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DISABLED SUBMARINE. REQUIREMENTS FOR EMPLOYMENT OF U.S. NAVY SUBMARINE RESCUE SYSTEMS

Navy Ship Systems Command
Washington, D.C.

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★ DISABLED SUBMARINE ★

REQUIREMENTS FOR EMPLOYMENT OF U.S. NAVY SUBMARINE RESCUE SYSTEMS

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DEPARTMENT OF THE NAVY
NAVAL SHIP SYSTEMS COMMAND
WASHINGTON, D.C.

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SECTION 1

INTRODUCTION

1.1 PURPOSE

The purpose of this document is to provide information concerning the U.S. Navy's capabilities in submarine rescue and to outline the requirements to make a submarine compatible with this capability.

1.2 RESCUE SYSTEMS AVAILABLE

The U.S. Navy submarine rescue system capability consists of the following:

- The Submarine Rescue Chamber (SRC) is capable of rescuing personnel from a stricken submarine to depths of 850 feet (259 meters). The SRC is a McCann Diving Bell, with life support provided by the surface support ship. (The SRC is normally operated from U.S. Navy ASR-type ships.) Rescue by SRC requires a mating surface on the submarine and a haul-down cable attached to the submarine hatch. Detailed information on the SRC Rescue System is presented in Section 2 of this document.

- The Submarine Rescue Fly-Away Kit is an air-transportable SRC with necessary equipment to conduct rescue work to depths of 400 feet (122 meters). The Fly-Away Kit can be operated from any ship capable of on-loading the equipment. In the event the selected ship is not equipped to handle an 11-ton (10 metric ton) load over the side, the SRC in the kit can be rigged for towing. The Submarine Rescue Fly-Away Kit detail information is contained in Section 3.

- The Deep Submergence Rescue Vehicles (DSRVs), currently in a test and evaluation phase, are capable of submarine rescue to depths of 2000 feet. The DSRV can be transferred to the scene and operated from a specially configured mother submarine, ASR-21 class ships, or in special situations from a ship of opportunity. Section 4 of this document covers the DSRV Rescue System details.

1.3 RESCUE SYSTEMS ALERT STATUS

The three submarine rescue systems are maintained in a ready status as follows:

- The SRC aboard ASR-type ships is fully ready for rescue operations unless the ASR is undergoing a period of refit or maintenance. At all times at least one ASR on each coast of the United States is maintained in a condition of readiness to respond within 24 hours of notification for submarine rescue operations.

- The Fly-Away Kit is maintained in a ready status at the U.S. Naval Base, Pearl Harbor, Hawaii, palletized and ready for shipment to a port near the scene of a disabled submarine. The kit is exercised periodically. During the exercise period some delays could be expected in palletizing the equipment and preparing for shipment.

- The DSRV Rescue System is currently in a test and evaluation phase which is scheduled to complete in 1974. Alert status policy has not been formulated. Because DSRV maintenance periods will be periodically scheduled between U.S. submarine sea trials, there may be times when the DSRV will not be ready to respond to disabled submarine (DISSUB) incidents on short notice.

1.4 PRELIMINARY REQUIREMENTS

Utilization of any of the Rescue Systems requires that physical compatibility must exist primarily in the areas of the submarine's mating surface, the submarine hatch, and the means of connection between the Rescue System and the submarine.

The submarine must have a flat mating surface large enough and of sufficient strength to accept the candidate Rescue System's mating surface with its attendant loading. There must be no obstructions that would interfere with mating. The hatch must be of such a configuration as not to interfere with the rescue unit and it must permit exit from the submarine into the rescue unit when the two are mated. A means of connecting to the submarine hatch must be provided to ensure movement of the rescue unit to and seating directly over the submarine hatch. Additional means are necessary to permit securing the rescue unit to the submarine during the transfer operations. Details of these and other requirements of each of the Rescue Systems are delineated in Sections 2, 3, and 4.

The submarine features or modifications required to permit utilization of any one of the three Rescue Systems are slightly different from those required for the other two systems. By meeting the most stringent requirements, those for use of the DSRV system, submarines are capable of using all three systems.

SECTION 2

SUBMARINE RESCUE CHAMBER/ASR SYSTEM

2.1 DESCRIPTION

2.1.1 Mission

The mission of the Submarine Rescue Chamber/ASR System is to provide a capability to effect the rescue of personnel from a disabled submarine submerged at depths to 850 feet (259 meters).

2.1.2 System Description

The Submarine Rescue Chamber/ASR System consists of a Submarine Rescue Chamber (SRC) capable of withstanding the pressures of 850-foot depths supported by a Submarine Rescue Ship (ASR). The SRC, Figure 2-1*, is made up of an upper chamber that houses the operators and rescued personnel in a dry environment at atmospheric pressure, and a lower chamber open to the sea at the bottom. The lower chamber has a flat seating surface fitted with a rubber gasket for mating with a disabled submarine. The chambers are connected by a pressure-tight hatch. Air and other support services are supplied to the SRC by the ASR. The SRC is connected to the submarine by a cable and is capable of vertical movement through operation of an integral haul-down winch and by control of buoyancy.

Under normal circumstances the SRC can transport six rescuees and two operators per trip from a disabled submarine.

2.1.3 System Operation

After arrival at the scene and upon locating the distressed submarine, the Submarine Rescue Ship (ASR) will establish a four-point moor so that it is nearly directly over the submarine's position. A haul-down cable is required that may be attached to the submarine hatch to be used for escape. On most U.S. submarines this cable and a messenger buoy to carry the free end to the surface are permanently installed on the submarine for deployment in case of a casualty. The

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*All figures where measurements are used are presented in a and b versions so that metric measures may be shown as well as English.

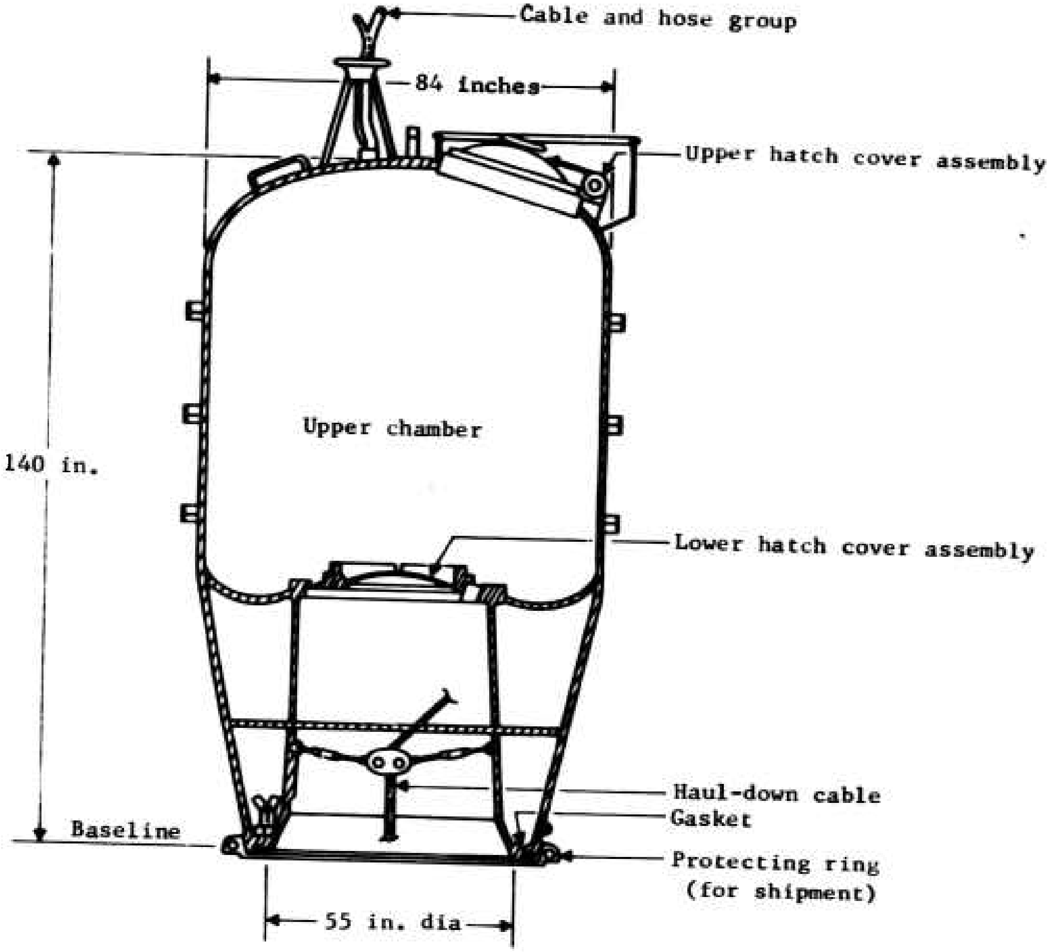


FIGURE 2-1a. SUBMARINE RESCUE CHAMBER

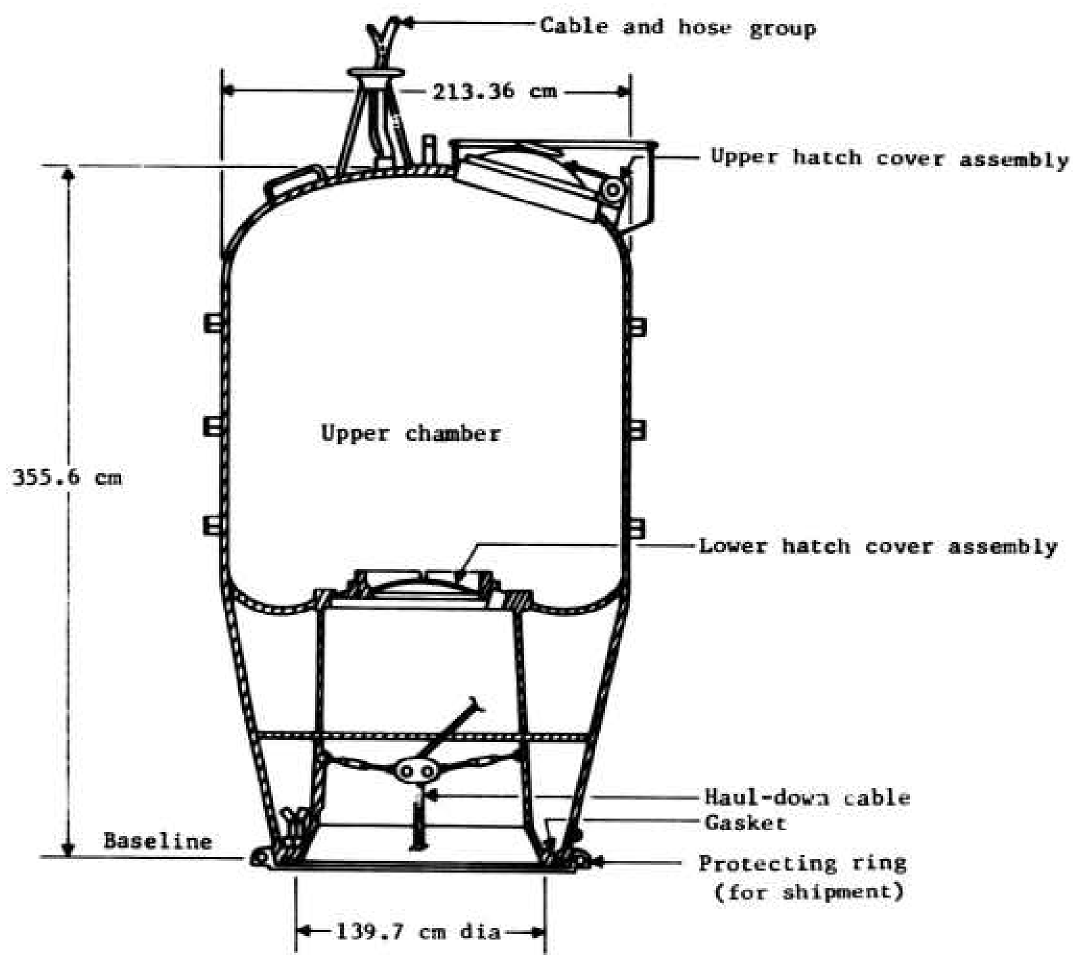


FIGURE 2-1b. SUBMARINE RESCUE CHAMBER

upper end of the cable is captured by the ASR and attached to the SRC as part of the SRC preparation. Details of cable and haul-down are covered in 2.2.3. Following preparation, the SRC is lowered into the water and secured alongside the ASR. At this point the SRC operators board through the top hatch, secure the hatch, and prepare for descent.

The positively buoyant SRC will power its way along the haul-down cable to the submarine. The mechanical supporting cable used initially to lower the SRC into the water will be slacked during the haul-down operation. Additional cables and hoses for air, electrical power, and communications connect the SRC to the surface support ship.

The SRC will winch itself down to a mating position with the submarine, centering over the submarine's hatch, after which the lower chamber of the SRC will be blown with high pressure air to remove the water. The lower chamber will then be vented, causing the greater external pressure to force the SRC against the rescue seat, compress the gasket, and effect a seal. The pressures in the upper and lower chambers are then equalized and the lower SRC hatch opened. The SRC will then be further secured to the submarine by one of the SRC operators, using the holding down bolts provided.

The SRC is primarily intended for use in rescue operations in which the pressure within the submarine is at or near atmospheric. However, under emergency conditions the SRC can be pressurized to effect a rescue from a disabled submarine with internal pressures up to 290 feet (88.4 meters) equivalent depth. Pressures greater than this could be harmful or cause loss of the system. Therefore it is necessary that atmospheric conditions within the submarine be known before the submarine hatch is opened. This subject is discussed further in subsection 2.2.5.

After atmospheric conditions in the submarine are checked, the submarine hatch will be opened to permit transfer from the submarine into the SRC. Under the control of the operators the SRC will return to the surface to off-load the personnel and then continue rescue operations as necessary.

2.2 REQUIREMENTS FOR SUBMARINE

2.2.1 Rescue Seat

The SRC-to-submarine mating surface on the SRC is a construction around the bottom of the lower chamber consisting of a rubber gasket and a steel retaining ring. The mating surface details are shown in Figure 2-2. The 1 3/4-inch-wide (4.445 centimeters) pure rubber gasket at the mating surface provides a seal against sea pressure when the SRC is mated to the submarine.

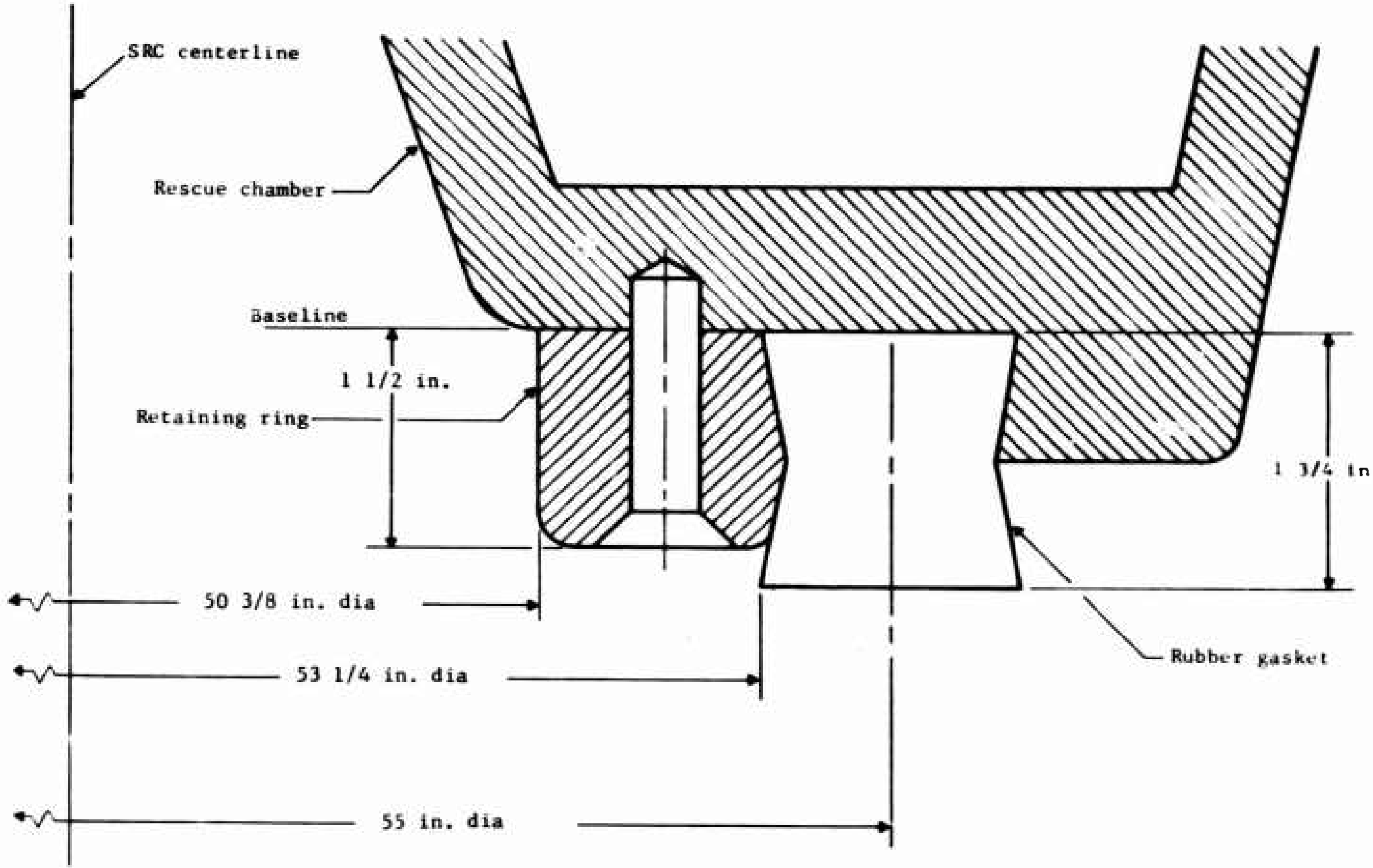


FIGURE 2-2a. SRC MATING SURFACE DETAILS

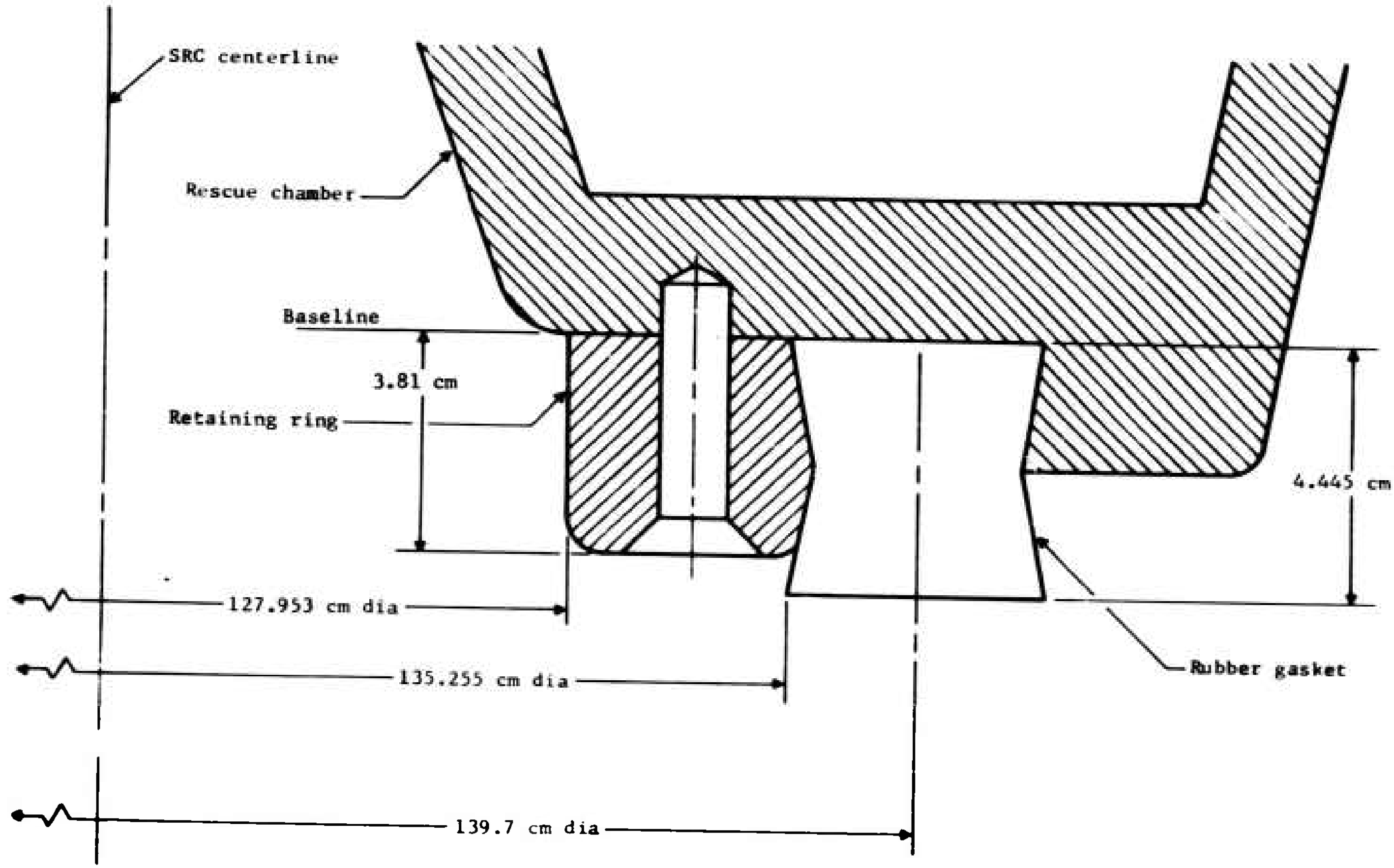


FIGURE 2-2b. SRC MATING SURFACE DETAILS

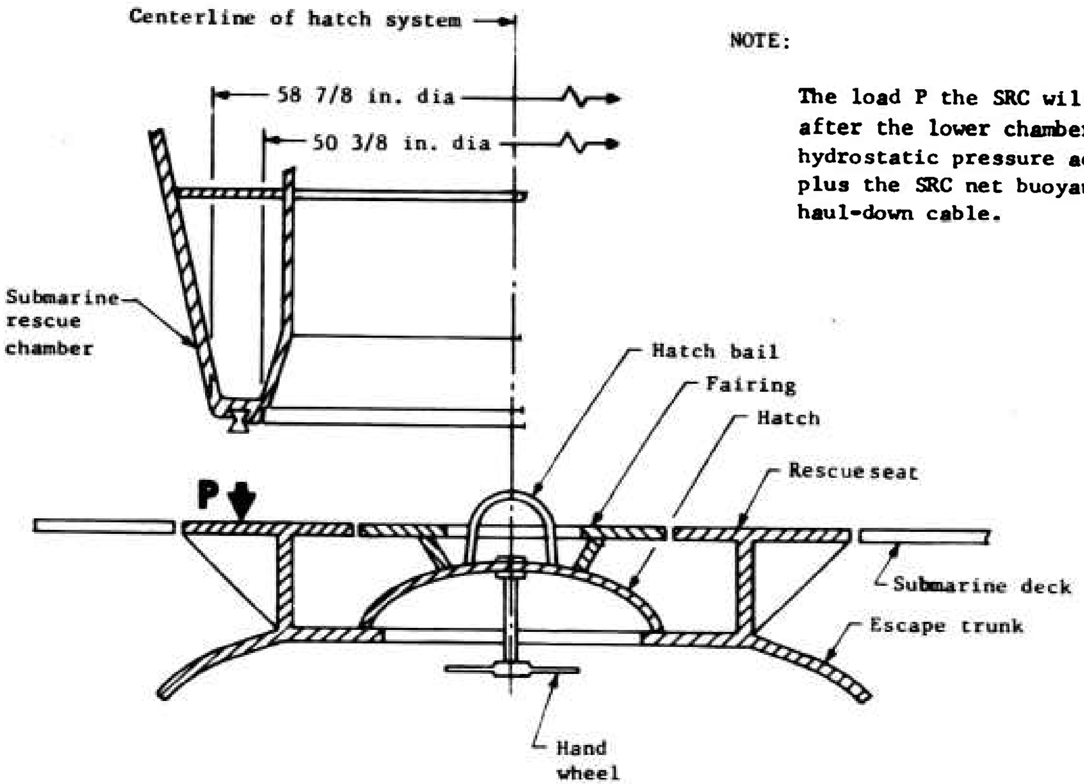
The disabled submarine must have an equivalent mating surface around its hatch to be used for the rescue. This flat "rescue seat" on which the SRC will rest must be a reinforced steel area around the submarine hatch opening extending over the area intended for mating. The strength required of the rescue seat depends on the depth at which the mating will be performed. Since the system has a depth capability of 850 feet (259 meters), the static load on the rescue seat after dewatering and venting of the lower chamber of the SRC will be the hydrostatic pressure at 850 feet acting over the corresponding area exposed to the lower pressure plus the net buoyancy of the chamber and the force exerted by the haul-down cable. This load may be as great as 893,000 pounds (405,065 kilograms). Seat loading of 3640 pounds per square inch (psi) (251 bars) will therefore result if the mating surfaces are perfectly flat. A safety factor should be utilized to allow for surface irregularities, corrosion, and minor impact loads. The strengthened area of the rescue seat should have a minimum outside diameter of 70 inches (177.8 centimeters), and a maximum inside diameter of 46 inches (116.8 centimeters), centered on the submarine hatch vertical centerline.

The rubber gasket at the SRC mating surface is designed to seal rescue seat surface irregularities such as scratches, nicks, and waviness. The gasket is capable of sealing gaps up to 1/8 inch (0.3175 centimeters). The seal limitation requires the rescue seat to be flat within 1/8 inch. That is, the maximum departure of any part of the rescue seat mating surface must not exceed 1/8 inch from the plane of the SRC mating surface (which is assumed to be perfectly flat) in its mated attitude.

Figure 2-3 illustrates the mating of an SRC with a typical submarine hatch.

2.2.2 Projections and Obstructions

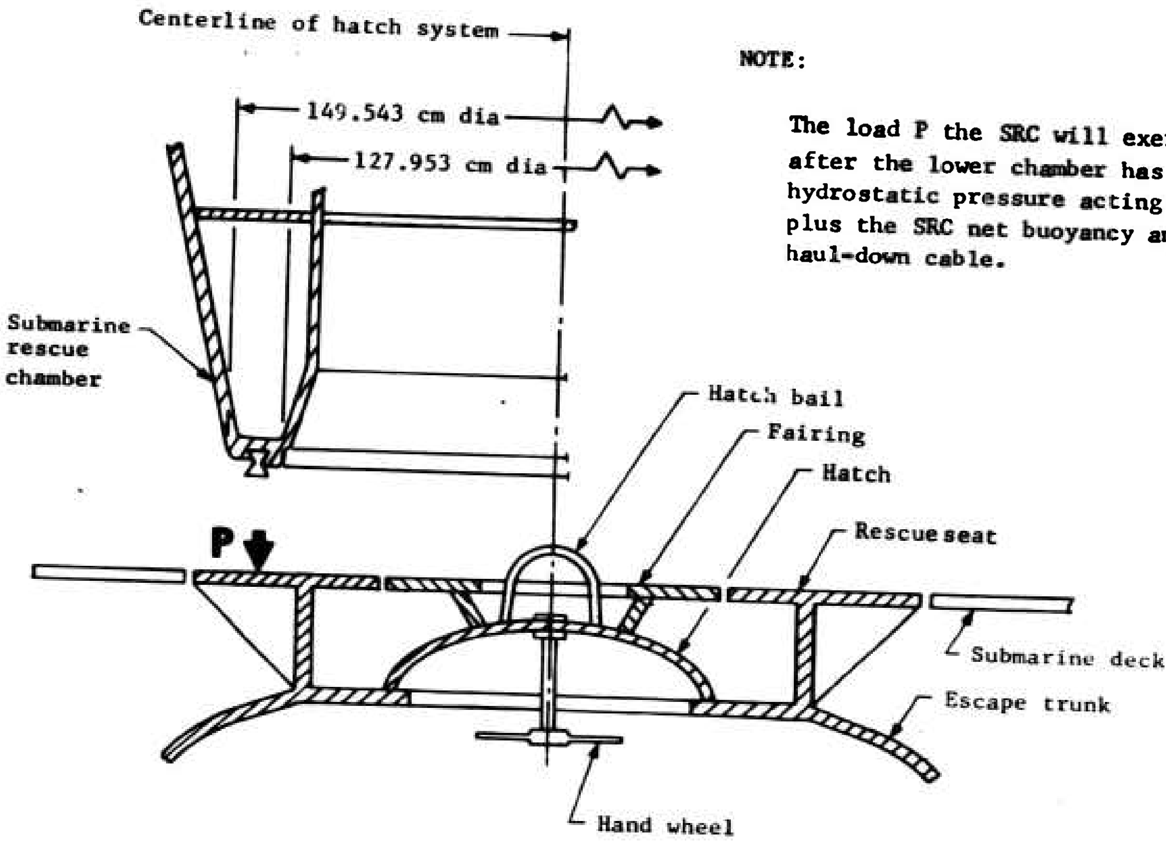
Projections and obstructions above the hull of the disabled submarine in the vicinity of the rescue seat present hazards to the SRC mating surface and seal. Damage to these systems could prevent mating. In the area of the submarine rescue hatch there can be no projections above the submarine hull which would impact an SRC descending vertically to a submarine that is inclined 30° from vertical in either the fore-and-aft or athwartships planes, or both. Information on obstructions outside of this cleared area must be available as necessary for the briefing of the SRC operators in the event the submarine attitude suggests these obstructions may interfere with the SRC.



NOTE:

The load P the SRC will exert on the rescue seat after the lower chamber has been dewatered is hydrostatic pressure acting over the sealed area plus the SRC net buoyancy and the tension in the haul-down cable.

FIGURE 2-3a. TYPICAL DISABLED SUBMARINE RESCUE SEAT



NOTE:

The load P the SRC will exert on the rescue seat after the lower chamber has been dewatered is hydrostatic pressure acting over the sealed area plus the SRC net buoyancy and the tension in the haul-down cable.

FIGURE 2-3b. TYPICAL DISABLED SUBMARINE RESCUE SEAT

2.2.3 Haul-Down System

The SRC is equipped with a haul-down mechanism to permit the chamber to winch itself down to the submarine hatch. A cable must be attached to the center of the submarine hatch; the upper end of the cable must be available to the surface support ship (ASR) before the SRC is lowered into the water. The Rescue System personnel will attach the upper end of the cable to a winch in the SRC's lower chamber.

The cable and cable fixtures must be capable of withstanding a load of approximately 15,000 pounds (6804 kilograms). The cable must be of corrosion resistant material without splices that could interfere with the haul-in mechanisms and must have a diameter of 7/16 ± 1/16 inch (1.11125 ± 0.15875 centimeters).

If the cable is not permanently installed on the submarine, a strengthened connection point must be available at the hatch to permit hook-up of a haul-down cable by external means. The maximum depth at which this can be accomplished is a function of ASR maximum deep diving capability, and is generally about 400 feet (122 meters). The connection point should be as nearly centered on the hatch as possible. This padeye or bail must be able to withstand a load of 12,500 pounds (5670 kilograms).

A cable fairleader is located in the SRC lower chamber 25 1/2 inches (64.77 centimeters) above the plane of the SRC mating surface. The padeye/bail and fittings, cable swagging, etc., must not extend higher than this distance during haul-down if a seal is to be made.

2.2.4 Hatch Construction

To allow survivors to leave the submarine, its hatch must be of such size that it can be opened without interference into the lower chamber of the SRC while the SRC is mated to the submarine. SRC lower chamber minimum internal clearances are shown in Figure 2-4.

The hatch area should include tiedown attachment points so that the SRC can be firmly secured to the submarine before the haul-down cable is slacked. The SRC has four holding down rods with shackles on their ends which will be emplaced by the rescue crew before the hatch is opened. The tiedown points should be padeyes or staples with openings through which the 1 1/8-inch-diameter (2.858 centimeters) pins of the holding down rod shackles can be passed and secured. They must be placed around the submarine hatch inside the area of SRC/submarine mating (orientation is not critical). The tiedown attachments must be individually capable of withstanding a holding down load of 10,000 pounds (4536 kilograms).

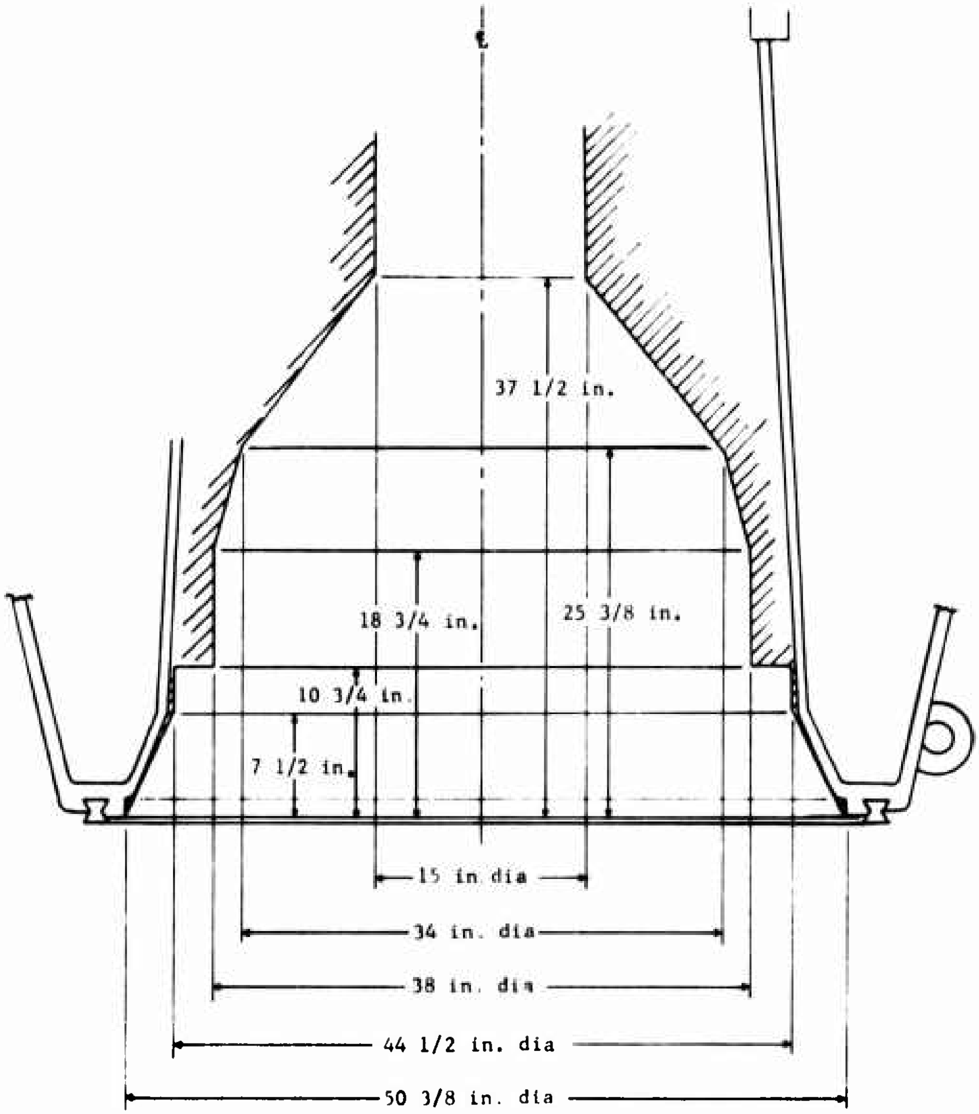


FIGURE 2-4a. SRC LOWER CHAMBER CLEARANCE ENVELOPE FOR SUBMARINE HATCH

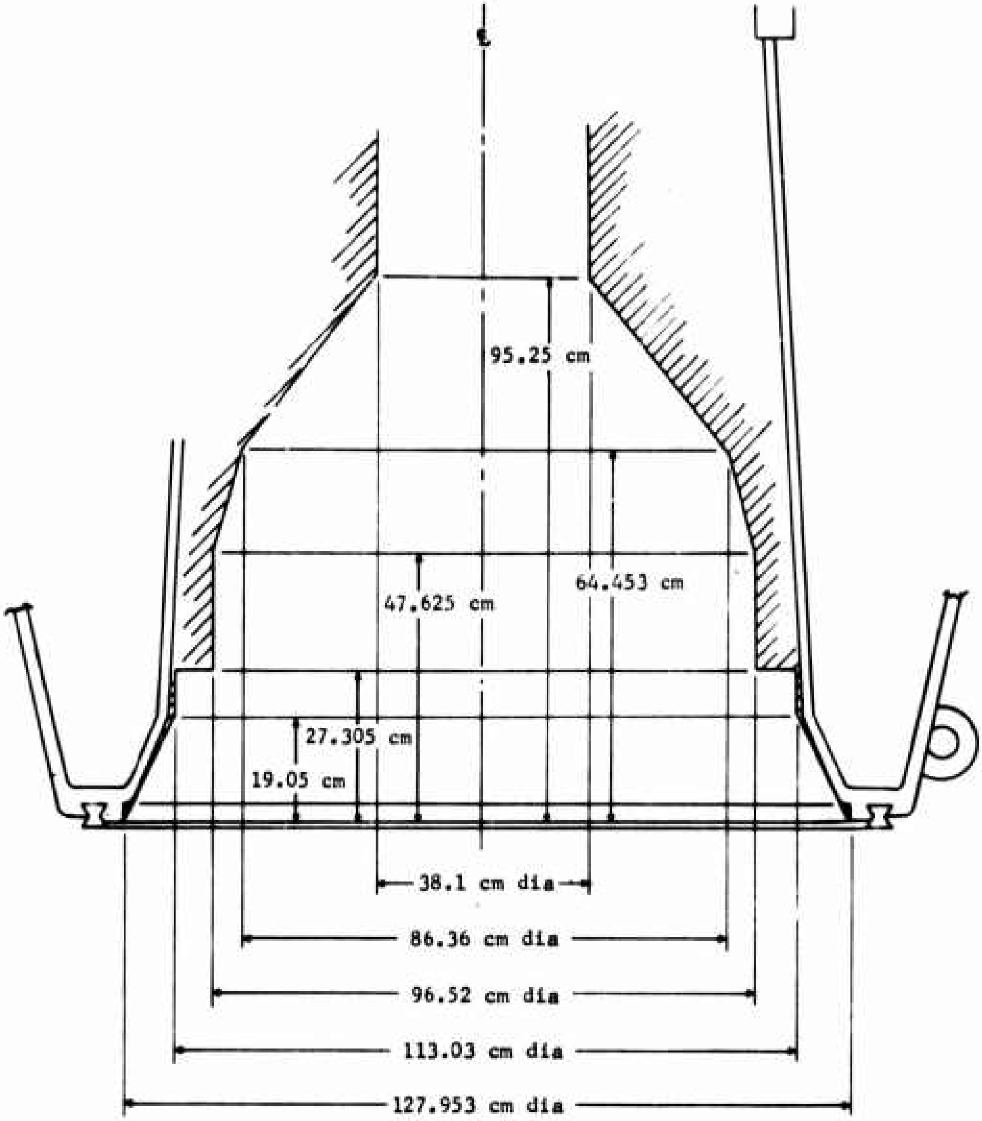


FIGURE 2-4b. SRC LOWER CHAMBER CLEARANCE ENVELOPE FOR SUBMARINE HATCH

2.2.5 Pressure Determination

Pressure differential, if any, between the SRC and the disabled submarine must be equalized before the submarine's hatch can be opened. As previously discussed (subsection 2.1.3), the SRC can, under emergency conditions, equalize pressures between the disabled submarine and the SRC up to 290 feet (88.4 meters) equivalent depth for the purpose of effecting a rescue.

2.2.6 Rescue Vehicle Ballast Exchange

The SRC carries portable ballast consisting of lead pigs. Water ballast cans can also be carried as portable ballast. In order to maintain proper SRC buoyancy, the portable ballast will be placed in the submarine after the rescuees are taken aboard.

2.2.7 Personnel and Communications

No specialized training of submarine personnel is required in order to make use of the SRC/ASR Rescue System. Knowledge of English is not required.

Communications between the SRC or ASR and the disabled submarine would be most beneficial to the rescue operation, but the rescue can be accomplished without communication. In accordance with the restrictions noted in 2.2.5, it must be recognized that if communications do not exist, some means must be available to determine conditions in the submarine.

The SRC has a U.S. Navy single-sideband underwater telephone system AN/BQC-1 which could be used for communication with the submarine. This system, compatible with most other underwater telephone systems, has a carrier frequency of 8.3 KHz with a sideband modulation out to 11.1 KHz.

SECTION 3

SUBMARINE RESCUE FLY-AWAY KIT

3.1 DESCRIPTION

3.1.1 Mission

The mission of the Submarine Rescue Fly-Away Kit is to provide a capability to effect the rescue of personnel from a disabled submerged submarine when a Submarine Rescue Ship (ASR) is not immediately available.

3.1.2 System Description

The Submarine Rescue Fly-Away Kit, Figure 3-1, is an air-transportable system including a Submarine Rescue Chamber (SRC) similar to that of the SRC/ASR system described in Section 2. In place of the ASR as the surface support ship, virtually any ship can be used. This is made possible by the inclusion in the kit of a diesel-powered air compressor, hoses, and other ancillary equipment. To ensure that the support ship is able to maintain a proper position during the rescue work, a four-point mooring system complete with anchors, buoys, and mooring lines is included in the kit.

All equipment in the kit is palletized and ready for shipment in U.S. aircraft to a port near the scene of the submarine incident. A complete operating crew of approximately 21 officers and men is dispatched with the equipment kit.

The rescue depth capability of this system is presently limited to 400 feet (122 meters).

3.1.3 System Operation

System operation on the scene will be virtually identical to that described for SRC/ASR rescue. The kit equipment will be secured on the ship selected as the surface support ship. Using the mooring system provided in the kit, the ship will set up a four-point moor after arriving at the scene. The SRC will be lowered into the water using the ship's booms. In the event the selected ship is unable to handle a 22,000-pound (9979 kilograms) load over the side, the SRC will have been rigged for towing and then towed to the rescue site.

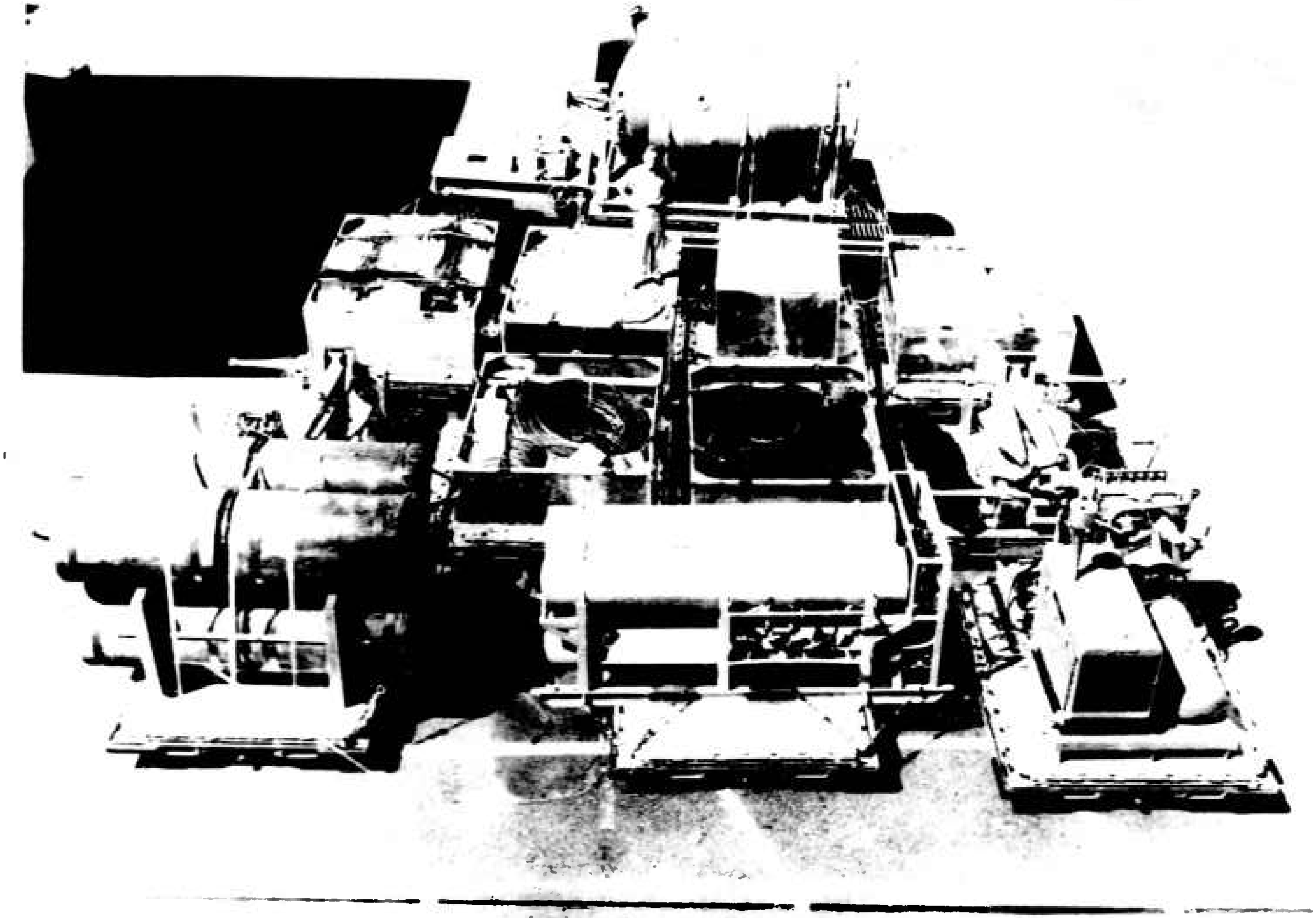


FIGURE -1. SUBMARINE RESCUE FLY-AWAY KIT

The system is self-sufficient with the exception of electrical power for lighting in the upper and lower chambers of the SRC. Approximately 10 amperes of 110-volt 60-Hz single-phase electrical power is required from the surface support ship.

All other operations are identical to those described for SRC/ASR rescue.

3.2 REQUIREMENTS FOR SUBMARINE

3.2.1 Rescue Seat

The physical requirements of the submarine's rescue seat are identical to those described for SRC/ASR rescue, except that the rescue depth limitation of 400 feet (122 meters) requires that the rescue seat be capable of supporting a loading of only 1800 psi (124.1 bars) instead of 3640 psi (251 bars).

3.2.2 Projections and Obstructions

Same as for SRC/ASR rescue.

3.2.3 Haul-Down System

Same as for SRC/ASR rescue except that divers with the Fly-Away Kit can dive only to 250 feet (76.2 meters).

3.2.4 Hatch Construction

Same as for SRC/ASR rescue.

3.2.5 Pressure Determination

Same as for SRC/ASR rescue.

3.2.6 Rescue Vehicle Ballast Exchange

The Fly-Away Kit utilizes water cans as portable ballast. In order to maintain proper SRC buoyancy, the ballast water will be placed in the submarine after taking rescuees aboard.

3.2.7 Personnel and Communications

Same as for SRC/ASR rescue except that the AN/BQC underwater telephone is not included in the kit.

3.3 AVAILABILITY AND DEPLOYMENT

3.3.1 Readiness and Initial Actions

The Submarine Rescue Fly-Away Kit is maintained at the U.S. Naval Base, Pearl Harbor, Hawaii. Standard procedures have been established to permit rapid deployment. Preparation for deployment commences with the first alert that the system may be required. The palletized Fly-Away Kit is loaded on board C-141 aircraft and transported with the necessary personnel to the desired location.

3.3.2 Movement to Disaster Scene

At the destination airfield the rescue chamber would be placed on its own trailer, which is part of the kit, for transport to the ship. The total weight of the chamber and its trailer is approximately 35,000 pounds (15,876 kilograms) with a length of 21 feet 10 inches (6.654 meters), a width of 10 feet 8 inches (3.251 meters), and a height of 13 feet (3.96 meters). A prime mover for the SRC trailer must be provided at the receiving airfield. The remainder of the equipment, with all items mounted on aircraft pallets, requires tractor-trailers or trucks of proper capacity to transport it.

In addition to the SRC trailer, Table 3-1 lists the pallets forming the Fly-Away Kit.

At the port designated, the system is loaded aboard and secured on the deck of the designated support ship. If the ship is not capable of handling the 11-ton (9979 kilograms) SRC over the side, the Fly-Away Kit personnel will prepare the chamber for towing by ship to the disaster site.

TABLE 3-1

PALLETIZED UNITS OF FLY-AWAY KIT

Pallet number	Weight		Dimensions[a]		Contents
	Pounds	Kilograms	Inches	Centimeters	
1	6,965	3,159	110 x 89	279.4 x 226	Mooring lines
2	6,845	3,105	110 x 89	279.4 x 226	Mooring lines
3	8,645	3,921	110 x 89	279.4 x 226	Mooring wire
4	6,705	3,041	110 x 89	279.4 x 226	Mooring wire
5	4,745	2,152	110 x 89	279.4 x 226	R/C hose and cable
6	5,530	2,508	110 x 89	279.4 x 226	General cargo
7	9,665	4,384	147 x 108	373.4 x 274.3	Anchor pack
8	9,665	4,384	147 x 108	373.4 x 274.3	Anchor pack
9	6,945	3,150	156 x 89	396.2 x 226	Air banks
10	6,045	2,742	110 x 89	279.4 x 226	Air compressor
11	22,000	9,979	168 x 108	426.7 x 274.3	Rescue chamber
12	7,665	3,477	156 x 89	396.2 x 226	Mooring buoys

[a]The maximum height dimension of concern, the rescue chamber as mounted on its trailer, is 156 inches (396.2 centimeters).

SECTION 4

DEEP SUBMERGENCE RESCUE VEHICLE

4.1 DESCRIPTION

4.1.1 Mission

The Deep Submergence Rescue Vehicle (DSRV) is designed to provide a worldwide quick-reaction capability to rescue personnel from a disabled submarine lying on the ocean floor to depths of 2000 feet.

4.1.2 Rescue System

The DSRV is a component of a Deep Submergence Rescue System developed by the U.S. Navy for rescuing personnel from disabled submarines (DISSUBs). The DSRV descends as a self-propelled vehicle from a support ship to the DISSUB to accomplish the rescue.

The Rescue System is air transportable. It consists of the DSRV, a Land Transport Vehicle (LTV) on which the DSRV is moved on land, a support van, miscellaneous support equipment, and spares. Three U.S. Air Force C-141 aircraft are required to transport it from its home base to an airfield near the port from which the rescue mission will be conducted. Certain U.S. Navy mother submarines (MS) have been specially equipped to transport the DSRV from the rescue port to the DISSUB location and to support the DSRV system at that location.

Although the MS is the primary means of on-site support for the DSRV, the U.S. Navy has also built two specially equipped submarine rescue ships (ASRs) to transport and support the DSRV. In addition, a capability is under development to use suitable ships of opportunity.

The DSRV is a submersible designed to mate with the rescue seat of a U.S. Navy DISSUB and remove the DISSUB crew. The DSRV can carry up to 24 rescuees and its three-man crew. Figure 4-1 shows the basic shape and certain details of the DSRV. The rescuees enter the DSRV through the skirt extending from the bottom of the DSRV after it mates with the DISSUB.

The DSRV is approximately 50 feet long (15.24 meters) and 8 feet in diameter (2.44 meters), and it weighs approximately 37.4 short tons (34.03 metric tons). Thrusters and a conventional propeller with

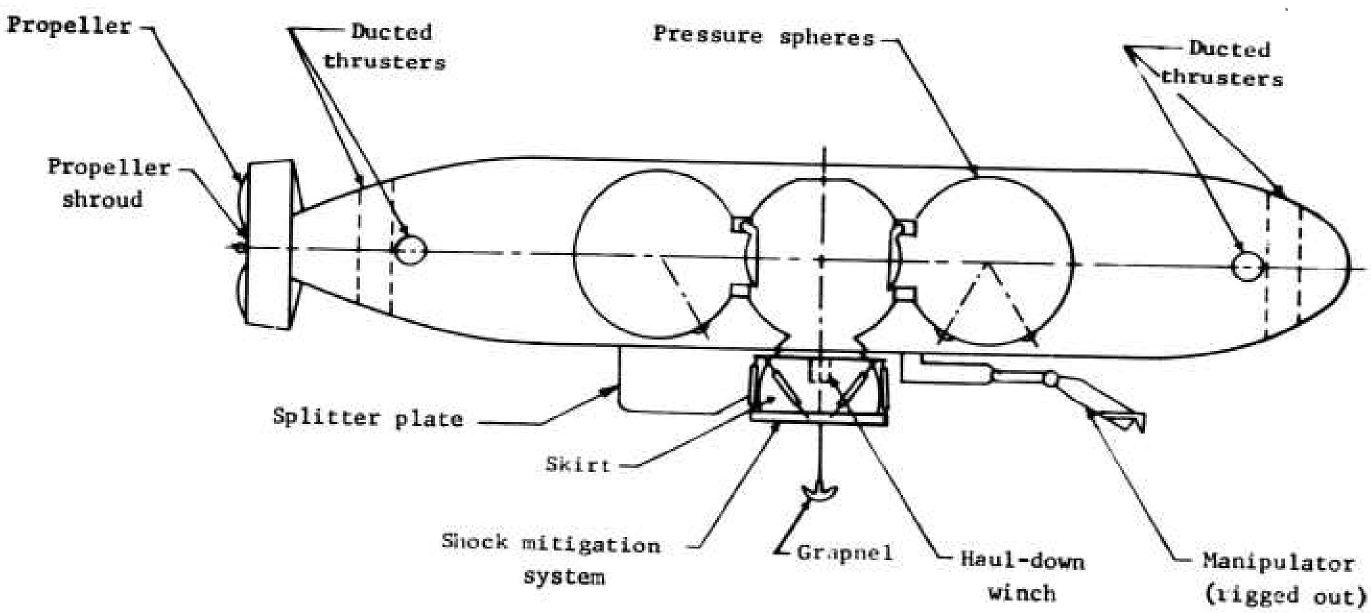


FIGURE 4-1. DEEP SUBMERGENCE RESCUE VEHICLE

a movable shroud provide propulsion and control of the DSRV. This system permits the DSRV to maneuver, hover, and mate with the rescue seat of a DISSUB. The DSRV is capable of mating with a DISSUB lying at inclination angles up to 45 degrees fore and aft or athwartships (or both) in a 1-knot current.

4.1.3 System Operation

In the event of a submarine disaster the DSRV and its crew and fly-away support equipment will be alerted, then transferred to an airfield and flown by three C-141 aircraft to a selected airfield near the disaster site.

At the destination airfield the DSRV is off-loaded onto its Land Transport Vehicle (LTV). The support equipment is also off-loaded, and the system is moved to the port and to dockside for transfer to either a Submarine Rescue Ship (ASR) or a mother submarine (MS) for transportation to the DISSUB location.

4.2. REQUIREMENTS FOR SUBMARINE

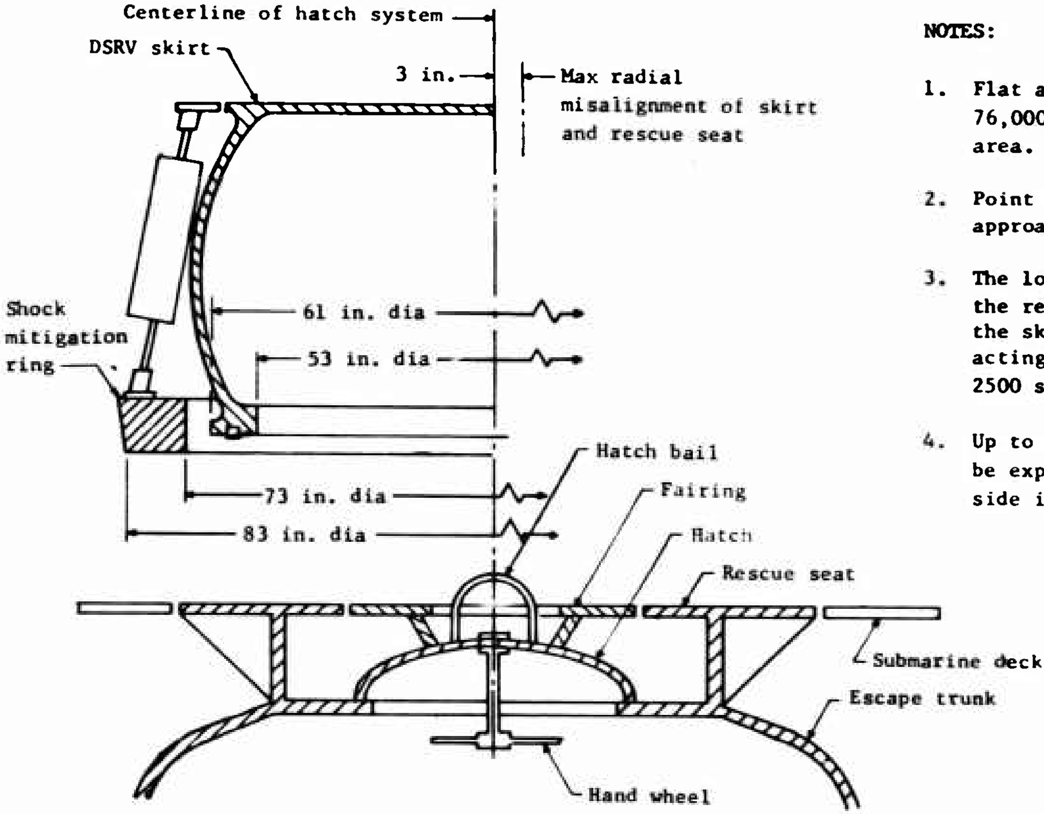
4.2.1 General

The specific requirements or conditions which must be met by a submarine for it to be accepted as a candidate for rescue by the DSRV are presented in this section.

4.2.2 Rescue Seat

A typical submarine hatch with which the DSRV skirt was designed to mate is shown in Figure 4-2. The skirt will come to rest on the rescue seat, which is a circular reinforced steel area surrounding the escape hatch. The rescue seat must have a minimum outer diameter of 65 inches (165 centimeters) and a maximum inner diameter of 44.50 inches (113 centimeters). The strength required of the rescue seat is dependent on the depth of the rescue operation. Figure 4-2 describes the loads applied to the DISSUB. In addition to the requirements placed on the rescue seat, the deck of the DISSUB beyond the rescue seat must be of sufficient size and strength to safely accommodate the DSRV shock mitigation ring loading (Figure 4-2, Notes 1 and 2) for all approaches.

The skirt mating flange contains a rubber gasket designed to seal rescue seat irregularities up to 0.125 inches (0.3175 centimeters). The surface of the rescue seat must thus be flat within 0.125 inches at all rescue depths and under the loads imparted by the DSRV. The skirt flange details are shown in Figure 4-3.



NOTES:

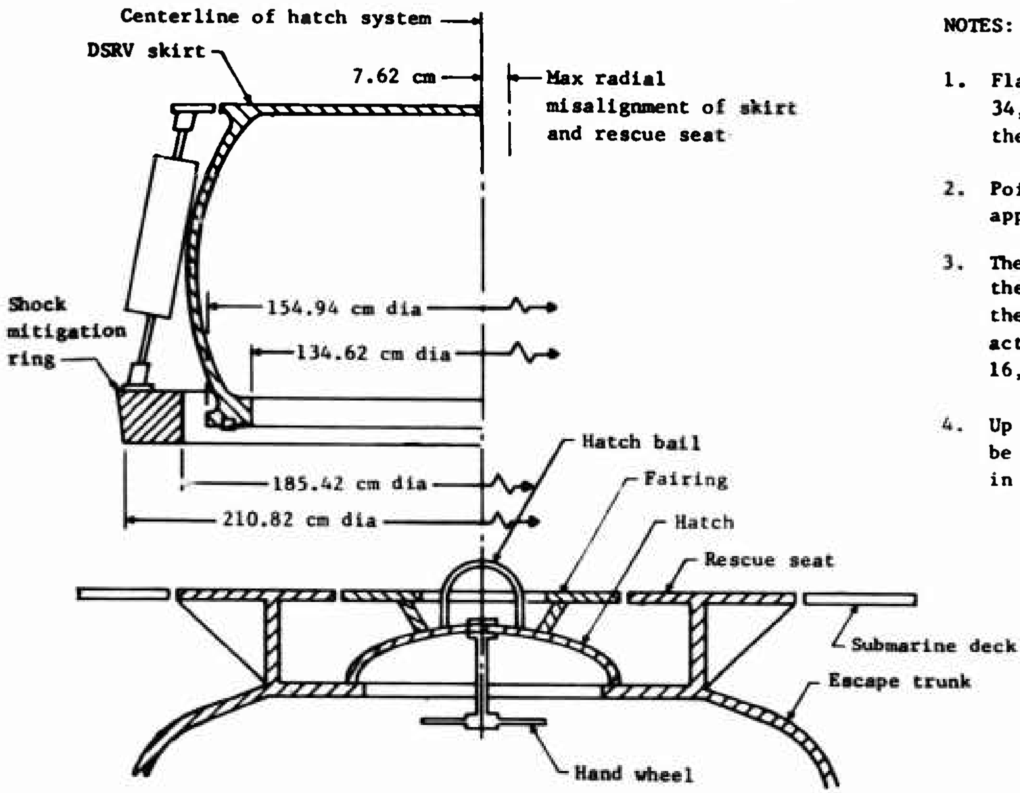
1. Flat approach max load impact 76,000 pounds total over the contact area.

2. Point impact load at angular approach is 30,000 psi max.

3. The load the skirt will exert on the rescue seat after dewatering the skirt is hydrostatic pressure acting over the sealed area of 2500 square inches.

4. Up to 290 psi additional loading may be expected on the downstream side in lateral currents.

FIGURE 4-2a. DETAIL OF TYPICAL SUBMARINE HATCH RESCUE SEAT



NOTES:

1. Flat approach max load impact 34,473.6 kilograms total over the contact area.

2. Point impact load at angular approach is 2070 bars max.

3. The load the skirt will exert on the rescue seat after dewatering the skirt is hydrostatic pressure acting over the sealed area of 16,130 square centimeters.

4. Up to 20 bars additional loading may be expected on the downstream side in laterial currents.

FIGURE 4-2b. DETAIL OF TYPICAL SUBMARINE HATCH RESCUE SEAT

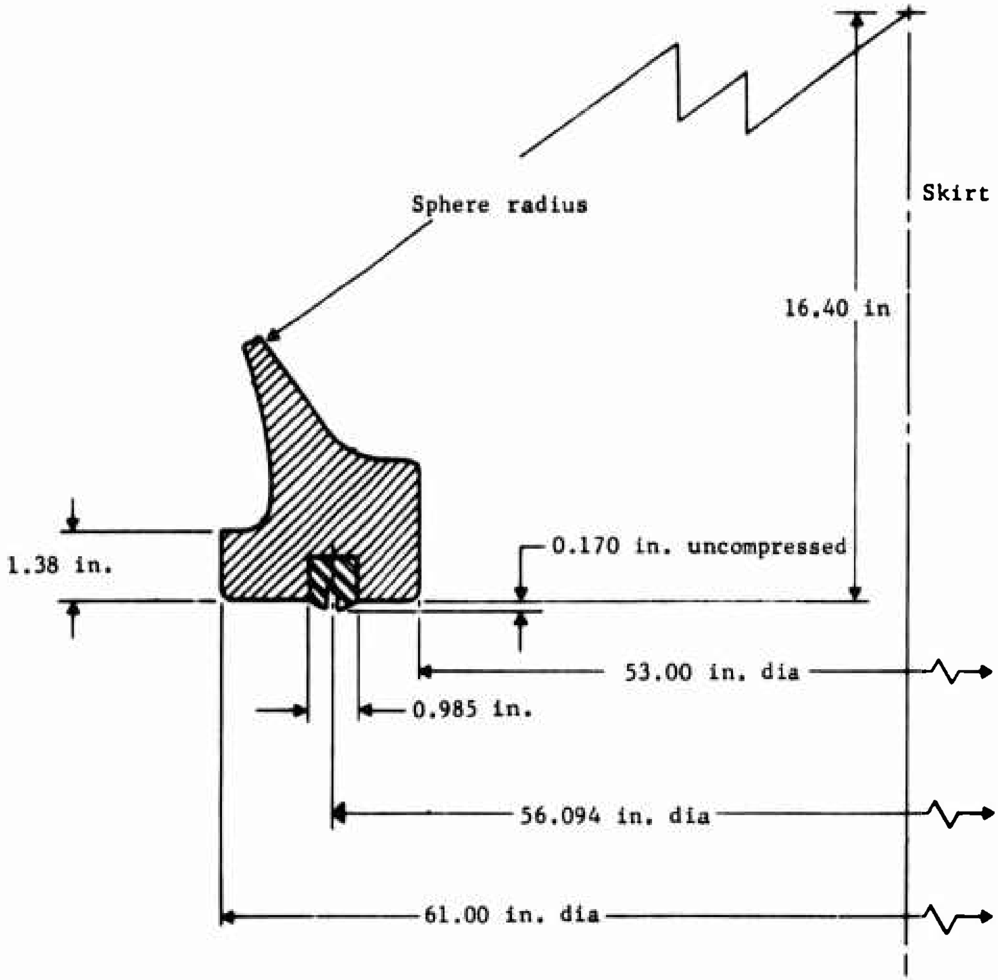


FIGURE 4-3a. DSRV SKIRT FLANGE DETAIL

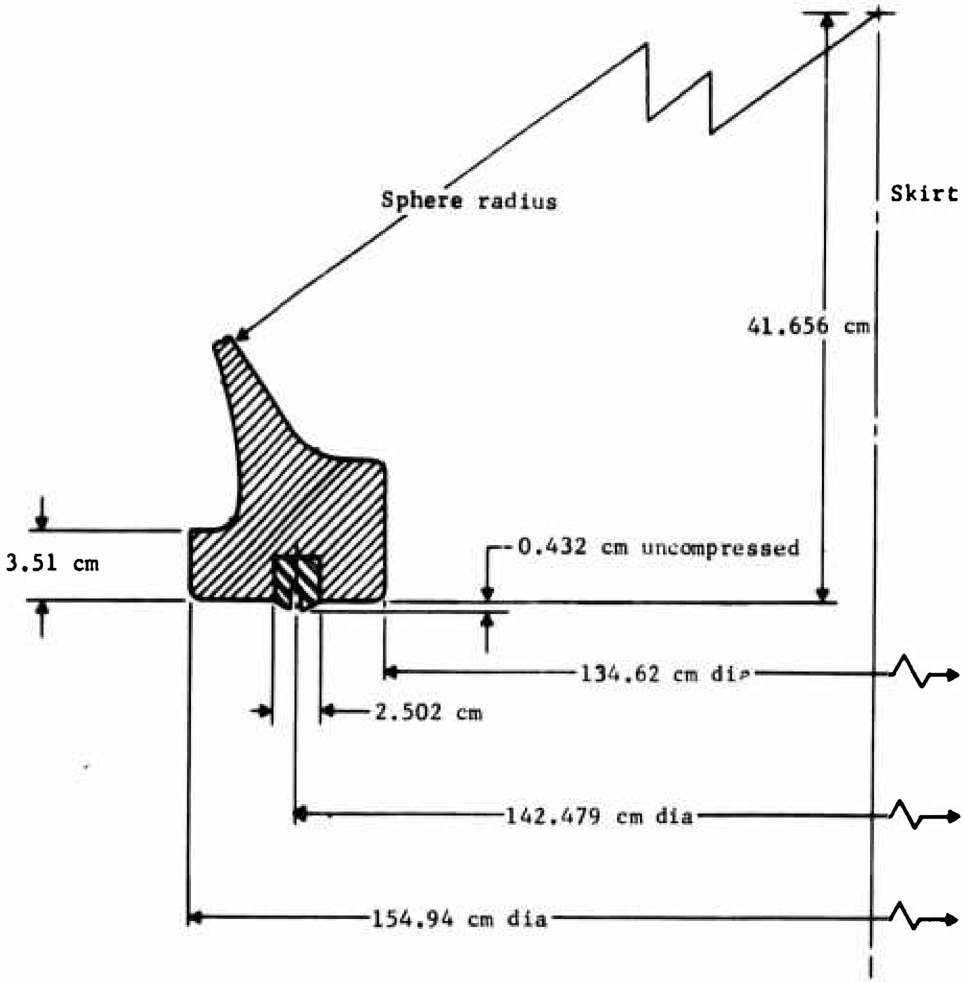


FIGURE 4-3b. DSRV SKIRT FLANGE DETAIL

4.2.3 Projections and Obstructions

Projections and obstructions above the hull of the DISSUB in the vicinity of the escape hatch present hazards to the DSRV when it is maneuvering during the mating operation. The obstructions could interfere with the DSRV skirt or splitter plate, and damage caused by impacting the obstructions could prevent mating. Therefore an area encompassing a 220-inch diameter (5.59 meters) centered on the rescue seat should be clear of obstructions and projections above the hull. Unavoidable obstructions within and adjacent to this area must be documented and available for briefing the DSRV operators.

The DSRV is 98.50 inches (2.5 meters) wide and extends 280 inches (7.11 meters) forward and 312 inches (7.92 meters) aft of the center of the skirt.

The DSRV is equipped with a mechanical arm (manipulator) which can be used to clear the hatch area of the DISSUB of debris. The manipulator also has a cable cutter with a cutting force of 20,000 pounds (9072 kilograms), capable of cutting a 5/8-inch-diameter (1.5875 centimeters) stainless steel wire rope. The manipulator can be used to cut and clear a messenger buoy cable if such a cable is used. In the event a cable passes over the rescue seat area, a 3-inch-high (7.62 centimeters) by 3-inch-wide space is required under the cable for manipulator access.

4.2.4 Hatch Construction

The DISSUB hatch must open upward into the skirt cavity while mated; therefore its opened dimensions must be such as to permit egress from the submarine through the skirt into the DSRV. The minimum internal all-around clearances of the DSRV skirt are shown in Figure 4-4. These clearances indicate the greatest protrusion of any skirt interior item toward the center of the skirt cavity.

4.2.5 Haul-Down System

The DSRV is equipped with a haul-down system to assist the DSRV in mating with the DISSUB in unfavorable underwater currents. The system consists of a winch and cable located in the DSRV skirt. A grapnel hook at the end of the cable is lowered and attached to the escape hatch. A suitable bail capable of withstanding a load of 12,500 pounds (5670 kilograms) from the haul-down cable should be provided at the center of the rescue seat surface (for example, on top of the escape hatch) for this attachment. The hook and a typical hatch bail are shown in Figure 4-5.

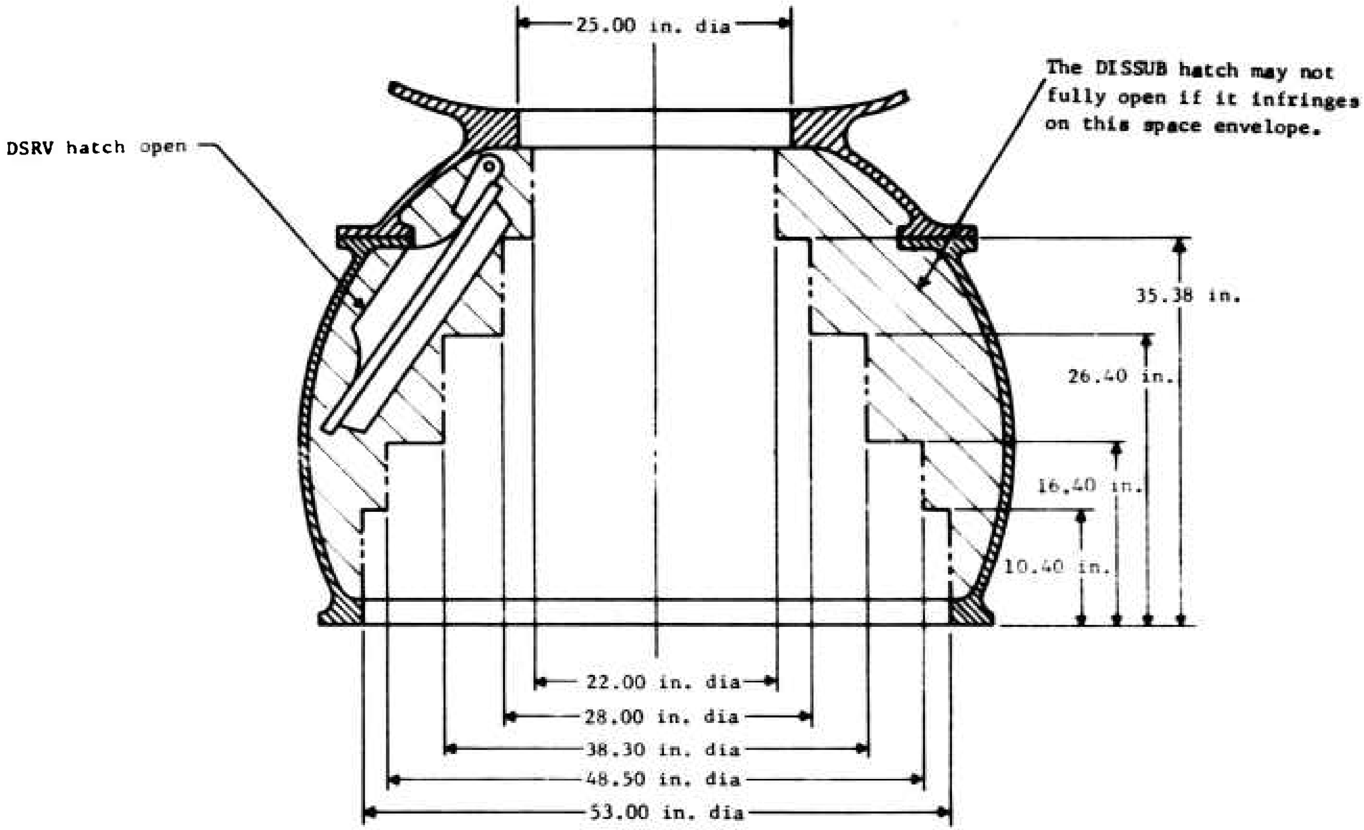


FIGURE 4-4a. DSRV SKIRT EQUIPMENT ENVELOPE

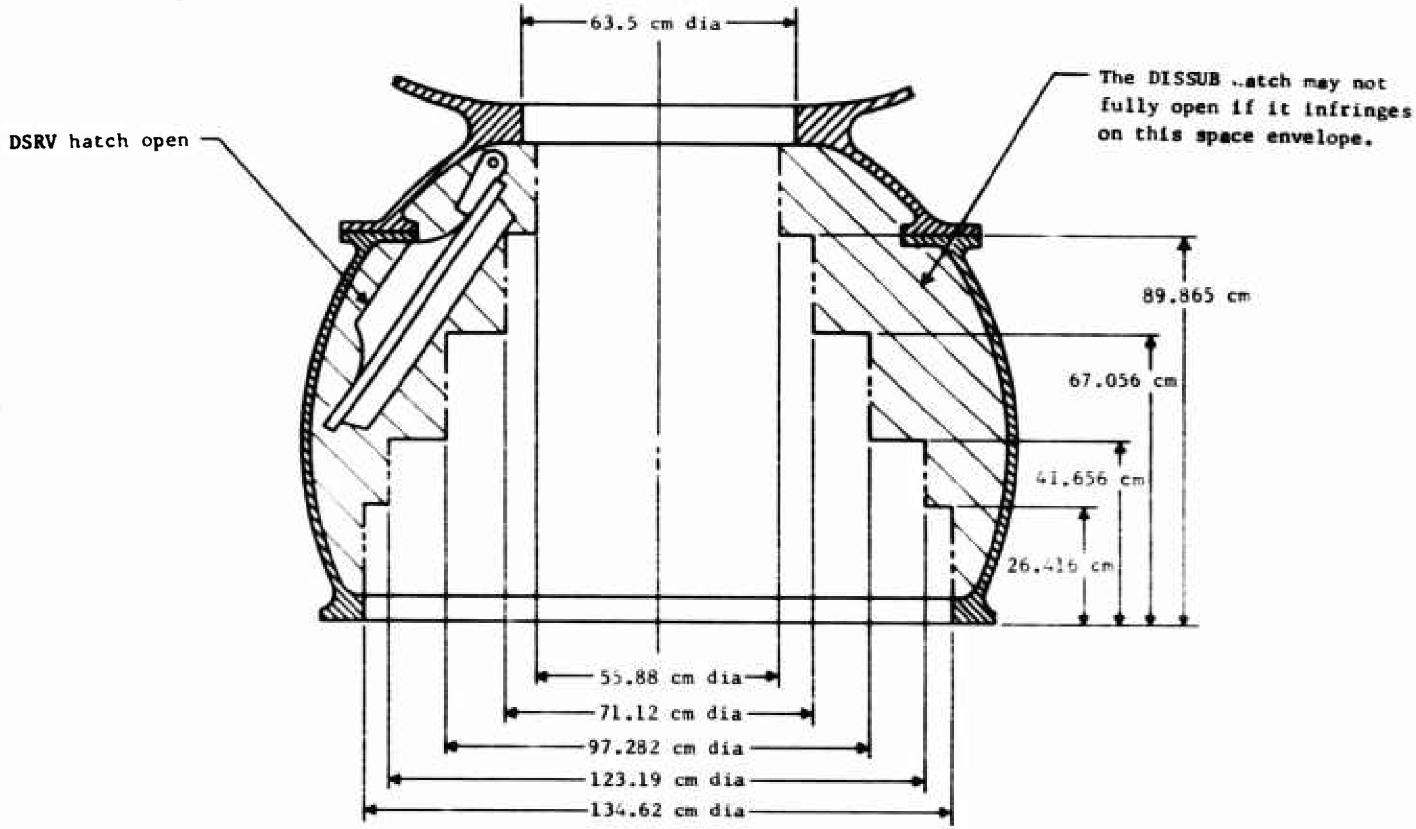
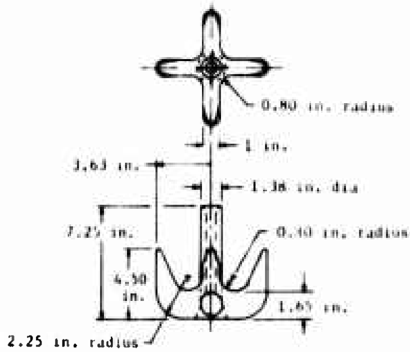
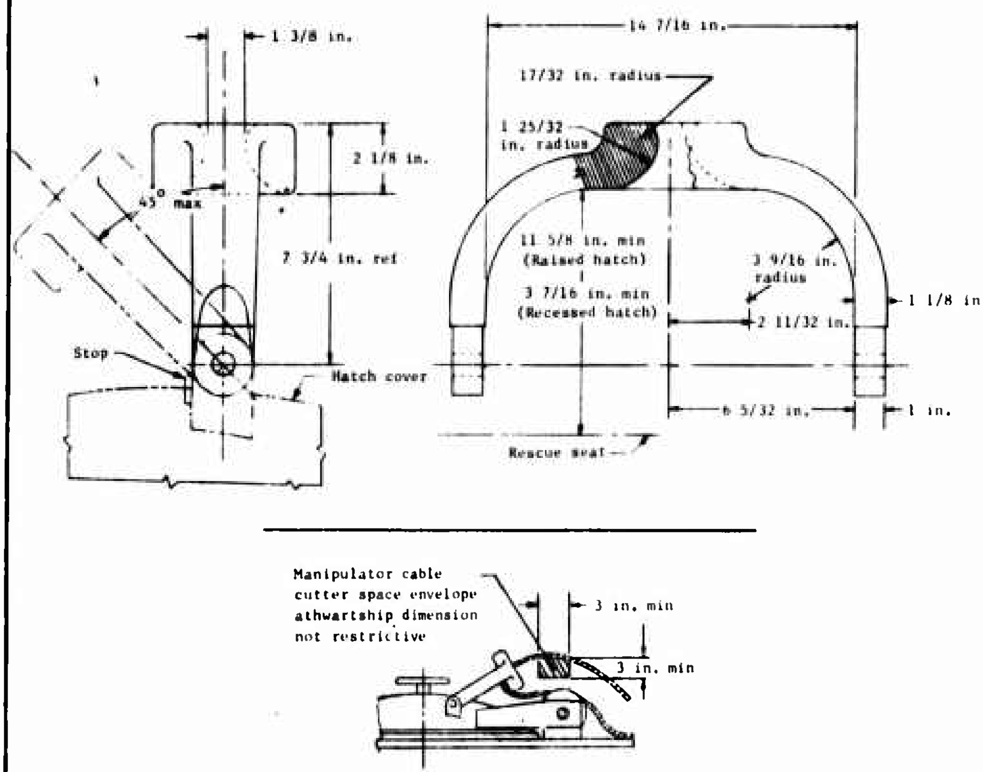


FIGURE 4-4b. DSRV SKIRT EQUIPMENT ENVELOPE

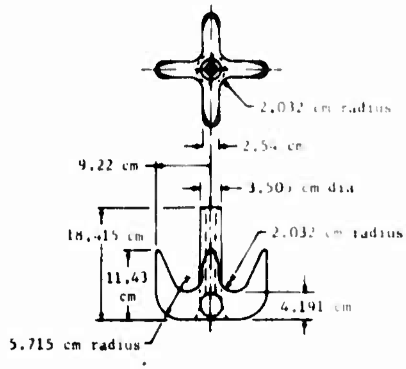


GRAPNEL DETAIL
FOR USE WITH BAIL/MESSENGER BUOY ARRANGEMENT

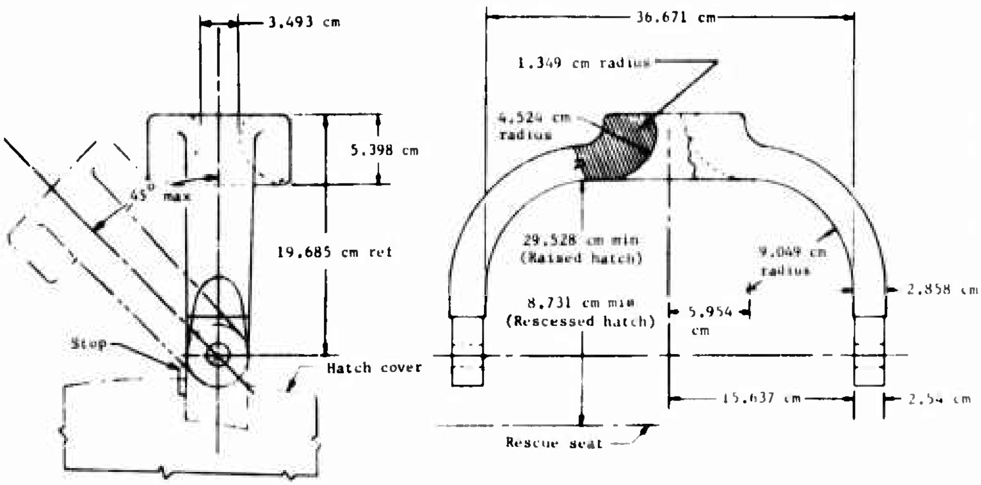


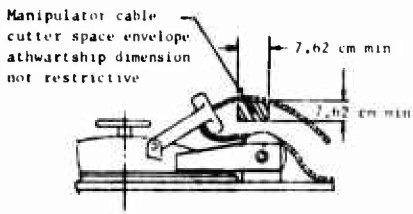
HATCH BAIL FOR USE WITH MESSENGER BUOY CABLE

FIGURE 4-5a. DETAILS OF HAUL-DOWN SYSTEM: GRAPNEL AND TYPICAL HATCH BAIL



GRAPNEL DETAIL
FOR USE WITH BAIL/MESSENGER BUOY ARRANGEMENT





HATCH BAIL FOR USE WITH MESSENGER BUOY CABLE

FIGURE 4-5b. DETAILS OF HAUL-DOWN SYSTEM: GRAPNEL AND TYPICAL HATCH BAIL

The vertical distance from the plane of the rescue seat to the haul-down system fittings in the skirt along the haul-down cable path is 22 inches (55.88 centimeters). For a seal to be made, therefore, the height of the raised bail with grapnel attached (to the highest point on the grapnel shaft) must not exceed 22 inches from the rescue seat.

The DSRV's manipulator (see Figure 4-1) can be used to assist in raising the bail and attaching the hook. The winch is then operated to haul the DSRV down to the rescue seat. Use of the haul-down system is not mandatory.

4.2.6 Pressure Equalization

Pressure differential, if any, between the DSRV and the disabled submarine must be equalized before the submarine's hatch can be opened. The DSRV can rescue personnel from a submarine pressurized to a maximum of 5 atmospheres absolute.

4.2.7 Rescue Vehicle Ballast Drain

The DSRV carries approximately 4000 pounds (1814 kilograms) of water ballast which will be drained off to maintain neutral buoyancy after taking rescuees aboard. This water is carried in the rescue spheres of the DSRV and must be drained into the disabled submarine after the DSRV mates to the submarine. The water is metered so that the proper buoyancy can be maintained. This water can be drained into the disabled submarine through the open hatches.

4.2.8 Mission Aids

The use of acoustic transmitters on the DISSUB would assist in reducing mission time. U.S. Navy submarines are being equipped with dual battery-powered acoustic beacons ("pingers") which generate pulsed 3.5 KHz acoustic signals.

Communications between the DSRV and the disabled submarine would be most beneficial to the rescue operation, but the rescue can be accomplished without communication. The DSRV and the support ship will both have the standard U.S. Navy single-sideband underwater telephone systems which operate on a carrier frequency of 8 KHz with a sideband modulation out to 11.1 KHz.

4.2.9 Personnel Requirements

No specialized training is required by the personnel of the disabled submarine to make use of the DSRV Rescue System.

4.3 AVAILABILITY AND DEPLOYMENT

4.3.1 Readiness and Initial Actions

The U.S. Navy has two DSRVs. Standard procedures have been established to ensure rapid response to a DISSUB notification. The system is loaded on board the C-141 aircraft and transported with the necessary personnel to a port near the DISSUB location.

4.3.2 Deployment Requirements

Successful deployment of the DSRV Rescue System requires knowledge of conditions and characteristics of roads to be traversed, airfields and ports to be used, and the attendant support equipment. Proper coordination with cognizant authorities is also a prerequisite for control of system movement.

4.3.2.1 Airfield Requirements

Airfields capable of receiving the DSRV system C-141 aircraft have been selected and are specified in subsection 4.4.

4.3.2.2 Ground Handling Equipment

Ground handling equipment is necessary at the airfield to load material onto transporting vehicles for road transportation to the nearby port. The material description, dimensions, weights, and numbers of items are shown in Table 4-1.

4.3.2.3 Motorized Support Equipment

The following motor vehicles must be available at the staging area to transport the DSRV and associated equipment from the airfield to the staging port:

(a) One three-axle approximately 14,000- (6350 kilograms) to 18,000-pound (8165 kilograms) truck tractor with standard U.S. type commercial fifth-wheel capability to tow the loaded LTV. Total towed weight will be approximately 110,000 pounds (49,900 kilograms). Maximum allowable height of the truck tractor is 102 inches (259.1 centimeters).

(b) One prime mover with pintle, capable of utilization with a 3-inch (7.62 centimeters) inner diameter lunette eye tow bar, to tow the support van. The 20,000-pound (9072 kilograms) van requires minimum of 600 pounds (272 kilograms) drawbar pull on level dry concrete.

(c) Stakebed trucks or flatbed trailers to transport the material listed in Table 4-1 of this document.

(d) Convoy and traffic control vehicles as required.

TABLE 4-1

MATERIAL DIMENSIONS

Item	Dimensions Inches/Centimeters	Weight Pounds/Kilograms	Quantity
Mission containers	60L x 36W x 36H/ 152.4 x 91.44 x 91.44	500-1124 (each)/ 227-510 (each)	8
Pylon dolly	180L x 86W x 50H/ 457.2 x 218.44 x 127	9150/ 4150	1
Skirt dolly	110 dia x 44H/ 279.4 x 111.76	3500/ 1588	1
Splitter plate	79L x 40W x 14H/ 200.66 x 101.6 x 35.56	400/ 181	1
Sling	151L x 36W x 9H/ 383.54 x 91.44 x 22.86	1200/ 544	1
Storage bins	130L x 20W x 6H/ 330.2 x 50.8 x 15.24	300/ 136	1
Bin support	42L x 18W x 10H/ 106.68 x 45.72 x 25.4	400/ 181	1
Access ladders	73L x 14W x 2H/ 185.42 x 35.56 x 5.08	20 (each)/ 9 (each)	2

4.3.2.4 Connecting Roads Requirements

The loadbearing capacity and clearances required of the road system linking the airfield and port, including bridges, tunnels, overhead obstacles, turns, and curves, are:

(a) Roadway loadbearing capacity equal to or greater than

(1) A gross load of 125,000 pounds (56,700 kilograms).

(2) A maximum single-axle load of 21,000 pounds (9526 kilograms).

(b) A minimum road width of 12 feet (3.66 meters) on straightaways.

(c) A minimum height of overhead obstructions of 13 feet 6 inches (4.11 meters). In addition, any height needed to prevent arcing of overhead wires or power lines must be added.

(d) A minimum 34-foot (10.36 meters) roadway width in the vicinity of a 90-degree corner. For corners of over 90 degrees the road width requirements increase 1 foot (0.3048 meters) for each additional 3 degrees of turn.

(e) On curving roads the minimum road width requirements of the LTV/DSRV depend on the radius of curvature of the roadway. Figure 4-6 is a graph showing the minimum required road width as a function of the radius of road curvature. Curves falling in the area marked "Safe Zone" are acceptable for LTV/DSRV travel.

4.3.2.5 Seaport Requirements

The seaport serving as a staging area for a submarine rescue mission must provide:

(a) A water depth of 35 feet (10.67 meters) or more at mean low water or mean lower low water, whichever is applicable, for rescue missions using an ASR or a mother submarine. If a ship other than an ASR or a mother submarine is used, its draft with the DSRV on board will dictate the required

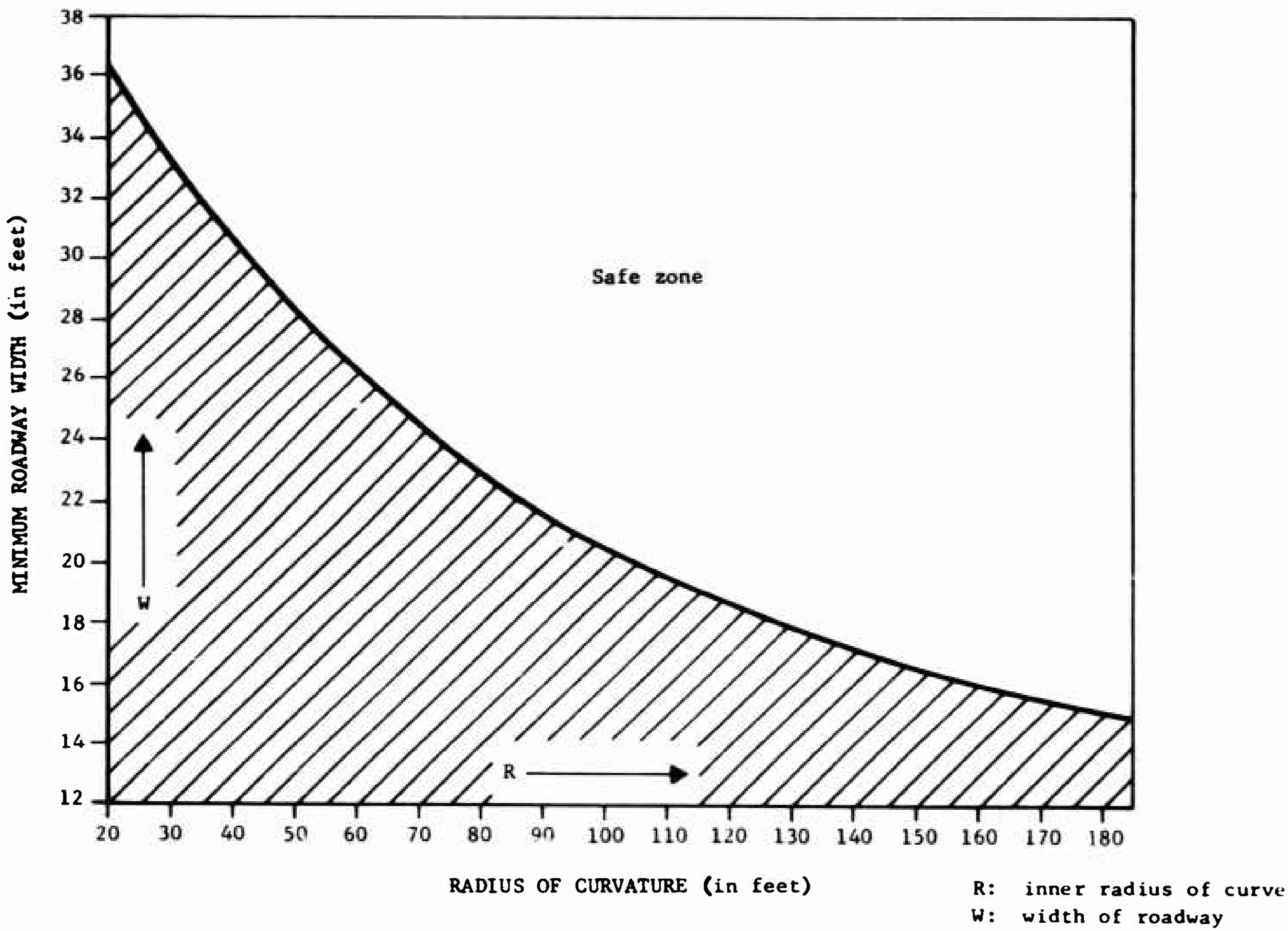


FIGURE 4-6a. MINIMUM REQUIRED ROADWAY WIDTH AS A FUNCTION OF ROAD CURVATURE RADIUS

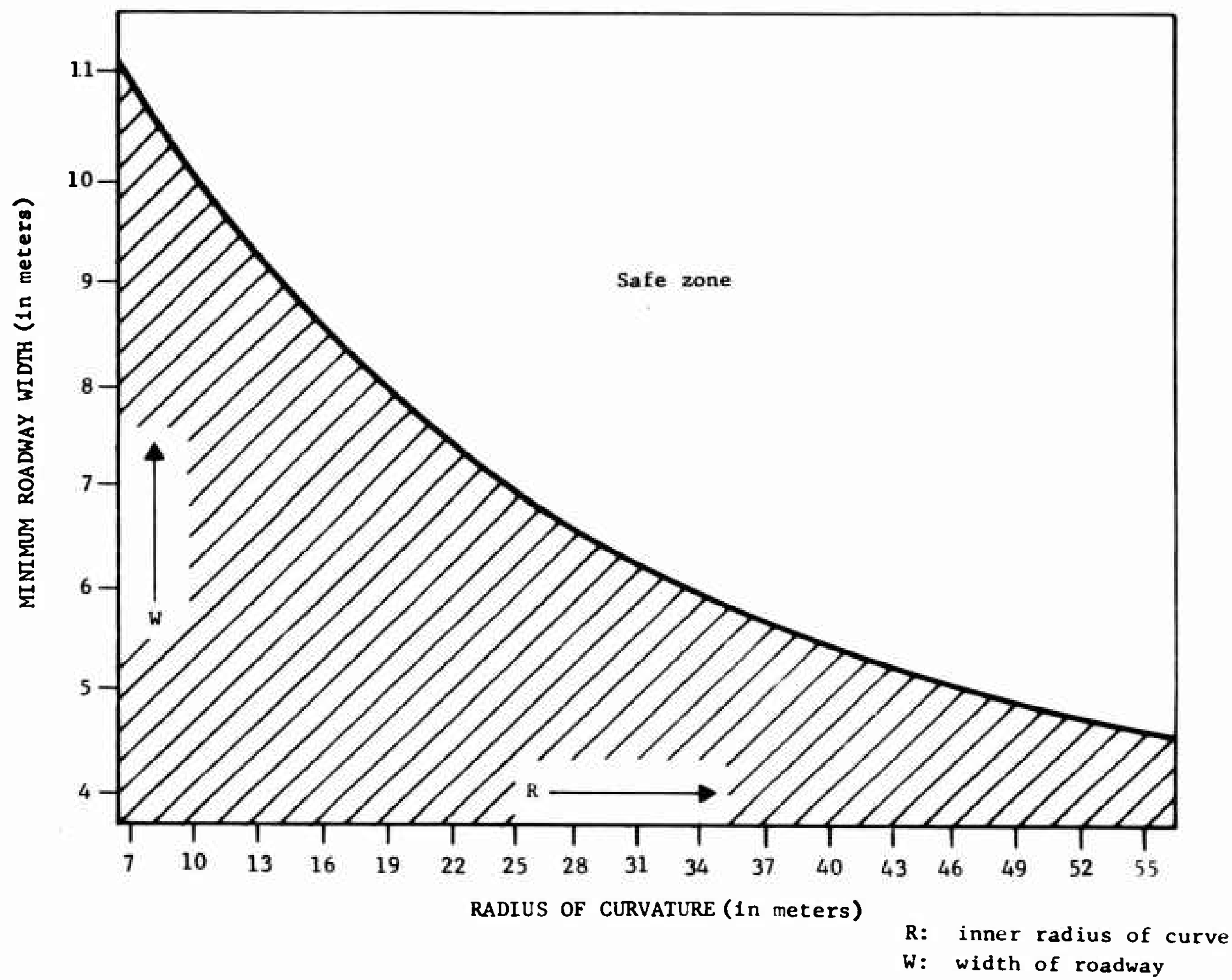


FIGURE 4-6b. MINIMUM REQUIRED ROADWAY WIDTH AS A FUNCTION OF ROAD CURVATURE RADIUS

depth. If the DSRV is to be towed out of the harbor, the draft of the DSRV (10 feet, 3.048 meters) with skirt and splitter plate, or of the towing vessel, will determine the required depth.

(b) A loading pier with the following characteristics:

- A length of at least 350 feet (107 meters).
- A width of at least 30 feet (9.14 meters).
- A loadbearing capacity of 150,000 pounds (68,040 kilograms) gross load, with a maximum axle load of 21,000 pounds (9526 kilograms) and an average single wheel load of 3875 pounds (1758 kilograms).

These are necessary to withstand the weight of the LTV with DSRV and support van alongside plus truck or trailer for off-loading crated material.

(c) Crane capability as follows:

- Boom reach from 10 feet (3.048 meters) inside the pier apron to the centerline of a submarine or ship 18 feet (5.49 meters) from the pier pilings or camel.
- A hook height 25 feet (7.62 meters) above the pier.
- A lifting capacity of at least 40 short tons (36.3 metric tons), at the above-cited reach.

(d) Materials handling equipment to unload containers and crates from equipment trailer to pier.

4.3.2.6 Administration and Control

Successful deployment is dependent upon prompt and effective control of movement of the Rescue System. The United States has specified a representative in each of the candidate port/airfield combinations noted who will assist in handling administrative responsibilities related to the deployment.

4.4 PORT/AIRFIELD CANDIDATES

Candidate submarine rescue port/airfield combinations outside the continental U.S. have been selected and have been divided into five groups according to their geographical locations. These selections are listed in Tables 4-2 to 4-6. In addition, a number of U.S. ports may be utilized.

Candidate port/airfield combinations will be added as information becomes available; therefore the tables should not be considered as final.

TABLE 4-2

SUBMARINE RESCUE PORT/AIRFIELD COMBINATIONS:
NORTH ATLANTIC OCEAN AREA

Seaport	Airfield
Algiers	Alger/Dar El Beida
Guantanamo Bay	Guantanamo NAS
Liverpool	Liverpool
Portsmouth	Thorney Island
Marseille	Marseille/Marignane
Bremerhaven	Bremen
Piraeus	Athinai
Thessaloniki	Thessaloniki
Thule	Thule AFB
Genoa	Genova/Sestri ITAFB
Naples	Napoli/Capodichino ITAFB
Beirut	Beirut International
Rotterdam	Rotterdam
Oslo	Fornebu
Halifax	Halifax International
Lisbon	Lisbon
Dakar	Dakar/Yoff
Palermo	Palermo/Punta Raisi ITAFB
Barcelona	Barcelona
Rota	Rota NS
Cartagena	San Javier SAFB
Stockholm	Stockholm/Arlanda
Port of Spain	Piarco
La Guaira	Maiquetia
Roosevelt Roads	Roosevelt Roads

TABLE 4-3

SUBMARINE RESCUE PORT/AIRFIELD COMBINATIONS:
SOUTH ATLANTIC OCEAN AREA

Seaport	Airfield
Luanda	Luanda
Salvador (Bahia)	Dois De Julho
Capetown	D. F. Malan (Capetown National)
Montevideo	Carrasco

TABLE 4-4

SUBMARINE RESCUE PORT/AIRFIELD COMBINATIONS:
NORTH PACIFIC OCEAN AREA

Seaport	Airfield
Hong Kong	Hong Kong
Apra	Agana NAS
Pearl Harbor	Hickam AFB
Balboa	Howard AFB
Subic Bay (Olonagapo)	Cubi Point NAS
Cam Ranh Bay	Cam Ranh Bay AFB
Chilung	Taipei International
Midway Island	Midway NS
Rodman	Howard AFB
Naha	Naha AB

TABLE 4-5

SUBMARINE RESCUE PORT/AIRFIELD COMBINATIONS:
SOUTH PACIFIC OCEAN AREA

Seaport	Airfield
Brisbane	Brisbane
Darwin	Darwin RAAF
Sydney	Kingsford Smith
Antofagasta	Cerro Moreno
Auckland	Auckland International
Callao	Jorge Chavez International
Pago Pago	Pago Pago International
Guayaquil	Simon Bolivar

TABLE 4-6

SUBMARINE RESCUE PORT/AIRFIELD COMBINATIONS:
INDIAN OCEAN AREA

Seaport	Airfield
Fremantle	Perth
Melbourne	Essendon
Colombo	Colombo/Bandaranaike
Madras	Madras
Djibouti	Djibouti
Durban	Louis Botha
Singapore	Changi RAF