NATO STANDARD

ANEP-85

MATERIAL INTEROPERABILITY REQUIREMENTS FOR SUBMARINE ESCAPE AND RESCUE

Edition A Version 4

MAY 2020

NORTH ATLANTIC TREATY ORGANIZATION ALLIED

ALLIED NAVAL ENGINEERING PUBLICATION

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NORTH ATLANTIC TREATY ORGANIZATION (NATO)

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NATO LETTER OF PROMULGATION

22 May 2020

1. The enclosed Allied Naval Engineering Publication ANEP-85, Edition A, Version 4 – MATERIAL INTEROPERABILITY REQUIREMENTS FOR SUBMARINE ESCAPE AND RESCUE, which has been approved by the nations in the Military Committee Maritime Standardization Board, is promulgated herewith. The agreement of nations to use this publication is recorded in STANAG 1475.

2. ANEP-85, Edition A, Version 4 is effective upon receipt and supersedes ANEP-85, Edition A, Version 3, which shall be destroyed in accordance with the local procedure for the destruction of documents.

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4. This publication shall be handled in accordance with C-M(2002)60.

Zoltán GULYÁS
Brigadier General, HUNAF
Director, NATO Standardization Office

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RECORD OF RESERVATIONS

CHAPTER	RECORD OF RESERVATION BY NATIONS

Note: The reservations listed on this page include only those that were recorded at time of promulgation and may not be complete. Refer to the NATO Standardization Document Database for the complete list of existing reservations.

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RECORD OF SPECIFIC RESERVATIONS

Nation	Detail of reservation
DEU	- Chapter 1 Para 1.3 not implemented - Chapter 2 Para 2.2.1.1 not implemented - Chapter 4 not implemented - Chapter 5 not implemented Due to the single compartment design of DEU submarines of type U212A some technical equipment is not required by the DEU rescue concept.
DNK	The Danish Navy does not have any submarines; therefore, the STANAG is RATIFIED but will not be IMPLEMENTED until the Danish Navy acquires submarines.
ESP	Implementation of paragraph 3.2 "MINIMUM REQUIREMENTS FOR ATMOSPHERE CONTROL" pertaining to the required equipment for atmosphere control in the Spanish submarines will be accomplished over time and according to available funding.
ITA	- Chapter 1: Para 1.3 is not implemented by "Todaro" Class Submarine. - Chapter 5: Para 5.2 is not implemented by Italian Submarines.
ROU	The standard is ratified excepting the provisions of Chapter 1, 2 and 4, as following: a. The current equipment that exists onboard of the Romanian Navy's submarine does not meet the requirements described in chapter 1 of the standard; b. The characteristics of the "Damage beacon" are not compatible with the requirements described in chapter 2 of the standard; c. The SRV locking mechanism on the rescue hatch docking surface of the submarine does not meet the requirements described in chapter 4 of the standard; d. In case of submarine's modernization/revitalization the acquisition of the equipment presented in the standard will be considered.
TUR	a. Chapter 1: TUR Submarines outfitted with an emergency underwater telephone (E-UWT), just fitted UWT supported by power supply. b. Chapter 2: Para 2.2.1 in the Chapter cannot be implemented by "AY" class submarine. c. Chapter 4: This chapter will not be implemented by "AY" class submarines.

Note: The reservations listed on this page include only those that were recorded at time of promulgation and may not be complete. Refer to the NATO Standardization Document Database for the complete list of existing reservations.

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CHAPTER 1 UNDERWATER COMMUNICATIONS

1.1. PURPOSE

This chapter defines the minimum requirements for underwater telephones (UWT) for use in allied submarines, surface ships and helicopters to allow two-way underwater communications and to receive transmissions from underwater distress or security beacons initiated by a submarine.

1.2. UWT MINIMUM REQUIREMENTS

UWT shall comply with the following requirements:

a. Carrier frequency of 8087.5 Hz;

b. Omni-directional reception and transmission in the horizontal and vertical planes as far as possible;

c. Modulation in the upper single-side-band (300 to 3000 Hz);

d. Operation of a 712 Hz or 800 Hz audio-frequency within a 30 knots positive and negative Doppler bandwidth;

e. Minimum acoustic power delivery of 80 Watts, as evenly distributed across the bandwidth as possible.

Moreover, some submarines may also use an UWT at carrier frequency:

a. 27 kHz, modulation of 1 kHz in upper single-side band;

b. 37.5 kHz, modulation of 1 kHz in upper single-side band;

c. 39.4 kHz, modulation by voice in the lower single-side band 300 - 3000 Hz, with an acoustic omni-directional power delivery of 60 W.

Submarine distress and navigation beacons shall use transmitting frequencies compatible with the above characteristics, and units fitted as above shall be able to detect them.

1.3. EMERGENCY UWT

An emergency underwater telephone (E-UWT) should be fitted in all compartments from which escape or rescue is possible. This equipment should be consistent with the requirements of paragraph 1.2.

As the E-UWT is required for emergency use, it must be supported by battery backup and shall be capable of unsupported operation for at least 7 days with a 10% / 90 % ratio of talking-listening and, in addition, be capable of emitting one ping per minute. An acoustic power output of 80 Watts may not be achievable but the aim should be to obtain the highest power commensurate with the required endurance.

1.4 DIGITAL COMMUNICATIONS

To enhance disabled submarine communications, units that comply with the above should use digital communications as defined in STANAG 4748.

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CHAPTER 2 LOCALIZATION DEVICES

2.1. PURPOSE

This chapter defines the minimum requirements for the provision of devices in a distressed submarine to assist location by rescue forces and to standardize the color and markings of submarine marker buoys.

2.2. ACOUSTIC DEVICE

2.2.1. SUBMARINES

2.2.1.1 Submarines shall be fitted with a long time marking device, which shall:

a. have a self-contained power source;

b. work to at least minimum collapse depth;

c. transmit on one or more frequencies in the range of [3.5 kHz - 45 kHz] compatible with current NATO sonobuoys, sonars or underwater telephones i.a.w. the requirements laid down in paragraph 1.2;

d. radiate these frequencies from as close as possible to the rescue seat hatch without fouling the rescue seat;

e. transmit a minimum of one ping per minute for a minimum of 14 days;

f. provide an acoustic power of at least 177 dB/µPa at 1m in a 1 Hz band.

Each nation shall list in the ATP-57.2 (submarine specific data) the frequencies used.

2.2.1.2 The longtime marking device should:

a. be attached to the pressure hull;

b. be capable of manual isolation from inside the submarine in each escape compartment;

c. transmit on an audible frequency on the UWT, which takes into account the carrier frequency (8.0875 kHz) and the modulation band (300 to 3000 Hz), for detection, localization and homing;

d. have the ability to automatically activate when the submarine is in a distressed condition, i.e flooding or pressurization

2.3. RADIO DEVICE

Submarines shall be fitted with at least one of the following systems:

2.3.1. INDICATOR BUOYS

The indicator buoys, tethered or untethered, shall transmit on:

a. the COSPAS SARSAT system frequency (406 MHz) for the alert;

b. 243.0 MHzor 121.5 MHz for local homing by SAR resources.

Ideally, indicator buoys should have the ability to be automatically released when the submarine is in a distressed condition, i.e flooding or pressurization

2.3.2. SLOT BUOYS

The SLOT buoys shall transmit on the same frequencies stated in paragraph 2.3.1.

2.3.3. OPTICAL DEVICE

2.3.3.1. PYROTECHNICS

Submarines shall be fitted with a minimum of four (4) red smoke floats or four (4) red grenades that can be released from collapse depth. Minimum burn duration, minimum candlepower, dominant wavelength, purity, and flare ejection from the submarine shall adhere to individual national standards.

2.3.3.2. INDICATOR BUOY

If fitted, Tethered and/or untethered submarine marker buoys shall:

a. be painted with color "international orange", meeting the specifications for the color orange as laid down in chapter 3, "Color for Surface markings" of appendix 1 to annex 14 of the International Civil Aviation Organization Convention (ICAO convention);

b. have a plate attached to it with the following information engraved in the language of the nation concerned and also in English except in the case of the English speaking nations where it is engraved in English and French:

- “This is a [nationality] submarine marker buoy”.
- An identification number or letter sequence code known to the SUBOPAUTH, indicating the particular submarine.
- A statement as to whether the buoy comes from forward or aft in the submarine for tethered buoys only).
- Any other instructions as necessary.

The portion of the marker buoys above the water may have additional alternate white and yellow fluorescent marking and a light to enhance location by night and day.

CHAPTER 3 INTERFACE BETWEEN DISSUB AND RESCUE SYSTEMS

3.1. PURPOSE

This chapter defines the requirements to allow the mating of a rescue system on to a distressed submarine.

The absolute atmospheric pressure is essential to enable the mating of a rescue system with a DISSUB.

3.2. MINIMUM REQUIREMENTS FOR ATMOSPHERE CONTROL

The submarine escape compartments shall include equipment to measure the absolute atmospheric pressure, the partial pressures of oxygen and CO2, and the concentration of CO within the compartment. This equipment shall:

a. be robust and salt water resistant;

b. measure the absolute pressure up to 10 bar with a accuracy of ±0.1 bar;

c. measure the partial pressure of oxygen up to 2 bar with an accuracy of 0.01 within range (0 – 0,3 bar) and 0,05 within range (0,3 – 2 bar);

d. measure the partial pressure of CO2 up to 0,1 bar with an accuracy of 0.01 bar;

e. withstand temperatures ranging from -2 to +50°C;

f. be capable of continuous measurement;

g. have a self-contained power source with at least a seven-day endurance;

h. be displayed and readable without external lighting.

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CHAPTER 4 COMMON SUBMARINE RESCUE SEAT

4.1. PURPOSE

This chapter defines the design requirements for a submarine rescue seat.

4.2. RESCUE SEAT DESIGN REQUIREMENTS

To support the rescue of personnel from a DISSUB by an SRV (submarine rescue vehicle), the submarine rescue seat design requirements are:

a Minimum outside diameter shall be 167.64 cm (66 inches) which should be centerlined on the submarine trunk and landing surface mating seat.

b Maximum inside diameter shall be 114.3 cm (45 inches) which should be centerlined on the submarine trunk and landing surface mating seat..

c Seat flatness shall not deviate from a true plane by more than 3.17 mm (0.125 inches) total indicator reading.

d Seat surface defects shall not be greater than 1.6 mm (0.0625 inches) in depth or height.

e Surface roughness shall not be greater than 6.35 micro meters (250 micro inches) roughness average (RA) for the painted surface.

f The diameter of the escape hatch and the volume it displaces as it is opened shall be consistent with inside dimension of the rescue asset's mating skirt as described by ANEP-85.1.

g Seat surface shall not be coated with abrasive or anti-skid treatment.

h The seat and supporting structure shall be capable of withstanding an impact load of 133,447N applied over 6.45 cm^2 (30,000 lbf applied over one in^2) applied at the weakest part of the rescue seat; i.e. the midpoint of the two adjacent supporting brackets of the greatest separation on the outermost edge of the rescue seat.

i The rescue seat and support structure should be designed to withstand the hydrostatic load at the specific submarine's calculated collapse depth.

j The rescue seat supporting structure shall be able to withstand an underwater current of 3 knots on the rescue asset after a hard mating seal is achieved. The resultant overturning moment and twisting moment on the trunk is determined by the rescue asset dimensions, which shall be superimposed to the hydrostatic load defined in paragraph 4.3.9.

k The submarine nation shall determine a maximum rescue depth for their rescue seat and supporting structure as defined by their load analysis.

l A submarine rescue hatch should not be within 5.59 m (220 inches) of any projections and restrictions above the rescue seat.

l.1 Projections and restrictions within this radius shall be identified to any potential rescue asset nation.

m The submarine should have a hatch cavity drain system to drain the remaining water below the mating flange of the rescue seat and above the submarine hatch into the submarine.

n The submarine rescue hatch should be capable of being opened from the outside of the submarine.

n.1 A submarine capable of performing rescue operations with an SRC (submarine rescue chamber) shall include the following design requirements for their rescue seat in addition to the requirements listed in paragraph 4.2

o There shall be 4 hold down devices, one device per circular quadrant, designed to withstand a load of 44,482 N (10,000 lbf) of vertical pull.

p There shall be a downhaul device.

p.1 If the downhaul device is a singular centered device, it shall be designed to withstand a load of 53,379 N (12,000 lbf) at 30 ° in all directions (forward, aft, port, and starboard);

p.2 The hold down devices may be used as a downhaul device. If this is the case, the hold down devises shall be designed to withstand a combined load of 53,379 N (12,000 lbf).

4.3. RESCUE SEAT TECHNICAL DATA PACKAGE

a In order to ensure the safety of rescue assets and personnel, Submarine operating nations shall be prepared to provide a technical data package when requested by any rescue asset operating nation prior to any planned or unplanned rescue.

a.1 Unless the rescue asset operating nation has determined that the data package is satisfactory, rescue operations may be delayed.

a.2 A rescue asset operating nation will analyze the data contained within the technical data package and reserve the rights to request additional information or data as required for determining safety to perform rescue operations.

b This technical data package should include the following data:

b.1 Detailed Drawings

b.2 Submarine Collapse Depth

b.3 Detail Design Analysis

b.4 Material Documentation

b.5 Maintenance plan and records

b.6 Quality Objective Evidence

b.7 Submarine Escape Trunk and Hatch Inspection

b.8 List of Tools Required for Removing Fairing Cover and Entering a DISSUB Hatch from Outside

b.9 Last Man Out for Rescue Procedure

c This technical data package should include the following measurements and inspections:

c.1 Measure thickness using ultrasonic testing (ut) methods or calipers and a qualified operator using calibrated instruments.

Measure roughness on the finished painted surface using a mechanical surface finish tester (profilometer or equivalent);

Measure flatness by using three dimensional laser or photogrammetric methods.

Measure the depth or height and length or width to one-thousandth of an inch accuracy (0.001 in, or 0.025 mm) of all visible nicks, gouges, pits, lumps, scratches, dents, or paint cracks.

Ensure that all structural components meet maintenance requirements, paying particular attention to any areas that show signs of corrosion. Inspect structure to ensure the as-built condition matches the as-designed condition detailed on the drawings.

Measurements shall be taken to ensure structural integrity of the escape trunk at depth during rescue operations.

Circularity measurements of the escape trunk vertical structure are required.

Identify any modifications or repairs made to the rescue seat or support structure. If no modifications or repairs were performed, provide a statement to this fact.

Along with this survey, documentation of any obstructions that would prohibit an SRV or SRC landing/mating should be delivered.

Load testing of the hold down devices is required (SRC only).

c.2 For SRC Rescue operations only:

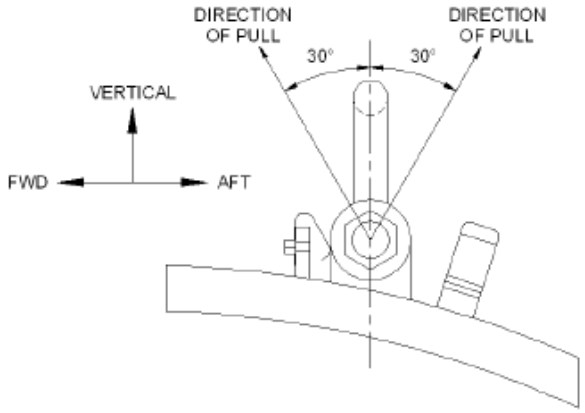
Pull for Test Hold Down Devices 22.5° in all Orthogonal Directions to 10,000 lbs (44,482 N)

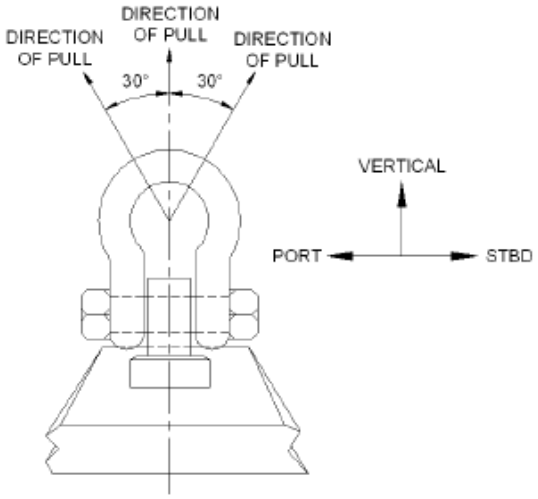
Pull for Test Downhaul Device 30° in all Orthogonal Directions to 12,000 lbs (53,379 N)

Submarine Downhaul Device:

Pull test to 12,000 lbs (53,379 N) in the following directions:

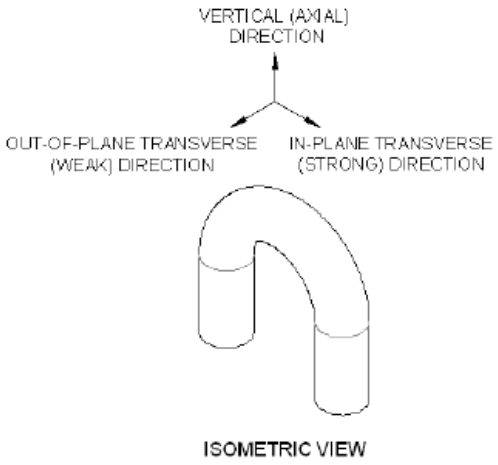
a. Vertical
b. 30° from vertical in forward direction
c. 30° from vertical in aft direction
d. 30° from vertical in port direction
e. 30° from vertical in starboard direction



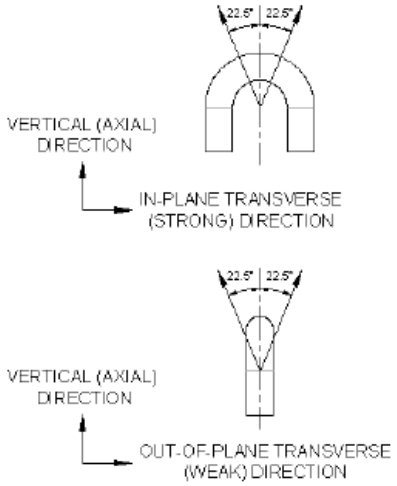


Submarine Hold Down Devices:
Pull test to 10,000 lbs (44,482 N) in the following directions with respect to device orientation:

a. Vertical
b. 22.5° from vertical in + strong direction
c. 22.5° from vertical in - strong direction
d. 22.5° from vertical in + weak direction
e. 22.5° from vertical in - weak direction



ISOMETRIC VIEW



TYPICAL SUBMARINE
HOLD DOWN DEVICE

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CHAPTER 5 INTERVENTION FOR LIFE SUPPORT

5.1. PURPOSE

This chapter defines:

- fittings and devices required to allow the safe transfer of Emergency Life Support Stores (ELSS) into a distressed submarine (DISSUB) using a Pod Posting System via either an escape tower or a torpedo tube;
- an interface to connect an external ventilation air delivery equipment on a DISSUB with the objective to carry out an air exchange inside the DISSUB without causing a dangerous internal pressure increase.
- Additional requirements for mini pod

These devices are to extend the survivability of the crew onboard the DISSUB till the arrival of the rescue systems.

5.2. POD POSTING REQUIREMENTS

5.2.1. POD REQUIREMENTS FOR ELSS TRANSFER

ELSS are fitted within Pressure Tight Pods which shall:

a. have a cylindrical shape with a sealable end-cap at one end and a removable cap on the other end;

b. be validated for an internal pressure of 5 bar.

c. be capable of equalizing internal/external pressure prior to opening.

d. withstand both internal to external (i.e. explosive) and external to internal (i.e. implosive) pressure differentials.

e. fit into and be removed from the tower and/or torpedo tube receiving systems, so that:

e.1. the overall diameter is less than 360 mm;

e.2. the overall length is less than 1260mm;

f. weight less than 60 kg, when empty.

Moreover, the Pods should:

g. allow for its gross weight to be adjusted by use of internal weights so as to ease handling by diver, ADS, ROV or manned submersible. [Approximately 7 to 11 kg of negative buoyancy is normal for pod handling by submersibles/ROV, somewhat less when pods will be handled by free divers];

h. be manufactured from a rigid, non-deforming material;

i. incorporate features to allow for easy handling by mechanical grab and, for torpedo tube posting, a means of attaching a line or other mechanism to facilitate pod removal from the tube;

j. be clearly marked with maximum operating depth.

5.2.2. MINIPOD REQUIREMENTS FOR ELSS TRANSFER

ELSS are fitted within Pressure Tight Mini-Pods which shall:

a. have a cylindrical shape, have a removable section for size adjustment and a removable end-cap.

b. be validated for an internal pressure of 5 bar gauge.

c. be capable of equalizing internal/external pressure prior to opening.

d. be clearly marked with maximum operating depth.

e. withstand both internal to external (i.e. explosive) and external to internal (i.e. implosive) pressure differentials.

f. fit into and be removed from the submarine signal ejector, so that:

I. the overall length of long version is less than 1100mm

II. the overall length of short version is less than 500mm

III. the diameter is less then 76mm.

Moreover, the Pods should:

g. allow for its gross weight to be adjusted by use of internal weights so as to allow the Mini-Pod to be transferred into the submarine with negative buoyancy and transferred out of the submarine with positive buoyancy, if so desired.

h. incorporate features to allow for easy handling by mechanical grab.

5.2.3. POD REQUIREMENTS ONBOARD A SUBMARINE

To realize pod posting, the following devices shall be fitted or stowed onboard the submarine:

a. pod receiving bag or receptacle complete with raising/lowering mechanism as blocks and tackles;

b. eyebolts and shackles positioned in the upper portion of the tower for securing of pod receiving blocks;

c. cleats positioned in the lower portion of the tower for securing of pod receiving tackle;

d. blocks, tackle and eyebolts or other mechanisms for facilitating pod removal from torpedo tubes;

e. escape tower with upper and lower hatches and/or torpedo tubes with flooding and draining system;

f. any special tools required for opening pods;

g. signal ejector with a minimum diameter of 76mm / 3 inches, and a minimum length of 500mm.

When pod receiving bags or receptacles cannot be stowed onboard the submarine, these together with the blocks, tackle and any special tools may be posted into an empty tower or torpedo tube at the outset. This will entail additional delay and pressure rise within the DISSUB. Thus, stowage onboard is the recommended option.

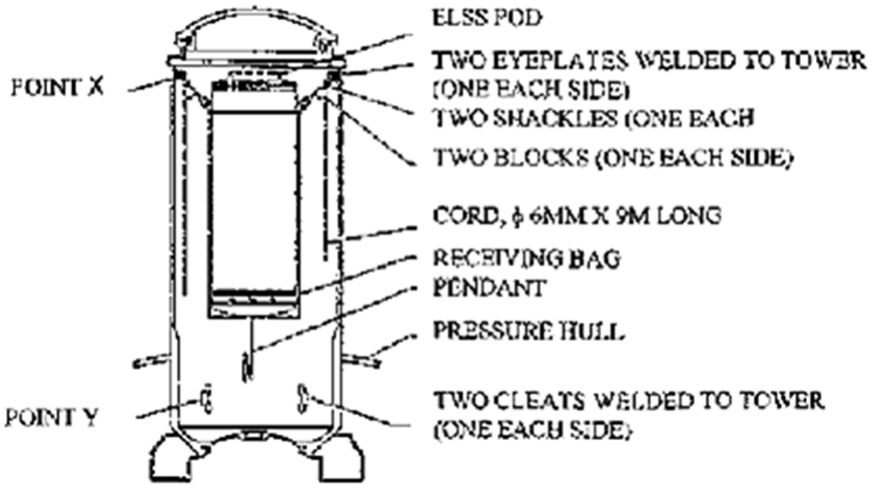
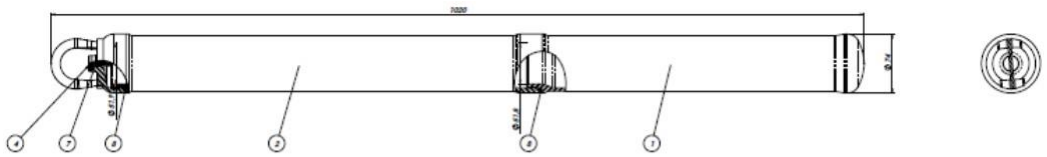


Figure 5.1 – Typical POD receiving system (Tower)



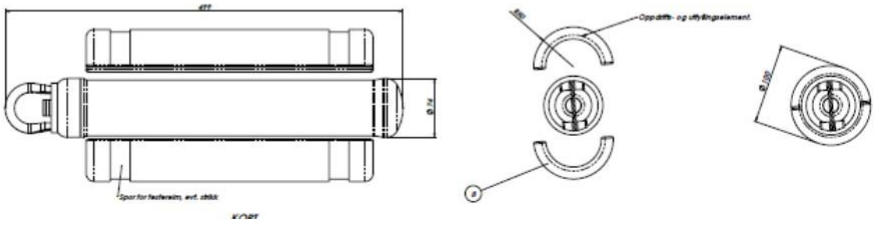


Figure 5.2 – Example of Mini-Pod in short and long version

5.3. REQUIREMENTS FOR EXTERNAL VENTILATION OF A DISSUB

The DISSUB Nation has to provide specific interfaces Alfa and Charlie, while the Rescue ship provides interfaces Bravo and Delta. According the situation, the air inlet and outlet hose is provided by one of the two actors.

The fittings shall:

a. comply with the standard ASME B16.11 "FORGED FITTINGS, SOCKET, WELDING AND THREADED";
b. be made of marine bronze BzN7 2% in bars, without any imperfection in the basic material;
c. be built with a minimum walls thickness of 4,89 mm;
d. have internal threads in accordance with the AMERICAN NATIONAL STANDARD TAPER PIPE THREADS ANSI/ASME B1.20.1;
e. have countersink or chamfer in accordance with paragraph 6.3.4.of the ASME B16.11.

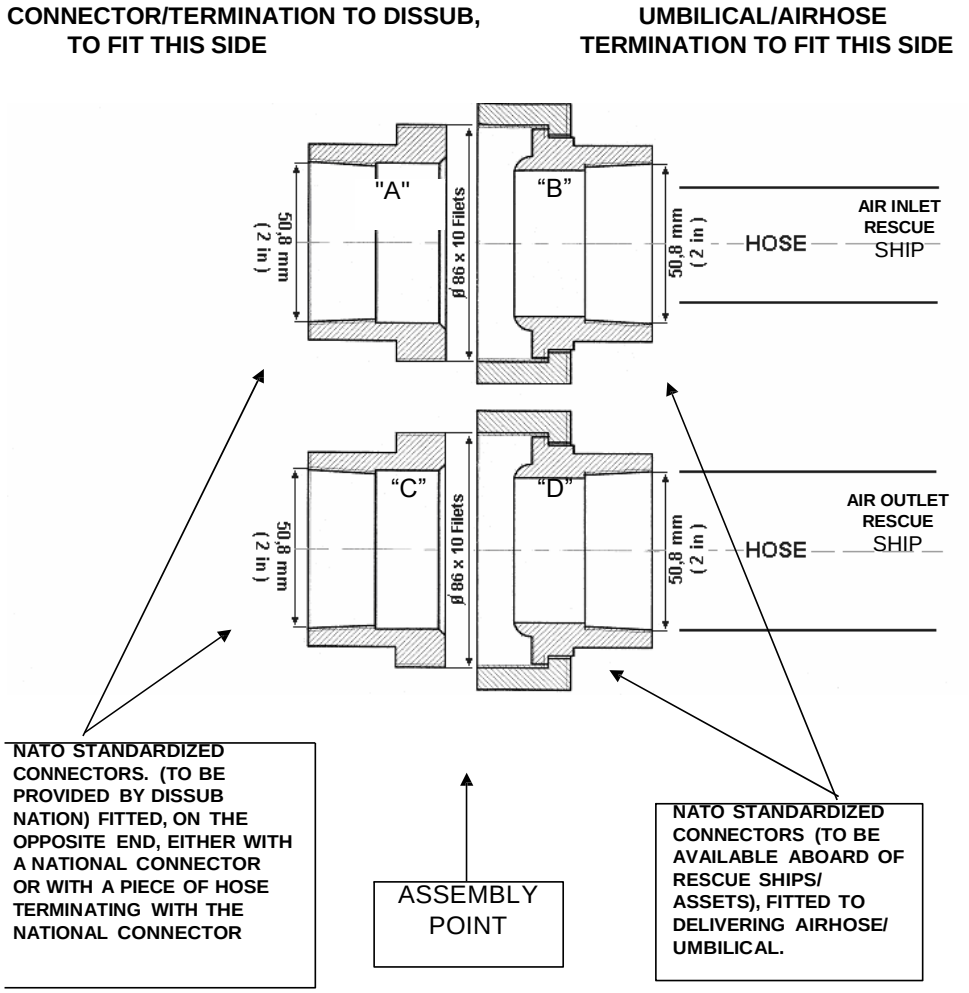


Figure 5.3 – Airhoses and umbilicals to DISSUB air inlet/outlet connectors

Since the union is not standardized according to ASME B16.11, the following features shall be provided:

a. a threaded union in both half coupling by planes (octagon) to be machined to leave at least wall thickness as established in order to apply a nominal torque with a suitable wrench (see Figure 5-4);

b. a national coupling between the national connectors and the NATO interface according to the previous paragraph (see Figure 5-5);

c. All plans shall be chamfered with an angle of 45 ° to a round section or to the end of the fitting, whatever applicable.

d. THREADED UNION will have a male/female interface (3 pieces) coupling with M86 x 3 with a nominal external diameter of 86,00 mm and distance between threads 3 mm.

e. THREADED UNION will have at least 5 complete threads (15 mm); the height of the female thread will pass the male thread of at least 1 turn (3 mm), total height at least 18,00 mm, suggested 21,00 mm (7 complete threads).

f. Nominal distance between the SHIP HALF COUPLING and the DISSUB HALF COUPLING will be more than 2,0 mm (nominal distance 2,41 mm).

g. Tolerances of roundness should be less than 0,1 mm, trying to reduce to the minimum the surface roughness.

5.4. OPERATIVE INSTRUCTION

The DISSUB HALF COUPLING and the RESCUE SHIP HALF COUPLING should be fitted onboard already joined together with the standard tightening torque of 135 N*m (13.5 Kg*m) both for the INLET and for the OUTLET.

5.5. CAUTION

The operation of assembling of the coupling can be done at sea even if it's not recommended. In that case the tightening will be performed using a sealant in the form of a silicone grease between SHIP and DISSUB parts, a tightening torque reduced to 20 N*m, taking care to do not damage the NATIONAL CONNECTORS.

THREADED UNION

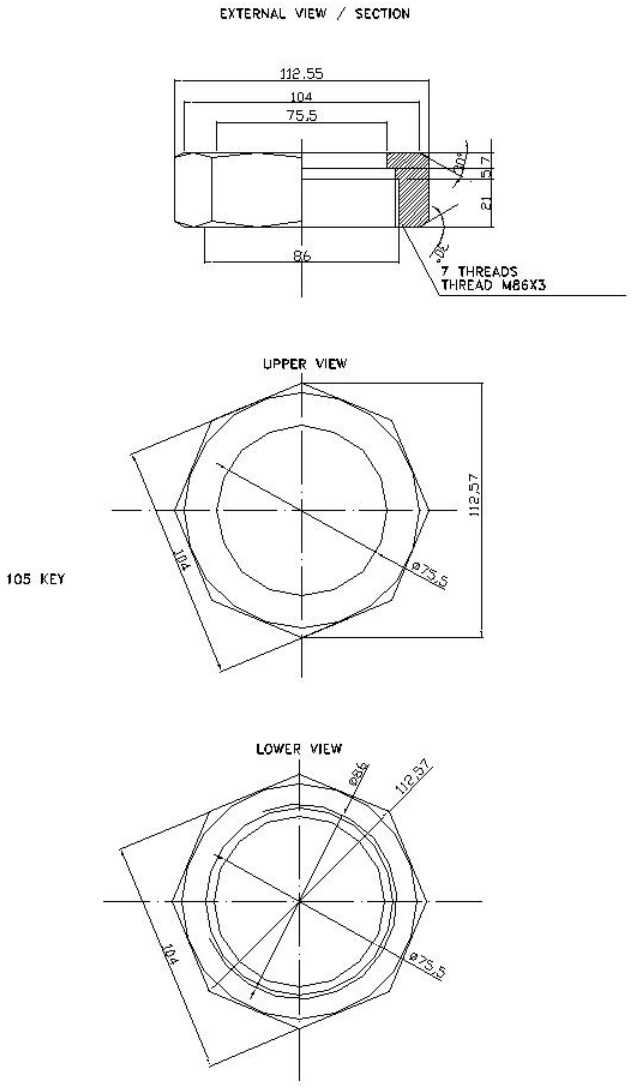
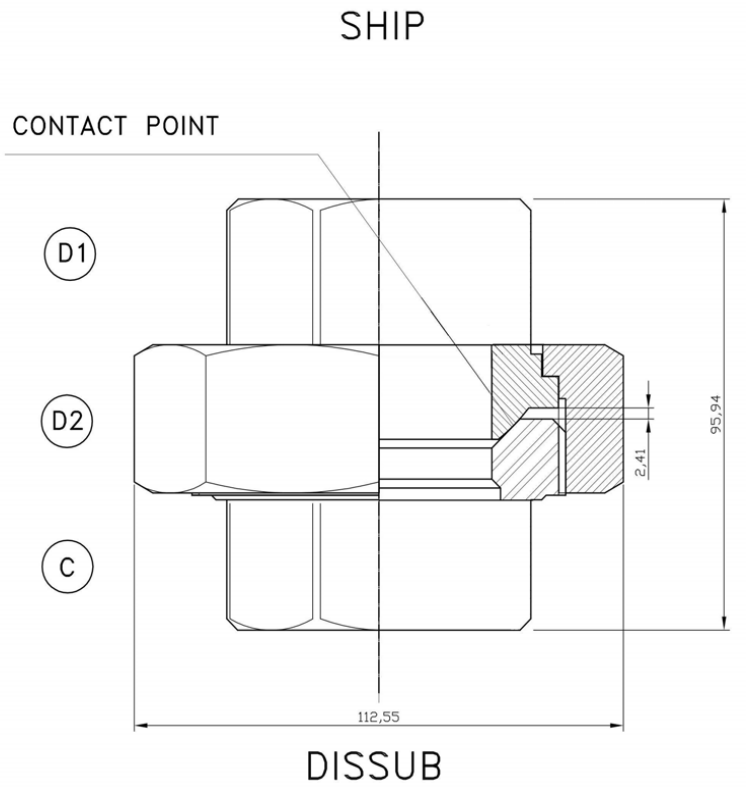


Figure 5.4 – Threaded union



D2	THREADED UNION
D1	FEMALE (SHIP) HALF COUPLING
C	MALE (DISSUB) HALF COUPLING

Figure 5.5 – Coupling details

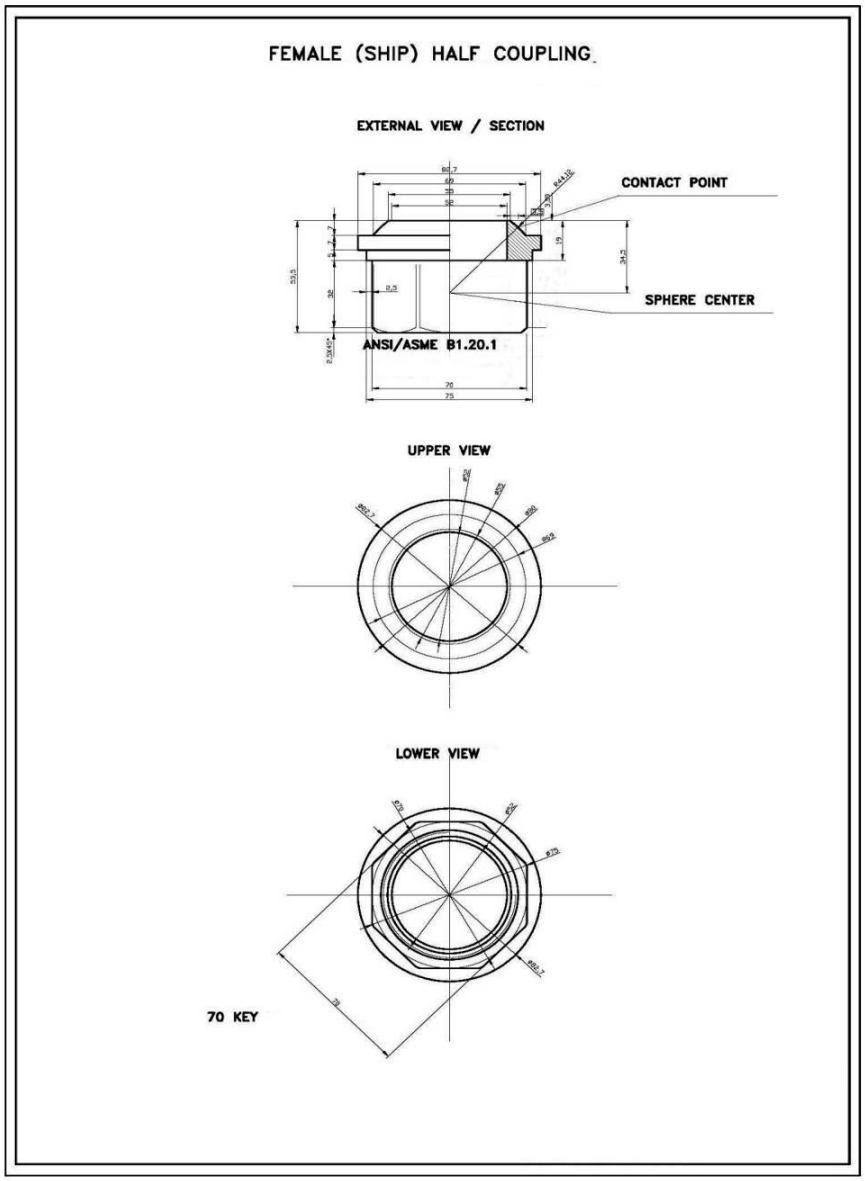


Figure 5.6 – Female (intervention ship) half coupling

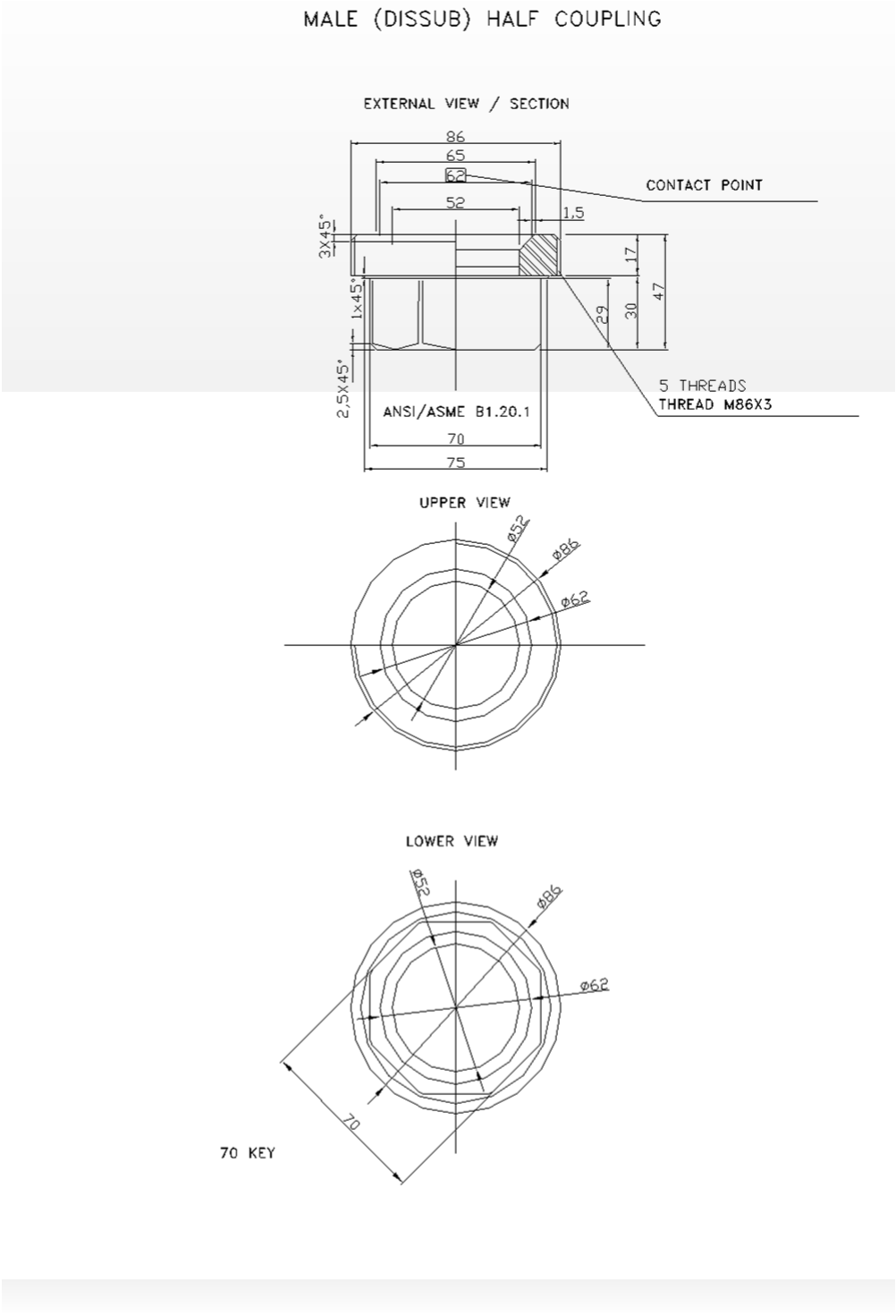


Figure 5.7-Male (DISSUB) half coupling

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