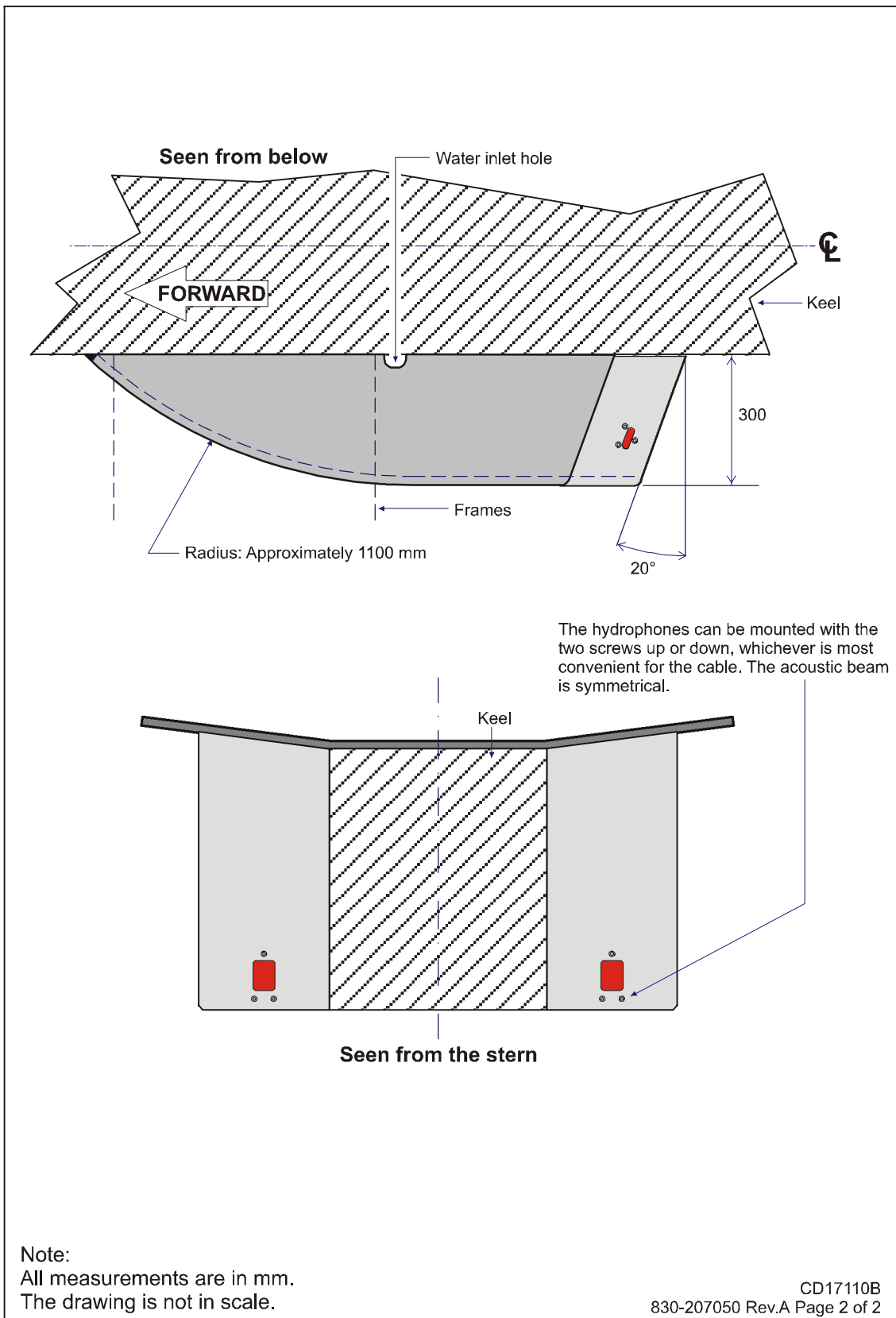


PI Trawl hydrophone in blister - Arrangement drawing - Page 1



PI Trawl hydrophone in blister - Arrangement drawing - Page 2





PI Trawl hydrophone in keel mounted shoes - Arrangement drawing - Page 2

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