91. PERSONNEL DIVING KIT

SELF CONTAINED UNDERWATER AIR BREATHING APPARATUS (SCUBA)

PART I — GENERAL INFORMATION

Purpose.

(a) The requirement of Self Contained Underwater Air Breathing Apparatus (SCUBA) is to enable a diver to breathe underwater using this set up to a depth of 35 meters. The equipment is required for undertaking a diving operation in lakes/rivers/reservoirs/open water (sea) and to assist the diver to undertake the task in a safe and hazard-free manner.

(b) The SCUBA set should indicate the reserve air pressure and should also supply air for inflation of the Buoyancy Jacket (Buoyancy Control Device) for emergency ascent to the surface. The equipment is required to supply continuous compensated air to a diver at the depth he is diving.

Regulation/Standards.

The Self Contained Underwater Air Breathing Apparatus (SCUBA) should comply to certification as per EN250:2014 (for testing & marking of Respiratory Equipment) or equivalent Standards (EN 16972:2020, EN 13274-2:2019, EN13274-7:2019, EN148-1:2018, EN 14594:2018).

Functionality.

The equipment should be capable of being used by any diver underwater during a diving operation. The role of each item should be as per characteristics enumerated along with the description/ main features.

PART II

OPERATIONAL CHARACTERISTICS AND FEATURES OF SELF CONTAINED UNDERWATER AIR BREATHING APPARATUS

Introduction. Self-Contained Underwater Air Breathing Apparatus (SCUBA) is used to enable a diver to dive up to depths of 35mts. As the name suggests the equipment is self-contained in terms of air supply for the diver and has an inbuilt capacity to regulate air pressure in accordance with the depth of dive.

General. The characteristics of each sub-assembly of Self Contained Underwater Air Breathing Apparatus (SCUBA) are as follow: -

(a) **Full Facemask**. The facemask should be with breathing valve assembly and have a positive pressure (of at least 01 Mili Bar) inside. The mask should have provision to integrate with 'Underwater Communication System' (DUCS as well as WUCS) and should fit on the divers face without any ingress of water. The straps should hold the mask in place even in strong current (2 - 3 knots).

(b) **Octopus Assembly.** An additional mouth piece with associated demand valve should be provided for use in emergency in case air supply to facemask fails or for use by the buddy diver.

(c) **Cylinder Pack assembly**. Compressed air cylinder pack with neck fitting of control valve should be provided and pressure gauge should be mentioned along with cylinder pack assembly.

(d) **Harness** The Harness basic structure should be comfortable to wear and should have provision for mounting air cylinders and other accessories on the set. Harness to have adjustable straps and belt so as to make a snug fit and ensure hands free movement of the diver.

(e) **Regulator Assembly** A pressure compensated regulator unit should be with first stage reducer assembly to convert cylinder HP pressure to low pressure.

(f) **Buoyancy Control Device (BCD)**. A BCD associated to the set shall be fitted with inflation option through main cylinders, separate cylinder and mouthpiece. Deflation should be through a corrugated hose fastened with a Velcro in a direction that does not disturb the diver. Emergency whistle and pockets/ recess for detachable weight should be available. Additional demand valve with ergonomic safe grip mouthpiece for use by diver / buddy in an emergency should be inbuilt in the BCD. The BCD should have a suitable arrangement for fitment of cylinders in case the harness in not being used.

(g) **Tool Kit**. The diving set test and tool kit for the periodical maintenance and testing of the Divers Harness

Requirements/ Dimensions of Diver Harness.

a)	Nominal Capacity of cylinder	Between 8-12 litres
b)	Charging pressure	Not less than 200 bars
c)	Capacity (Free air volume) of set after charging	At least 1600 litres
d)	Weight of the set	Not more than 30 Kg
e)	Weight in water	Not more than 04 Kgs
f)	Cylinders	Made of Non corrosive material.
g)	Designed Depth	Not less than 35 Metres

Environmental Conditions. The entire equipment should be suited for **Indian Weather Conditions** and not require any environment control for stowage.

Documentation. The offer should include following: -

(a) Complete documentation of handling/exploitation, preparation, testing, and repair/maintenance procedures to be provided.
(b) The life of all consumable sub-assemblies and spares to be stipulated in the documentation
(c) Paper particulars, company Part numbers with description and layout drawing of all components of the equipment are to be provided.

Maintenance and Product Support. -site maintenance, by replacement

of consumable spare parts or by way of replacement with new

(a) **Specified hub for maintenance**. All the items should afford easy for *a specified hub for maintenance*, by replacement of consumable spare parts or by way of replacement with new items. The supplier/ OEM are required to recommend a list of onsite spares. The equipment should be supplied along with special tool kit and test equipment as required for the same.

(b) **Product Support**. The OEM/ supplier should support each item of the equipment supplied, for a period of its life span. Any obsolescence of the component/ spare/ item need to be intimated by the firm, well in time, to enable stocking of spares by the NDRF. The firm should also recommend/ offer suitable substitutes/ replacement for such components. In addition, up-gradation/ modification to the equipment, resulting in enhancement in the performance should be intimated and offered to the NDRF. The firm should also indicate their willingness to undertake AMC/ periodic maintenance (which would be separate contract on expiry of the warranty period) either directly or their authorized Reps in India.

Sl.No.	Description	Role	Main Features
(a)	Graphite Fins	Assists Diver in hands free swimming on surface and underwater	(i) **Description** Colour Black length not less than 17" width not less than 4' (top) and 8.8" (bottom) (ii) **Material** Thermoplastic rubber with graphite content should not skid even on a wet metal deck. (iii) **Hydrodynamic shape** The shape of the fin to be hydrodynamic. (aa) Max.propulsion with swimming in water using light strokes and frog kick. (ab) Suitable for swimming for long duration without causing undue fatigue. (iv) **Shoe Pocket (Enclosure attached)** Pocket should be 7 to 8 inch deep with and adjustable back strap (not less than 1.5" in width) Input part should be made of soft rubber for with bare feet. One additional back strap should be supplied with the fins. (v) **Weight**by 1.5 Kg (approx.) (vi) **Buoyancy** approx 10% negatively buoyant.
(b)	Diver's Knife	To cut obstruction, ropes, nets, etc. underwater	(i) A metallic portable sharp knife with a handle (ii) **Material** Titanium/Non-corrosive (iii) **Shape of the Blade** Razor sharp smooth cutting edge on one side with considerably balley or curve and should include a sharp line – cutter hook for cutting fishing lines and leaders. The backbone of the blade to have a heavy serrated edge (wavy or rounded serrations) running nearly the full

			length of one side to function as a saw. **(iv) Knife Tip** Pointed and made of titanium **(v) Handle** The size of the handle should be about 110-120 mm in length with reasonable width so that a diver can hold the knife comfortably in water.The material used for handle should beblack in colour, marine proof theme rubber material externally and rubber / polypropylene internal with non-skid surface. There should be an effective guard/ridge/thumb rest between the handle and the blade to prevent fingers from slipping onto the sharp edge. There should be one lanyard hole at the top end of the handle with a brass metal eye (rounded edges) to secure the knife with a lanyard/rope. **(vi) Weight** Approx 200-300 gms **(vii) Length** Blade not less than 6 inches
(c)	Sheath of knife	Safety cover for knife and for attachment of the knife to the divers life Belt	(i) To be supplied with the swimming knife with locking and quick release facility. The shape and size of the sheath should be so designed that knife blade settles firmly when inserted into the sheath without any bladepart Projecting out. (ii) **Material** Thermoplastic rubber/ flexible nylon with the inside part of the sheath made of hard plastic that does not get cut / damaged when inserting the knife inside. (iii) **Colour** Black (iv) The sheath should have a simple and maintenance free locking mechanism so that when the knife is returned to the sheath, it should engage with a clearly heard or feltclick. The knife release should be operable byone finger of the hand (v) The sheath should have slots for attaching it to a 2" broad life belt (vi) **Lanyard** A lanyard of suitable size of 3ft length for securing the knife to the sheath to the belt. In addition a wrist lanyard of one feet with securing band should be provided. (vii)**Hose Clip** A hose clip to be provided

			with the knife sheath to secure the same onto the hose of diving set or buoyancy compensator device.
(d)	Life waist belt (Diver)	Attaching lifeline toa diver to:- (i) Pull the diver out of water in caseof emergency (ii) Pass directions/ instructions to the diver	(i) **Design** Broad belt made of polypropylene fabric with a loop on the right shoulder to secure the lifeline (8mm rope). Moulded to the waist belt at either end in front left side and back centre. The ends should be seized/hardened to avoid fraying. (ii) Size 2"broad, 3mm thick and 45" length (approx). The belt should be adjustable in the length. (iii) Buckle Waist belt should have a quick release non-breakable buckle of plastic/fibre/non-corrosive soft metal. (iv)**Total Weight** 250-300 gms (v) **Material** Thermoplastic/ Polypropylene fabric. (vi) **Working Load** 100 kg (vi) **Colour** Black
(e)	Lead weights (1 and 2 kgs)	To enable the diverto adjust buoyancy during a diving operation	(i) Ergonomic design (ii) Suitable slots for attachments to a weight belt. (iii) **Weight** 1kg, 2kg (iv)**Material** Lead (v) Slots to accommodate on weight belt.
(f)	Weight Belt	To attach lead weight of 1 and 2kgs to a diver to adjust buoyancy during diving operation.	(i) Should consist of a waist belt with pouches moulded onto the belt to house/attach the weights. The pouch should open independently on top with button/Velcro mechanism. (ii)**Material** The belt should be made of polypropylene/ nylon fabric with a quick release non-breakable buckle of plastic/non-corrosive soft material. (iii) The belt should be of adjustable size of not less than 45" in length, 3mm thick and 2" broad (approx). (iv) Should be suitable for 1 or 2 kg lead weights. (v)**Colour** Black.
(g)	Float spherical	To mark the diver underwater while swimming/diving	a. Bright coloured (orange) float to mark diver underwater. Provision for an eye to pass a rope of 8 mm thickness. b. Made of strong, light and non-

			breakable buoyant material (reinforced plastic) c. Minimum buoyancy of 4 kgs. Size spherical of diameter 1 ½ - 2 feet. d. Should have a provision to fix a 2 ft pole for a flag/light.
(h)	Lifeline	Lifeline is required to connect the diver to his surface attendant	(i) 8mm polypropylene rope, multi pleated avoids kinks in the rope, length 75 mtrs. (ii) Should have a good grip to pull the diver from underwater in case of emergency. (iii) Should be flexible to pass instructions to diver by way of pulling the rope. (iv) Mounted on a suitable roller to facilitate quick release and retrieval. Marked with yellow marking at interval of 3 mtrs and red bands at every 15 meters:- (aa) should have yellow bands at 3,6,9 and 12 mtrs and a red bank at 15 meters. (ab) The above marking to be repeated every 15 meters i.e. 15,30,45,60 meters. (v)**Colour** Preferably Black (vi)**Safe working load**: 100 kg.
(i)	Buddy line	Connect two divers in buddy pair during a dive operation	(i) Manufactured in three parts:- (aa) Centre part is of length 36" with Ingle field clip at each end or any other securing arrangement that is easy to disengage, if requirement so arises. (ab) Two end parts of 1 ½ ft with Ingle field clips at one end and armband is worn by a diver on the upper arm. (ii) Size 8mm(Approx.) (iii)**Material/Design** Polypropylene/ nylon multi-plated to avoid kinks in the rope. (iv)**Armband** To be of not less than 2 cm broad polypropylene/nylon fabric with rope attachment /Velcro (v)**Colour** Black

SPECIFICATIONS FOR ACCESSORIES FOR DIVING EQUIPMENT

Purpose.

(a) The requirement of diving accessories is to provide safety to a Diver while undertaking a diving operation and to assist the diver to undertake the task in a safe and hazard-free manner.

(b) A diver is required to be comfortable in swimming underwater after donning this equipment along with a diving set so that he does not lose energy to struggle in water.

2. Regulation/Standards.

(a) Current MILSEC/HSC/NATO equipment performance standards.
(b) Certification as per ISI/ISO/Lloyds/EN250/EN1809/DNV or equivalent Standards.
(c) The Cylinder and valve must be PESO (Petroleum & Explosive Safety Organization) approved.

3. Functionality. The equipment should be capable of being used by a diver underwater during a diving operation and free swimming. The role of each item should be as per characteristics enumerated along with the description/main features.

4. The item enumerated in the succeeding paragraphs are accessories used by a diver to enhance his efficiency during a diving operation and when carrying out free swimming. The diving accessories must meet the under mentioned requirements:-

(a)Should be suited for tropical climate and not require temperature / environment controlled stowage.
(b) Should not require any special chemical agents for cleaning/ after use routine washing.
(c) Should be rugged / break resistant and suitable rough use for diving operation.

5.

(j)	Snorkel Tube	To enable the diverto breathe while — carrying out surface swimming with swim mask	(i) The snorkel comprise of a silicon tubewith a soft comfortable mouth piece to enable a diver to breathe whilst swimming just below the water surface. Also, a provision to attach the snorkel to the swim mask. (ii) Should be fitted with a non-return valve inside the tube to obviate chances of water entering the divers mouth when submerged (iii) Should have a purge valve to remove/clear out water that has entered the snorkel tube. (iv) Should have a self-regulating valve that 'shuts off' when submerged but opens in air. (v) **Colour** Black.
(k)	Mask swim	To keep the eyes and nose of diver/ swimmer clear of water	(i) The mask should be made of high quality soft and non-corrosive silicon material. (ii) The visor should be scratch proof and of non-breakable glass/reinforced plastic/ silicon to provide clear front and side vision. (iii) Should incorporate suitable valve to remove water from the face mask.

			(iv) Tested for use to a depth of 55 mtrs. Certification for same to be provided. (v) Fitted with adjustable head strap and a provision to secure snorkel to the mask when swimming. (vi) **Colour** Black.
(l)	Magnetic underwater Compass	To indicate bearing to a diver underwater	(i) The magnetic compass to a diver whilst swimming underwater. (ii) Depth certification of the equipment should be 55 meter. (iii) Must have a radium/florescent dial with an indicator pointer for use in darkness. The dial cover should have magnifying characteristics and made of non-breakable glass/reinforced plastic. (iv) Provided with an adjustable strap for donning on the wrist and an eye to pass a thin lanyard for securing it to a diving set. (v) Must incorporate a spirit level to obviate chances of direction needle/pointer getting stuck due to excessive tilt. (vi) The compass should be usable for tilt up to 30°.
(m)	Neoprene suit	Wet suit to protect diver from nips and cuts, provide buoyancy and warmth	(i) The suit should be in the part of Jacket and Trouser in overall combination with compatible diving shoe, Gloves and Hood. *(ii)* It should be made of 5 mm (minimum) soft Macro cellular Neoprene *and the thickness of the suit can be increased as per requirement.* (iii) The thickness of the suit should be selected as per the location of the unit using the size viz. cold/hot/tropical climatic conditions. (iv) Should have two colours Black on top side and orange/red inside. The suit could be worn on either side depending on the requirement. (v) Jacket and trouser to cover body, legs and arms and to be body hugging to provide warmth to a diver. The closing zips should be of non-corrosive plastic. (vi) When worn the suit should enable the diver to swim freely with flexibility and

			should provide buoyancy in water. (vii) Should be supplied in standard sizes i.e. small, medium, medium large, large and extra-large (viii) Additional re-enforcement to be provided on elbow and knee.
(n)	Divers watch	To indicate time and duration of dive to a diver	i) The Dive watch should be waterproof Chronometer with depth certification of 100 meters. (ii) Operating Temperature between the ranges of 04ºC to 32ºC. (iii) Material should be non-magnetic metal/reinforced plastic. (iv) Must have a radium/florescent and scratch resistant dial with florescent needles for visibility in darkness. The dial cover should have magnifying characteristics. The outer rim should have a rotatable florescent time indicator. (v) Should indicate date and have a facility of an audio alarm in water. (vi) **Optional Facility :** A stopwatch with light in addition to above requirement (vii) Strap should have an additional locking facility.
(o)	Dive computer		Divers watch & Dive Computers both are required because existing divers are trained and comfortable with Divers watch wherein the Dive Computers has advanced features, therefore both are required. Detailed features & specifications of Dive Computer are attached as **Appendix- 'A'**.
(p)	Diving dry suit	To enable diver to undertake diving in cold climate conditions and in contaminated waters	(i) The dry suit should be manufactured from an internationally certified Triaminic/rubberized material that is soft, flexible and resistant to cuts from barnacles/sharp edges. (ii) Should consist of body suit with separate hood and gloves. The body suit to incorporate shoes in the same. The Gloves should be stretchable material to snugly fit the hands. (iii) Dry suit should cover the entire body, feet, hands and neck with elastic seal at wrist and neck ends to enable the diver to remain dry during the dive. (iv) Suit inflation bottle may be provided to ensure comfort to the diver in deep waters. (v) Suitable water proof and non-corrosive zip to enable donning and removing of the dry suit.

			(vi) Must have an inner cotton sweat suit. (vii) The suit should not obstruct wearing of other dive gear viz. dive apparatus, buoyancy control device, life belt etc. (viii) The shoe should have a hard sole for diver. (ix) The thickness of the suit should be 5-9 mm (Depends on water temperature).
(q)	Under water communication set (with wire)	The equipment should establish and maintain voice communication between the Divers under water and the Attendant/ Supervisor of the surface during a diving operation to a depth of 50 meters.	**(i) Essential Parameters:** (a) Should be able to maintain continuous voice communication between surface team and the divers under water to a depth of 50 mtrs with 02 channels. b) Should be rugged. c) Have mechanism to prevent water from entering the system d) The supervisor set should permit hands free use on the diving site. e) Length of the umbilical provided should be 50 meters with strength min 1500 N **ii) General Parameters:** a) The battery life should be minimum 8 hour. b) Type of components/ connectors used should not be of fragile material and compatible with each other with quick removal system. c) Communication set should operate minus 10 to 50 degree centigrade. **iii) Water Resistance Material:** The paneland other exposed parts should be of water resistant material and incorporate water proof switches that avoid the ingress of water. **iv) Clarity Of Speech**: High fidelity of the speech should be there in between surface attendant and under water diver. **v) Principal components of equipment**: The Diver Under water communication system (DUCS) should consist of under mentioned components:- a) Diver unit with bone conductor and speaker with attachment to the diving set mask – 02 Nos. per set b) Communication cable of 50 mtrs length with connectors – 02 Nos per set.

			c) Surface unit with speaker, amplifiers and headphone – 01 No. per set d) Rechargeable cells/batteries for divers unit and surface units – 01 No. per set e) Charger for the batteries – 01 No. per set f) Carrying case – 01 No. per set g) Repair kit/Tools Kit – 01 No. per set h) Operational and technical manual – 02 Nos. per set

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PICTURE OF EQUIPMENT



Appendix- 'A'

SPECIFICATION OF DIVE COMPUTER

1. The dive computer should be water proof chronometer and should be able to monitor diver's depth, duration of dive and movement underwater using a series of algorithms.
2. It should facilitate the diver to keep track of your surface-interval duration and to plan the next dive and should be of non-magnetic material
3. The dive computer should comply with EU standards EN250:2000 and EN13319:2000.

Additionally the key features of the dive computer should include following specifications:-

Sl.	Specification	Remarks
(a)	Display	Full color 2.2" QVGA LCD with always on LED backlight
(b)	Pressure (depth) sensor	Piezo-resistive
(c)	Calibrated Range	0 Bar to 10 Bar
(d)	Accuracy	+/-20 mBar(at surface) +/-100 mBar(at 10 bar)
(e)	Depth Certification	100 mtrs
(f)	Surface Pressure Range	500 mBar to 1040 mBar
(g)	Minimum Depth of Dive	1 m of sea water
(h)	Operating temperature range	+4 ºC to +32ºC
(j)	Battery and Battery Operating Life	Rechargeable and commercially off the shelf available The battery should function for a period of minimum 24 Hours in 1 charge
(k)	Compass Resolution and Accuracy	1º/35 º
(l)	Compass Tilt Compensation	Yes, essential to compensate for any roll and pitch
(m)	Dive Log Capacity	Approximately 1000 hours
(n)	Weight	Should be less than 200 gms
(p)	Size of the Dive Computer	Befitting for individual usage on the wrist; allowing the diver in free operation.
(q)	Additional Facility	Strap should have an additional locking facility