

Annex A – The Rules

Submarine Design

Rule No.	Rule	
D1	The maximum overall length of a submarine is 5.5m	
D2	The maximum width of a submarine dictated by the geometry of the lifts is 1.5m. To fit the track on the lift, the width between the wheels must be between 500mm and 750mm	
D3	Submarines with appendages that extend the width beyond 1.5m can be accommodated, but the appendages will have to be designed so that they can be attached or removed by divers in the water	
D4	Submarines must be designed such that their centre of gravity when out of the water (dry or draining) can be placed on the lift between 2.1m and 3.1m from the bow or stern extremity of the submarine	
D4a	To ensure speedy draining of water from the hull of the submarine when it is on the lift and being raised, a free-flood hole of at least 233 cm ² [36 in ²] is to be sited on the bottom centreline of the hull, near the CofG longitudinal position. During racing the hole may be covered by a hatch or cover conforming to Rule D14	
D5	When being floated off or on to the lift, the draft of the submarine, plus the depth of the cradle, must be, or be reduced to, less than 1.2m	
D6	The propulsion must be water coupled. Wheels or other mechanisms which generate movement through friction along the bottom or the walls are not permitted	
D7	Propulsion systems must be directly coupled to the pilot. No clutches are permitted	
D8	Flywheels and other energy storage devices which could be loaded before the vessel crosses the starting line, are prohibited	
D9	No oils will be permitted in hydraulic systems - only water may be used as a fluid. Only water-resistant grease may be used to lubricate boxed gearing	
D10	Pneumatic systems may not use the diver's breathing air except for charging a closed system	
D11	Electric system voltage may not exceed 24 V DC	
D11a	If batteries are fitted there is to be a sign indicating their type, location and means of isolation	
D12	Expelled diver air may not be used to create thrust, either forward or sideways	
D13	Towing point not required	
D14	All hatches must be securely attached to the hull by means of hinges, straps or other device. For main pilot hatch see Rules O3 to O6.	
D15	A Design Report which completely describes the submarine and the design philosophy should contain information on each of the subsystems as well as on the overall design	
D16	Any and all external moving parts, plus any small parts extending away from the hull of a submarine, must have their tips painted hi-viz orange, to maximise their visibility to divers	

D20	Handles and release mechanisms for all exits must be clearly marked on the outside of the submarine. A 10cm square hi-viz orange patch bearing the word "Rescue" is recommended as a marker.	
D20a	In the case of 2-crew boats, an exit hatch is to be provided for each crew member. An indicator is to be provided for each crew member which shows that either a. Both crew exit hatches are in place and shut, or b. One or both exit hatches are open	
D21	The handle or release mechanism must be easily accessible from both inside and outside the submarine. Its use will have to be demonstrated as part of the Wet Inspection before the submarine is allowed on the course	
D22	If the pilot is restrained in any way inside the submarine (e.g. toe clips or shoulder straps), then release mechanisms must be clearly identified with orange paint or fluorescent tape. Any such releases will be inspected by the judging team during the dry test, and their function will have to be demonstrated as part of the wet test	
D23	The pilot's face and head must be easily seen by support divers outside the submarine. In the case of 2-crew boats, this applies to both crew members.	
D24	Emergency Pop-Up Buoy: The submarine must be equipped with a highly visible surface marker buoy which is released by the pilot to signal that help is required. The buoy must have a net buoyancy (natural buoyancy minus weight) of 500 grams.	
D25	The buoy must be attached to the submarine by 10m of floating, highly visible line, at least 5mm in diameter. To ensure that the line runs easily when the buoy is deployed, it must be stowed on a reel. If the reel is in the hull, the line between the reel and the stowed buoy must pass through a tube so that it does not snag on any fitting when the buoy is released. The attachment of the line to the submarine must be sufficiently strong that the line can be used to bring the submarine from the bottom of the tank to the surface (eg in the event of an abort)	
D26	The buoy shall either form part of the hull or be contained in a fully flooded compartment inside the hull, being prevented from floating to the surface either by a hatch in the top of the hull or by some other means. Using a "dead man's handle" or similar device, the buoy shall be released automatically in the event that the pilot is incapacitated and unable to continue preventing its release. Override mechanisms are permitted in order to ease operations while the sub is behind the start line.	
D26a	In the case of 2-crew boats, the marker buoy shall be released if EITHER crew member is incapacitated.	

Breathing Air

A1	The primary air supply shall be carried aboard the submarine, and have double the capacity required to complete one run at speed (i.e. it should be more than half-full on completion of one run)	
A2	The pilot must not allow the primary air supply to fall below 50bar (725 psi).	
A3	The primary air pressure gauge must be visible to the pilot inside the submarine and it must be possible to communicate that pressure to a support diver when the hatch is closed. The means for doing this must be described in the Design report	
A4	Each pilot must carry an independent air supply firmly fastened to his or her body	
A5	The independent air supply capacity shall not be less than 3L. Bailout bottles (eg Spare Air brand cylinders) are not sufficient for this purpose.	
A6	The independent air supply may NOT be used while installing the pilot and preparing for a run. At the start, its air pressure must be at least 50bar (725 psi)	
A7	All support divers must be equipped with a spare second stage regulator (octopus), for safety and support (e.g. assisting pilots during submarine entry and egress)	
A8	All support divers are to monitor their air supply, and no cylinder is to drop below 50bar (725psi)	
A9	All breathing air must be supplied using an open-circuit SCUBA system	
A10	Re-breather systems are prohibited	
A11	Evidence of recent qualified servicing of regulators (first and second stage) will be required. This includes pony bottles	
A12	In the UK it is not legal to charge air cylinders supplied and approved in the USA. DOT cylinders are not permitted. All cylinders must clearly display current hydro and visual inspection dates. They should be correctly labelled in accordance with European Standard EN 1089-2, namely with a label displaying the green compressed-gas hazard diamond. Air cylinders must clearly display current hydrostatic test and visual inspection dates (note: Cylinders will be inspected at the beginning of the competition and air-refill personnel will additionally inspect the tanks before filling to ensure that inspections are current)	
A13	Cylinders must be CE certified to appropriate EN or BS Standards that are suitable for PPE/breathing apparatus. The current standards are: a. EN 1964:2000 Transportable gas cylinders – Seamless Steel b. EN 1975:2000 Transportable gas cylinders – Seamless Aluminium c. EN 12245:2002 Transportable gas cylinders – Fully wrapped composite d. EN 12257:2002 Transportable gas cylinders – Seamless hoop-wrapped composite e. BS 5045-7:2000 Transportable gas containers – Seamless Steel f. BS 5045-8:2000 Transportable gas containers – Seamless Aluminium	
A14	Only compressed normal atmospheric air shall be used in divers' cylinders. Special gas mixtures (eg nitrox) are prohibited.	

Diving

V1	All team members must be 18 or more years old	Tank staff
V1a	All team members acting as submarine crew or support divers must be qualified to dive without an instructor by an internationally recognised dive training organisation	Ditto
V2	All divers must be recreational amateurs, receiving no remuneration for taking part in the event	Ditto
V3	Each team will be operating under its own certification organisation's rules and procedures for recreational expedition diving. The minimum acceptable dive qualification is either EN 14153-12 or ISO 2480	Ditto
V4	When registering for the event each team is to state what recreational diving training agency rules it will be operating under	Ditto
V5	<p>4 weeks before the Preparation Week, each team is to provide the following information:</p> <ol style="list-style-type: none"> The name of the team's Surface Liaison Officer (SLO) (see Rule V7 below) The names of team members qualified to the minimum standard required by the team's declared agency for diving with a diver of equal qualification Evidence that each diver has completed at least 10 dives post qualifying (not as part of qualifying) <p>[NB. scan diving logbooks to provide this evidence]</p> <ol style="list-style-type: none"> For each diver: a completed medical self- declaration form <p>Obtain forms from either of</p> <p>http://www.uksdmc.co.uk/downloads/self-cert-form-2013.pdf</p> <p>http://www.padi.com/english/common/courses/forms/pdf/10063-ver2-0.pdf</p>	Ditto
V5a	Every diver is to bring his/her diving log book to the event to be checked during Preparation Week	
V6	Any team member who cannot provide the information in V5 above will not be permitted to enter the water	Ditto
V6a	Each team is to nominate one person to check the diving evidence of all team members to ensure correctness and completeness.	
V7	Each team is to provide a Surface Liaison Officer (SLO) operating on the surface on the tank side who is fully conversant with both the design of the submarine and the team's recreational diving training agency rules. [The SLO may, for instance, be a member of the University staff]	Ditto
V7a	<p>The SLO is to</p> <ol style="list-style-type: none"> Be the single point of contact between the Dive Coordinator and 'Q' and the team. Keep the Diving Whiteboard up to date for his team 	
V8	<p>Before launching their boat in the Ocean Basin every member of the team must have</p> <ol style="list-style-type: none"> Attended the Ocean Basin safety brief Undertaken a familiarisation dive in the basin 	

Operating

O1	Pilots should indicate an abort by releasing the emergency safety buoy : <ul style="list-style-type: none"> a. If any malfunction prevents the submarine completing the course under full control b. If lost in the tank 	
O2	Accidental release of the buoy beyond the starting line will automatically abort a run, and abort procedure must be followed	
O3	When a run is aborted, the pilot should: <ul style="list-style-type: none"> a. Release the safety buoy b. open the main access hatch c. release any restraint systems (including pedals) d. switch to secondary air supply e. exit the submarine f. if able, make way to the surface g. stay on the surface until the rescue boat arrives h. keep the Regulator in the mouth until on board the rescue boat <p>Note: The opening of the hatch is the signal to the rescue team that the pilot is OK. If the hatch remains shut, the rescue team will take appropriate action</p>	
O4	When the submarine is on the course, the pilot's main access hatch must be fastened such that it remains attached to the hull when open and when shut	Tank staff
O5	The pilot's main access hatch may be detached from the hull when the submarine is in the water being prepared for a run, but must be fastened to the hull before the submarine is declared ready to start.	
O6	The pilot's main access hatch may be detached and removed on completion of a run when the submarine has returned to the queue	
O7	After an abort and after finishing, the pilot may not remove mask and regulator until safety divers and/or safety boat are in attendance	
O8	Emergency pop-up buoy override mechanisms must be disengaged and the safety buoy system armed before the submarine is declared ready to start	
O9	Before a submarine may join the queue to race, the following must have been successfully completed: <ul style="list-style-type: none"> a. The Dry Inspection by the judges b. The familiarisation dive by the support divers c. The hatch inspection by the Safety Divers d. The Wet Inspection by the Dive Coordinator 	
O10	The Wet Inspection shall comprise: <ul style="list-style-type: none"> a. Primary air supply (Rules A1, A3); Pilot independent air supply (Rules A4, A5); Marking of external moving parts & appendages (Rule D9); Visibility and Operation of Hatches (Rules D20, 21); Visibility of pilot's head & face (Rule D23); Safety Buoy (Rules D24, D26). b. Successful operation of the Emergency Safety Buoy c. Start procedure demonstration (paras 84, 85) d. Emergency exit (Rule O3 steps a. to e.) in 30 seconds demonstration 	